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Final Thesis

An Anthropology of Nuclear Landscapes: Negotiating Radioactivity in Italy

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Abstract

The global increase in energy uncertainty has renewed the discussion on the production and use of nuclear energy, recently labeled by the European Parliament as a climate-friendly investment (2022). The thesis aims to offer an anthropological analysis of nuclear spaces taking into consideration the testimonies of some of the 52 artists who were involved in the exhibition "Art Spaces: Nuclear Decommissioning. Science at the service of the future generation" in Ispra (2017), meant to be a meeting point between science, technology, and contemporary art. The thesis focus is on nuclear power, nuclear cultural heritage, decommissioning processes, and aesthetic reworkings of the relationship between nuclear waste, radiation, humans, and non-humans.

In the first part are presented the nuclear landscapes in Italy, which are naturalcultural (Haraway 2003) contact zones, and are underlined the cultural, historical, and political processes that characterize the history of Italian nuclear programs. In the second part, the interviewees' works and testimonies are discussed. These can be recognized as helpful tools to trace the coordinates of a relationship marked by interference and the invisible radioactive; moreover, their work offers an outlook on marking waste disposal sites for deep futures waste archives (Joyce 2020). As nuclear technologies will continue to influence different aspects of our everyday life, and radioactive fallout particles will contaminate the surface of our planet for millions of years, it is pivotal to question our role in electricity production.

Starting from these investigations, the objectives have been to define: what is the human contribution in these situations? Do techno-science landscapes reflect our un-degraded future? Is it possible to think about invisible contaminations through new languages? What defines nuclear heritage, and what happens when radioactive waste becomes part of our culture?

Introduction

As energy consumption and uncertainty have grown and will continue to grow exponentially, the discussion on the production and use of nuclear energy has opened up again: facing a possible second nuclear industry's global coming, it is pivotal to be accountable for our actions. Radiation is an invisible presence that has shaped our spaces, our bodies, and our imagination. The byproducts of nuclear technologies have saved or destroyed lives, ended wars, and promised cheap energy for civilian use. Because of its material longevity, radiation has had an impact on different aspects of our everyday life, marking its presence in our past, present, and future for millions of years, so much that scholars such as Peter C van Wyck have argued for a "Nuclear Anthropocene," where man-made radioactive isotopes provide a time-stamp of human impact on planet Earth (Wyck 2016). Since 1945, over two thousand nuclear explosive devices have been detonated around the world, the majority by far in the United States. According to the theorization that the first nuclear testing might be proposed as the beginning of the Anthropocene and of the nuclear age, "we suggest that the Anthropocene (formal or informal) be defined to begin historically at the moment of detonation of the Trinity A-bomb at Alamogordo, New Mexico, at 05:29:21 Mountain War Time ($\pm$2 s) July 16, 1945 (= 11:29:21 Co-ordinated Universal Time = Greenwich Mean Time)" (Zalasiewwicz et al. 2015, 200). The theorisations that see the beginning of the Anthropocene coinciding with the beginning of nuclear denotations bring new attention to the causes and consequences of the creation of certain realities. While the Anthropocene may still be an abstract concept, obscured even by the impossibility of visualising (through photos or

drawings) nuclear spaces because of concerns for safety, artworks can become traces and testimonies of these spills and mutable impacts.

This thesis aims at questioning the role of nuclear technologies in Italy, by focusing on nuclear spaces, technoscience landscapes, and the aesthetic reworkings of the relationship between nuclear waste, radiation, and humans. Currently, Italy is one of only two countries in Europe, along with Lithuania, that completely phased out nuclear power for electricity generation after having operational reactors. For this reason, what will be analyzed is not the production and use of nuclear energy, but the ways of dealing with radioactive waste. In particular, what will be investigated are the results of the encounter between semiotics and materiality, or how artists, who took part in the exhibition “Art Spaces: Nuclear Decommissioning: Science at the service of the future generation”, have conveyed the relationship with contemporary art and radioactive substances. This dissertation deals with various aspects of radiation and radioactivity: chemical transformations involving organizations, bureaucracies, militarized sites, communities, scientists as well as artists; contamination and containment of radioactive waste and the solutions to be adopted to archive this type of waste; (in)visible traces and how artists have dealt with them; exposure and slow violence which affects communities and ecosystems.

The research was divided into two chapters. The first chapter "Nuclear landscapes in Italy" provides information on the historical, political, and social processes that led to the beginning and end of the atomic age in the country. The second chapter “Ethnographic research” is devoted to a discussion of the data collected from the interviews that have been conducted with the artists. In the second chapter, their testimonies are illustrated, analyzed, and discussed. What follows is a brief literature review indicating the main works that allowed me to construct the ethnographic research. This same scholarship will be taken up later in depth, to better ground the research of the two main chapters.

The thesis moves in the broader framework of "anthropology of infrastructure" (Vleuten, 2004; Silvast et al., 2013; Strauss 2013; Anand et al. 2018; Silvast and Virtanen, 2019; Abram et al. 2019) and "chemical ethnography" or "chemo-ethnography" (Shapiro and Kirksey 2017). Anthropological interest in energy and infrastructure is not new and relationships between energy, labor, cultural practices, and the environment, have been largely investigated since the beginning of the discipline (Anand et al. 2018, 7). Nevertheless, the anthropology of infrastructure and electricity does not just tackle the "hidden" structures of societies, but it arises from a need to better understand the role of infrastructures in our current ways of living, in our times, politics, and societies.

While the ethnographic research presented in the thesis focuses on testimonies gathered from artists, they are not the sole protagonists of the investigated topic - namely, the methods of negotiation they have adopted to deal with radioactive waste material. Radioactive waste can be ascribed to the broader definition that Nicholas Shapiro and Eben Kirksey have offered in *Chemo-ethnography: An Introduction* (2017): "[c]hemicals are becoming increasingly useful linking figures as ethnographers follow complex, multi-sited, and multiscalar phenomena" (481). The concept of "chemical ethnography" comes from Lochlann Jain's argument in *Malignant: How Cancer Becomes Us*, "cancer and its identities out of the closet and into a space not of comfort, or righteous anger, but of mourning, a space where the material humanity of suffering and death informs communicative and collective action" (Jain 2013, 24). By using a chemo-ethnography approach, or by "thinking chemically" (Shapiro and Kirksey 2017, 482), research has channelled the attention also to non-living entities and how they reveal themselves to be not just chemical elements to live with (or in spite of) but also to think about or through; thinking chemically involves promises and perils, and by "detoxifying the atmosphere also sustain infrastructures of toxic exposure" (Shapiro et al. 2017). What sparked my interest in chemo-ethnography is the invite to go beyond the

cognitive, corporeal, or landscape transformation, to pay attention to "the longstanding relationships and emergent social forms that arise from chemical exposures and dependencies" (Shapiro and Kirksey 2017, 482) and to focus on the "relationships with human built infrastructures" (Shapiro and Kirksey 2017, 485).

Specifically, the chemical element that has been of interest in this thesis is the nuclear element. In order to better understand the aspects that make an object, a state, or a place nuclear, the work of historian Gabrielle Hecht was of fundamental importance. Hecht has worked on the nuclear industry in both France and Africa and has mapped serious blind spots in our "Western" understanding of nuclear matters, and her writing has helped me rethink the limits of "nuclearity" (Hecht 2012), which is defined by colonialism, imperialism, and techno-politics. A second key element is the "nuclear landscape," which does not function solely as a scenic backdrop but is also relevant in the reading offered by this thesis. I wanted to adopt a view of the landscape that goes beyond the visualization of it as a surface, highlighting its (more or less) hidden entanglements. To do this, I consulted the works of Donna Hawaray (2003), Anna Tsing (2014), and Doreen Massey (2006). Nuclear landscapes have fuzzy boundaries, containing different dynamics and temporalities: mines, nuclear plants, decommissioning facilities, nuclear waste repositories, communities, workers, and bodies, are all part of nuclear landscapes.

Of all these spaces, the ones that have become most important are the decommissioning sites and the spaces that will permanently contain radioactive waste. The interest in waste, more peripheral in the history of anthropology than in the discipline of archaeology (since waste has always been an important, often crucial, data source for archaeology), sparked from three works: Mary Douglas's "successful amalgamation of structural-functionalism and structuralism" (Eriksen and Schober 2017, 282) in her pathbreaking book *Purity and Danger: An Analysis of the Concepts of Pollution and Taboo*

(1966); the "archeology of garbage" by William Rathje (Rathje and Murphy 2001), and Zygmunt Bauman's reflections in *Wasted lives* (2004), which propelled the interest rise in surplus populations (Eriksen and Schober 2017). Waste has been interpreted as a key concept to better understand social exclusion, hegemonic relationships, and hierarchies that differentiate what or who is waste from what or who is not (Mbembe 2019; Armiero 2021). As a part of the broader field of "military waste" (Barad 2003; Masco 2006; Gusterson 2007; Lutz 2007), radioactive waste has been investigated by Peter C Van Wyck in *Signs of Danger: Waste, Trauma, and Nuclear Threat* (2004). Here, such waste is described as "no longer thinkable as pollution, as matter out of place. Rather, it must be seen as a novel feature of this point in history. Novel, because it represents a *new form* of waste. It really is matter *without* a place. A kind of waste that resists its own containment. A kind of waste that operates in a radically different temporality; it is material whose toxicity requires a different conception of history and time" (Wyck 2004, 4-5). Moreover, as it is inevitably connected with it, to delve into the topic of (radioactive) waste meant to relate to the chasm of purity and impurity, and contamination – of bodies, communities, and spaces. Alexis Shotwell's work and methodology offered an "ontology of embodiment and entanglement," and by reflecting on the political consequences of contamination, I had been drawn back to relational responsibility and uneven complicity for our toxic present, complex techno-ecologies, and space for crafting better futures (Shotwell 2016).

The final material destiny of radioactive waste is to be vitrified and then stored in facilities or permanent isolation from the environment. In *The Future of Nuclear Waste: What Art and Archaeology Can Tell Us about Securing the World's Most Hazardous Material* Rosemary Joyce (2020) addresses the future of nuclear waste and decision-making processes concerning a major technological challenge in present society. Joyce's work was pivotal in deciphering the interrelations between the domains of things and technology, and the domains

of culture and society. *The Future of Nuclear Waste* delves into semiotics and memory issues, as well as discussions of contemporary art, indigenous politics, and archetypes of meaning. To further investigate the relationship between contemporary art and the nuclear invisible, the work of curator Ele Carpenter was also of fundamental importance. *The nuclear culture source book* (2016) allowed me to better understand the current state of nuclear culture, providing numerous examples from the UK and Japan of how the nuclear economy impacts contemporary life and culture. Similarly, the Nuclear cultural heritage (Rindzevičiūtė 2022) project allowed me to see how the nuclear presence can be dealt with through heritage studies, providing ways of responding to pressing challenges experienced by nuclear nations, such as the management of nuclear waste and military arsenals, the future of the nuclear energy industry, and the need to reassess the wider social and cultural legacy of the nuclear past (Rindzevičiūtė 2022).

Methodology

The interview sampling included nine of the fifty-two artists who took part in "Art Spaces: Nuclear Decommissioning. Science at the service of the future generation" held in Ispra (2017) and organized by the Joint Research Centre (JRC). Initially part of my project would have included workers, experts, and technicians from the JRC in Ispra. However, the actualization of the task turned out to be more difficult than expected. Laboratories, research spaces, and decommissioning nuclear plants are highly guarded spaces: the information they contain cannot leave those spaces easily. Initially, the JRC in Ispra refused my proposition to organise a field visit, Although they had organised tours in the past, they were never designed

or aimed at privates, but mainly involved researchers in the field or school groups. In the email exchanges, I was advised by the Communications Office for Nuclear Decommissioning to contact the creators of the event and the curator of the event. This group proved to be helpful, curious, and wished to receive more details and information about the research project. Through one of the event creators I obtained the contact of the art curator. After making initial contact, some of them were interested in participating; all of them preferred to receive questions before the interview date. However, the online interviews were not completed. After many messages and agreements on the most convenient date and time for the interviewees, they kept putting it off due to personal and work issues. Likewise, the curator of the exhibition never show up for the scheduled interview. I also contacted the communications offices of Sogin (Società Gestione Impianti Nucleari), even though I had failed with the JRC in Ispra. At first, I explained to them my intentions and the reasons that led me to contact them, providing them with information on my research project. My willingness to investigate and get in touch with the working environment of nuclear decommissioning and the insiders sparked curiosity and interest in the company's Human Resources. Just like the JRC in Ispra, it would not have been possible for them to provide a visit for a private visitor. Still, with a proactive and open attitude towards the 'unusual' approach compared to the researchers they usually came into contact with (i.e. scientific researchers), they proposed to organize a visit to the former Caorso nuclear power plant. Despite the protracted timeframe and the difficulties in compiling a privacy guarantee document that would satisfy the hosting company, which imposed strict confidentiality requirements on the disclosure of the information collected, and which ultimately was not completed, the preparatory stages leading up to the meeting seemed propitious. Nonetheless, I was unable to visit the Caorso plant in person, not because of a lack of communication or the interruption of it, but because the research phase’s pace was slowed down after personal,

logistical, and economic difficulties. In particular, I did not feel ready enough to engage in field research with an institution that is supposed, for security reasons, to protect the information on which I had to base my study. In addition, I did not feel that I was sufficiently protected by my University's privacy committee, as the thesis was not part of any project commissioned by the University. In addition, the feeling that I was about to venture into environments that were very distant and difficult to decipher fully never left me.

Expanding the project in this direction, i.e. delving into the relationship that workers in nuclear plants undergoing decommissioning might experience with the nuclear invisible, would have constituted a more complete picture of the overall situation. This would have entailed an analysis that would have gone beyond the ways in which decommissioning is observed, perceived, and communicated from the outside (through the work of artists), but also how this can be perceived in the daily routine by workers. Specifically, it could have offered some insights into what the consequences of adopting this type of communication were, and how it was perceived by insiders.

In this respect, the suggestions gathered at the workshop held on 13 and 14 October 2022 and co-organized by the University of Liège, the BoS in collaboration with HealthXCross, and the FNRS would have been very useful. The workshop focused on the scientific work and on the question of the health of living environments and its intimate link with human health, together with investigating the modes of data collection (i.e. biomonitoring), differences among scales (from the environment to the genome), and health of the environment and communities (antimicrobial resistance). The workshop probed areas of interest somewhat distant from my thesis project, yet I was invited by one of the organizers because there were thematic affinities, such as the focus on toxic substances in our environment, or on complex, layered issues on various scales. The invisible traces (be it bacteria, toxic substances, or radioactive waste) led me to the fruitful opportunity to present

my thesis project at the workshop. There, I not only had the opportunity to observe how academic discussions take place, but also I received very useful feedback from experienced academics in the field, among whom the philosopher of science Isabelle Stranger. One of the most interesting insights was the proposal to do cross-interviews, i.e. allowing the group of workers to comment on the works exhibited in “Art Spaces”. What would their reactions be? Would they, as insiders, have interpreted the communication and implementation methods adopted by the organisers and artists differently? Listening to their advice was a unique opportunity. Although I did not have the chance to put them into practice, I will cherish their lessons for a long time.

The actual sampling for the ethnographic analysis included artists with various fields of expertise in art (visual artists, sculptors, painters), currently living in different parts of Italy (therefore with direct/non-direct experience of “clean” or contaminated areas), and who do not share the same ideas on the theme covered by the exhibition. Conducted mainly through semi-structured online interviews, via open-ended and non-directive questioning, the ethnographic research discussed in this thesis gathers and reveals the artists’ involvement, perspectives, and interpretations of the artworks they submitted for the exhibition. The invitation to participate in the ethnographic research was extended to the fifty-two who took part in the exhibition, but the material collected comes from nine of them who confirmed their availability and participated. All interviews were recorded, transcribed, translated, and analyzed through theoretical concepts to highlight commonalities and disparities.

The questions that were asked of all the artists concerned some aspects of their background and living conditions, their perception of the changes in the area, what their experience with "Art Spaces" was like, and what difficulties they encountered in dealing with the theme or dealing with waste material, their interpretation of the exhibition's potential to become an archive of the radioactive presence, and what each artwork could communicate for

the future. However, each interview was modulated based on the artwork taken into consideration, just as each artist's wish to explore certain themes or not was respected. While maintaining some common questions, each interview kept a flexible nature. The artworks revealed different outcomes and opened up discussions on security, the relationship between technology and art, environmental sustainability, power dynamics, and new ways of thinking about waste. Moreover, as the exhibition took place in a storage facility, it operated in a less normative space, benefiting from the possibility of constituting a space where different disciplines met while experimenting with knowledge-making.

At a later stage, a non-compulsory questionnaire was submitted to the artists who decided to participate in the interviews. The questionnaire was divided into six questions. It was not required to answer all questions to complete the questionnaire and most questions required a short open-ended response. The questions were: to assess whether the objective of the initiative (to make knowledge of the decommissioning of the Ispra site more accessible and transparent) had been achieved, to share more details on the training arrangements (whether they had received lessons, whether the training had been shared and what relationships had been formed with JRC staff), whether the facility was a space of exchange and connection between the two fields (artistic and technical), and the reactions of the public and the JRC workers. Finally, a closed-ended question (where possible answers were "yes" or "no") on being aware of the existence of the Nuclear cultural heritage project – the whole interviewed sample voted "no".

Although the artists were open to sharing their experiences with me, I had to face the issue of being there only partially. Fieldwork *in situ* and participative observation of this community was not feasible, as I started my thesis work when the exhibition had already ended. I would argue that it would have been interesting to actively participate in its realization as a student of environmental anthropology, to carry out fieldwork with a wider

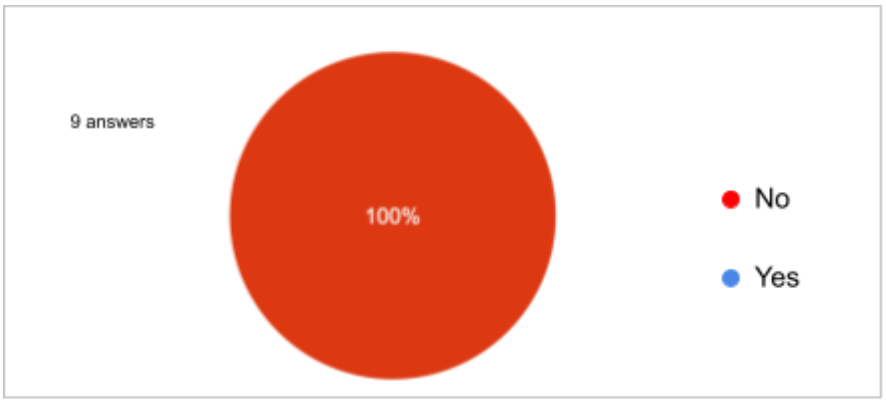

Figure 1. Pie chart of results

scope and investigate how anthropology could work with art production, to practice a more experimental form of ethnography. Also, the group of artists did not offer a unitary vision on the issue: they are coming from different backgrounds and different ways of seeing the theme addressed by the exhibition. Albeit sharing a common theme and a common starting point, namely nuclear decommissioning and the drum used to store radioactive waste, the results in the artworks presented varied extensively.

To conclude, the consideration of a plurality of fields and approaches, from contemporary art to anthropology, from space to epidemiological studies, conveys an organization of ethnographic research that may not correspond to a linear pattern. I'd argue that there are elements of this thesis that could be interpreted as not very pertinent to either field of research, and I hope that it can be read as an attempted boundary-testing research project, which moved obliquely and paid attention to the points of intersection (or distance). Lastly, as I was aiming to show intra- and cross-disciplinary aspects of the research, the final result could appear as a patchwork and cut up more than a cohesive reading of the event itself.

1.1. Introduction

The aim of the chapter will be to illustrate the nuclear experience in Italy, analyze its history, and highlight its political aspects, social repercussions, and the protests that have arisen from the issue, as well as public opinion. Currently, nuclear energy production in Italy is at a standstill: although nuclear research has not stopped, Italy has not been a nuclear power-producing state since 1987 following the popular referendum. Although the questions to vote mainly concerned the placement of nuclear plants instead of nuclear energy production per se [1], in each referendum the "Yes" won bringing the Italian government to commence the shutdown of the existing plants. For this reason, we are currently undergoing a decommissioning phase.

The chapter is divided into two parts. The first part introduces the concept of "nuclear landscapes," spaces where dualities of nuclearity occur and which have fuzzy or blurred perimeters. These landscapes result from interactions between technology and power (Hecht 2012), as well as can be interpreted as naturalcultural contact zones (Haraway 2003) or as "events" or "happenings" (Massey 2006). This is the framework adopted to deal with the second part of the chapter, which is focused on Italian nuclear landscapes. These are the result of interactions between national and international factors, political ideologies and choices, technological development, culture, and public opinion.

[1] To abolish the power of the State to oblige the local administrations to accept new nuclear plants in their territory; to abolish rewards for local administrations that accepted nuclear, and coal, plants in their territory; and to abolish the authorisation for ENEL to build nuclear power plants outside Italy.

For this reason, the second part of the chapter will present the history of the nuclear phase in Italy, from its origins after the Second World War until the first referendum in 1987. This section will highlight the relationships that the Italian nuclear field has woven with external and international influences and how these have co-operated with domestic realities. Various elements influenced the Italian nuclear season, such as subsidies from the United States of America or the oil market crisis, internal political or economic currents, as well as judicial events ("Ippolito case"). The next section will present the attitudes that have historically characterized the relationship between public opinion and nuclear presence, with a focus on the hopes and fears of Italian citizens, cultural and literary products, and anti-nuclear protests. Concluding the chapter is the section introducing and explaining the current situation of nuclear decommissioning and the problems that have arisen from finding a national site capable of storing radioactive waste in the long term.

1.2. Nuclear landscapes

As Gabrielle Hecht's definition suggests, nuclearity or "how places, objects, or hazards get designated as 'nuclear'" is profoundly spatial in its uneven distribution and consequences" (Hecht 2012, 4-14). In this sense, it is impossible to interpret nuclear technology as a separate element existing apart from the social, political, and spatial relations that bring it to life (Hecht 2012). Nuclearity has fluid boundaries, which have been described within the broader concept of "nuclear landscapes," a common term in photographic and some academic work (Zonabend 1989: Goin 1991; Kirsch 1997; Wills 2001). Nuclear

landscapes are spaces where several dualisms occur: ruin and redemption (Cram 2015), visibility and invisibility, materiality and immateriality, spectacle (or sublime), and banality. Discussing his latest archival project *100 Suns* (2003) Michael Light, photographer and bookmaker dealing with the politics of the environment and America's cultural relationship to it, suggested that "[t]he nuclear landscape is one of power and violence that needed to be described, particularly in how since 1945 it has irrevocably altered the cultural mechanics of landscape and the environment after humans became architects of the sublime" (Hirsch 2005, 25). The intersections between landscape and power have been investigated by W. J. T. Mitchell in *Landscape and Power* (2002), which transformed landscape studies, arguing that landscapes should not be seen as an object or text to be read. Instead, landscapes are an instrument of cultural force and a tool in the creation of national and social identities. In particular, Mitchell has claimed that "an official nuclear landscape became the medium for violence and evil written upon the land to be veiled and naturalized" (Mitchell 2002, 29-30). These landscapes are hybrid as they are embedded with technological artifacts, systems, and practices, where strategic use of technology enacts political goals (Hecht 2011); moreover, "[t]he material qualities of technopolitical systems shape the texture and the effects of their power" (Hecht 2011, 3) even if "[m]aterial things can be more flexible–and more unpredictable–than their builders realize" (Hecht 2011, 3). To consider the nuclear landscape one has to acknowledge the sublime origins and its lasting geographic implications. However, to fully comprehend nuclear landscapes one should also consider those alternative spaces and contexts, out-of-the-cloud, obscured by the spectacle, state secrecy, and banality (Pitkanen and Farish 2018).

In a 2017 article, Becky Alexis-Martin and Thom Davies examined how nuclear technology interacts with space and place, inhabiting a wide range of geographic scales. In their study, they have demonstrated how we come into contact with radiation focusing on

three critical sites of nuclear geography: the zone, the body, and the community. In particular, the creation of zones and nuclear technology are intrinsically linked: nuclear spaces rely on boundaries (exclusion zones, zones of nuclear industry, technological experimentation zones, bunkers) where the nuclear environment is actively controlled (Alexis-Martin and Davies 2017). These zones are marked, mapped, and enforced, in order for humans to "see" what otherwise would be invisible: "[i]n this sense, nuclear spaces are constructed socially and politically, and are subjected to a diverse array of different influences, that extend far beyond the ontological presence of radiation" (Alexis-Martin and Davies 2017, 4). Nuclear zones are both in the realm of everyday life (places of healthcare and industrial activity) and also constitute the most spectacular example of the nuclear presence when constructed in the wake of nuclear disasters (Alexis-Martin and Davies 2017). These postnuclear accident landscapes, as discussed by William Bunge (1989) are symbols of technological failure, and in a state of constant becoming (Beck, 1992; Davies, 2013; Freudenburg and Davidson, 2007). These "exclusion zones", which most notable examples are those of Chernobyl or Fukushima, are carved up among the wider landscape and marked as "unclean" territory (Davis &and Hayes‐Conroy, 2017). More often than ever, narratives depict the absence of human components as the fundamental step toward the rebirth of "Nature" in these (seemingly) abandoned spaces. However, differently from the common narrative, I would argue that such zones do not represent an example of "pure" or "thriving" nature, but these spaces have to be conceptualized as hybrids that emerge from connections of global politics, such as capitalism, and also militarization. The nuclear infrastructures, the control of space, and restricted human access are all deeply political factors. While the proliferation of multiple species can be observed in the absence of the human component, the two elements cannot be separated or placed in a causal connection. On the contrary, it would not be possible to imagine a multi-species presence without human disturbances. Furthermore, not all exclusion zone is

not inhabited by human communities. There these communities have learned to negotiate the reality of living in contaminated zones, creating ownership of their marginalized situation (Stawkowski 2016) and their own understanding of the everyday relationship with risk and place (Davies 2013). In this sense, I propose to interpret them through the framework of "natureculture," where ecological relationships are biophysically and socially formed, seen as the synthesis between nature and culture, and are ultimately inseparable (Haraway 2003). Together with that, as Doreen Massey argues place and landscapes are "events" or "happenings" (Massey 2006, 46). Because of that, I think that observing spaces and landscapes through the lenses of the natureculture dynamic is as important as interpreting them as stories that through time change, move, go on, disaggregate, and are unfinished. As the geographer states, "space is imbued with time" (Massey 2006, 46) and landscape is "one constantly emergent, ongoing, product of that interwining of trajectories" (Massey 2006, 46). Spaces and landscapes in this sense are not just surfaces, but "product of a meeting up of trajectories out of which mobile uncertainty a future is – has to be – negotiated" (Massey 2006, 46).

In light of what has emerged and the definitions of landscape that go beyond those of a mere surface, after this necessary explanation of the framework that will be used, the following sections will return to the focus of the chapter: nuclear landscapes in Italy. For the reasons mentioned before, it is pivotal to look at Italian nuclear landscapes as the result of interactions between national and international factors, political ideologies and choices, technological development, culture, and public opinion.

1.3. Making nuclear Italy

1.3.1. The beginning and decline of Italy's civilian nuclear program

Between the end of World War II and the mid-1960s, Italy was one of the first countries to express interest in developing civilian nuclear energy (Bini and Londero 2017; Bini 2018). The influence of the Cold War, assistance coming from the United States through the Atoms for Peace program, together with a general lack of energy resources, played a fundamental role in leading politicians and industrialists in Italy to embrace the idea that atomic power would help in producing an unlimited, clean, and efficient source of power (Bini & Londero 2017). While being influenced by it, Italy's civilian nuclear program did not represent an imposition of American technology and industrial strategies. Rather, US policies interacted in complex ways, and until the early 1960s with the establishment of the Comitato Nazionale per l'Energia Nucleare (CNEN), they encountered resistance on the part of Italian politicians and institutions (Bini 2017, 39). Once the Italian government supported the idea of the development of a nuclear policy as a part of the forms of economic planning and modernization, the US acted as a provider: of enriched uranium (rather than a natural one [2], thus making Italy dependent on a technology controlled by the US), of reactors, of training for Italian scientists and technocrats (Bini 2017, 40). The production of electric energy from nuclear plants dates back to the 1960s: the first electronuclear plant, the first civil reactor, a British Magnox gas-cooled reactor, was built in 1964 in Latina (Lazio) and only a few months later, the second nuclear plant was built in Sessa Aurunca (Campania). The third one

[2] Uranium exploration in Italy began in the early 1950s by private companies, which evaluated known radioactive occurrences. Exploration efforts and activities have been focused on the Alps, Sardinia, and Calabria. Few vein-like occurrences were discovered in Monte Bianco, in southern Sardinia, but the most important findings were in Novazza and Val Vedello, both in the Permian Collio Basin, located in the Lombardy Alps (Tedesco 1984).

in Trino (Piedmont) was completed in 1965. Five years later, in 1970, the construction of the Caorso plant (Emilia Romagna) started, only for the facility to become operational in 1981. The Caorso plant was the last one to be dismissed, in 1990. Given that it was difficult to predict in advance which technological pattern the nuclear sector would have followed, the immaturity of the technology helped to partially justify the nuclear industry's diversification (Lavista 2017).

Despite the fact that in the mid-1960s Italy was one of the most advanced countries in terms of nuclear research, it was also one of the first nations to abandon nuclear power production. Italy's shift away from nuclear energy was the result of the creation of Ente Nazionale per l'Energia Elettrica (ENEL) and its decision to rely on oil to fuel its electric plants, making the Italian economy and industry dependent on imported oil and vulnerable to changes in the oil market, as it was clear during the 1973 oil "shock" (Bini 2017, 37); and it was linked to political decisions such as the aftermath of the "Ippolito affair," when Felice Ippolito, General Secretary of CNEN, was accused in 1963 of mismanaging public funds. The trial that began following the accusations of Giuseppe Saragat, leader of the Italian Social-Democratic Party (PSDI, a political group opposed to nuclear plants), was widely followed and had a strong influence on public opinion; a year after the "Ippolito affair" began, the American Embassy in Rome argued how the major results had been "to waste a year in the field of nuclear research and development, reduce the country's stature and prestige in international nuclear agencies, and convince the public that nuclear power was too expensive for Italy" (Bini 2017, 39).

To conclude, the decline of public investments in the nuclear sector was only partly the result of American political pressure. While US oil companies and the State Department pressured the Italian government and Ente Nazionale Idrocarburi (ENI) to buy large quantities of cheap crude extracted in North Africa, thus reducing the country's dependence

on Soviet petroleum, ENEL's resolution to rely on oil, rather than nuclear power, to fuel its electric plants, was a domestic choice (Bini 2017). It sparked from a struggle between public and private firms and interests and intersected with the Italian government's decision to marginalize the forms of economic planning and modernization that had characterized the late 1950s and early 1960s (Lavista 2017; Bini 2017). As the story of the Italian nuclear industry took place in an unstable political environment of social and political unrest (such as those in 1968), both nationally and internationally (Curli 2017; Lavista 2017), it should come as no surprise that the American Embassy, the US administration, and the USAEC interpreted the "Ippolito affair" as putting an end to one of Italy's most advanced scientific, technological and industrial projects, and undermining Italy's international prestige.

According to Giovanni Battista Zorzoli, engineer and physics professor, and expert in nuclear energy and renewable energy sources, who analyzed the reasons that led the Italian approach to nuclear energy to failure, Italian decision-makers knew "the right pattern they had to follow in order to carry out a consistent and cost-effective nuclear program. However, they decided to ignore it so they would not displease anybody: a decision that was consistent with the way of acting preferred by Italian governments (business as usual in an unusual business)" (Zorzoli 2017, 98). Zorzoli pointed out how studying the motives behind the failure of nuclear production in Italy, which happened because it lacked a joint and integrated plan of action between many public bodies (i.e. research, development, and private companies), can help avoid similar errors today, especially in aiming at targets such as energy efficiency, the building of smart cities, climate change mitigation, and promoting of renewables sources of energy (Zorzoli 2017, 101).

1.3.2. Public opinion and anti-nuclear movements

In the early 1960s, public awareness in Italy of the complexities of nuclear issues and crises had yet to be built (Ciglioni 2017, 165). A 1964 US Information Agency (USIA) survey reported that "over 70 percent of Italians either had wrong ideas about the Partial Test Ban Treaty or ignored its existence altogether" (Ciglioni 2017, 165). At the same time, Italians were afraid of nuclear bombs, as was revealed by USIA surveys from the same period: Italians were particularly sensitive on the issue of nuclear weapons, favoring disarmament (Ciglioni 2017). Observers and opinion makers agreed on the fact that humankind was living in the "atomic age". At the time, albeit the expression "atomic age" had never been explained in detail and the foundational event of the new era was not clarified, it was widely in use in the Italian press, and had become "a reference to the human condition in the postwar period as evocative and symbolic as the mushroom cloud itself was iconic. In fact, at that point, it implied a whole set of images and meanings, alluding not only to death and looming dangers but also to modernity more in general, in both positive and negative ways" (Ciglioni 2017, 167). While the fears of the "atomic age" were embodied and fuelled by the memory of Hiroshima and Nagasaki and "one of the privileged venues for both molding representations of the atomic bomb and negotiating fears" (Ciglioni 2017, 168), feelings of hope centered on the fascination for the "peaceful" atom and development of civilian uses of atomic energy (Ciglioni 2017). To sum up these two opposing and parallel trends, during the 1960s, public opinion swung between a darker interpretation and a more optimistic form of fascination, fed by the vision of endless possibilities and progress (Ciglioni 2017).

In the early 1970s, concerns over the safety of civilian reactors, together with the issue of controlling nuclear technologies, led to the emergence of public demonstrations

against nuclear reactors (Candela 2018). Some scholars have highlighted the role that culture (visual history, images, narrative, illustrations, and science fiction) had had in shaping the collective imagery related to nuclear energy in Italy (Iannuzzi 2017; Candela 2018). In particular, science fiction "had a role in building many of the rhetorical *topoi* and themes used to discuss scientific issues" (Iannuzzi 2017, 183), providing linguistic and imaginary tools to interact with those issues. Science fiction conveyed the enthusiasm toward nuclear energy and unprecedented modernization in the peninsula, new hopes felt by Italian society, and the new centrality of techno-science, but it was hosted by the Italian cultural elite. Italian intellectuals interpreted the nuclear theme as an "observatory" (Iannuzzi 2017, 192) or a "transfer" (Antonello 2013) of the relationship with techno-science and their social role at large. At that time, the bomb was identified as a symbol of the nihilism of the contemporary age, deeply linked with the destructive power of the concentration camps (Iannuzzi 2017), and Italian intellectuals' condemnation of science fiction was a symptom of their "malaise of modernity" [3] (Iannuzzi 2017). The analysis of these issues is outside the scope of the thesis work, however, the study of cultural products and the effects of cultural products on society over the second half of the 20th century has still received little investigation (Candela 2018). Together with offering a reconstruction of the reception and attitude adopted by Italians towards nuclear research and technology, focusing on these aspects allows for deciphering the mechanisms between Italian history, cultural elites, and decision-making processes (Iannuzzi 2017). While on the cultural landscape narratives on the issue were unfolding, from a political point of view the Italian anti-nuclear mobilization had a slower development. The first environmentalist movements began to emerge in the years 1976-1977 (Serneri 2003) but they immediately encountered a moment of crisis. In Italy, the movement against nuclear weapons arose much later than in other countries such as Germany, the United Kingdom, and

[3] Taylor, Charles. *The Ethics of Authenticity*. 1991.

the Netherlands (Branciforte 2022), while a general opposition to nuclear power within public opinion was already present in 1979, following the Three Mile Island plant accident (Neresini and Lorenzet 2016). From the very beginning, however, the movement experienced a political division between young Communists and New Left members: the double origin of the mobilization was characterized by ideological differences that proved difficult to overcome (Moro 2017). The Italian anti-nuclear movement of the 1980s was fragmented, lacked agreements within itself, and had not an integrated strategy (Branciforte 2022) and while the Italian Communist Party (PCI) had the potential to lead the movement, it acted with caution and ambiguity (Branciforte 2022). However, in 1981 the anti-nuclear movement was able to transform itself on the basis of mass demonstrations held in London against Margaret Thatcher's nuclear rearmament policies, while NATO's decision to deploy cruise missiles in the small Sicilian town of Comiso (Ragusa, Italy) triggered mass protests against nuclear weapons (Branciforte 2022). The movement became pluralistic, encompassing a variety of political and religious cultures, and the Comiso protests (1981-1983) turned into a propagation point for new directions in terms of unification and growth. In 1983, women who were peace activists and supported nuclear disarmament issued an invitation to women throughout the world to join them in Comiso, during three days of dancing, parades, and an effort to encircle the base (Branciforte 2022). This resulted in the establishment of a peace camp, called *La Ragnatela* (Spider's Web). However, when groups decided to try and stop trucks from entering the base, the police responded violently, arresting the women and dragging them away from the protests. The forced removal from the camp, the beginning of a trial that became a matter of public interest, and finally the installation of the missiles, led to the disbandment of the camp between 1984 and 1985. Feminist and pacifist initiatives and demands continued to happen, but there was no second *La Ragnatela* camp. The missiles remained on the base until 1991 when they were dismantled. Nevertheless, the anti-nuclear

feminist protests at Comiso created “a widely supported, original movement that is hard to quantify” (Branciforte 2022, 333) and “greater cohesion within the [feminist] movement” both nationally and internationally (Branciforte 2022, 333). The protests “gave a renewed meaning to Italian feminism in the 1980s and 1999s, contributing to mitigating the anti-feminist backlash at the time, developing new forms of protest, organizing numerous novel events and creating a symbolic repertoire” (Branciforte 2022, 333). Lastly, by developing and share “new and original strategies and tools for protest against nuclear power” it “paved the way for ecological activism and environmentalism” (Branciforte 2022, 334).

The events and feminists’ demonstrations in Comiso can be interpreted as the materialization of the action of the “Daughters of Uranium”. Together with being an exhibition by Mary Kavanagh (2020), where she explored the legacy of the atomic age from the perspective of the sentient body and intergenerational trauma, “Daughters of Uranium” is a title redolent of both archaic chemical science and of generations born into an uncertain future. Originating in the radioactive decay chain of Uranium 235, widely known for its use in the first atomic bomb, the elements in Uranium's family tree are referred to as “daughters”. This poetically suggestive term referring to the generations to come can keep us understand how “[w]e are all such daughters in a globally integrated world, connected to generations of radioactive material that is difficult to contain and control” (Wilkinson 2020). We are all compromised, exposed, and contaminated. At the same time, the daughters of uranium are unruly and unpredictable – they disobey, and question authority. In a sense, the daughters of uranium are not so different from feminist philosopher Rosi Braidotti's theorization, which introduces the term “undutiful daughters”. Braidotti suggests, through the concept of “undutiful daughters” the possibilities of feminism across generations, where inheritance becomes “a productive form of conceptual disobedience” (2012). Ultimately, disobedience

can become yet another tool to deal with the inheritance of a contaminated world, as its dynamics affect us in our bodies, communities, and homes. With that, disobedience is also a feminist act, a task that requires us to look at ourselves and at each other as contaminated through intimacy (Wilkinson 2020).

1.3.3. Decommissioning of nuclear plants in Italy

Following the 1987 nuclear referendum, nuclear power programs have been halted in Italy, leaving the floor to increased production and import of natural gas as a source of energy. The causes for the decrease in nuclear development after 1985 concern a series of events with global-scale effects. Among them, the most important one is the increase of interest in oil after 1980 and the Chernobyl nuclear accident, which profoundly transformed how countries worldwide viewed nuclear power (Albino et al., 2014; Prăvălie and Bandoc 2018). For instance, that same year Germany approved a resolution aimed at abandoning nuclear energy by the end of the decade, and the following year Italy completely shut down its nuclear energy program (Albino et al., 2014; Prăvălie and Bandoc 2018). In this context, Italy became the first country to go back to a "non-nuclear energy" status. Two other states followed its lead and abandoned their nuclear reactors in the following decades – Kazakhstan in 1999 and Lithuania in 2009 (Schneider and Froggatt, 2011).

In Italy, the responsibility for nuclear and radioactive wastes and reactor and fuel cycle decommissioning is owned by Sogin (Società Gestione Impianti Nucleari). The decommissioning strategy, adopted in 1990 and accelerated in 1999, envisaged the end of the country's nuclear power program and the complete decommissioning of nuclear facilities by

2020. However, in 2004, the deadline was moved to 2024. Initially, Sogin was established to dismantle the power plants of Trino, Latina, Caorso, and Garigliano and with time the dismantling program was extended to other facilities, such as research centers owned by Enea: EUREX in Saluggia, ITREC in Rotondella, OPEC and IPU in Casaccia (Sogin 2022). The first decommissioning project to be implemented was Trino, which began in 2012.

As the last stage of a nuclear power plant life cycle, decommissioning or dismantling is described as a process that involves "removing fuel, carrying out the facility radiological characterization, the decontamination of structures and, lastly, the site radiological characterization" (Sogin 2022). The decommissioning process also involves the management of 'collateral' waste such as iron, copper, or concrete, which will be removed to be recovered and lastly recycled. At the end of the process, with the demolition of the power plant structures, conditioning of radioactive waste, and its storage in interim facilities (to be transferred to the National Repository), the land previously occupied by the nuclear plant will be classified as a "brownfield" and then as a "greenfield". While there is no standard definition for brownfields across Europe, in common usage it refers to "previously developed land, encompassing a range of sites in terms of size and location" (Ferber et al., 2006, 12). Specifically, the European multi-stakeholder network Concerted Action on Brownfield and Economic Regeneration Network (CABERNET) adds some other information to the brownfield definition, describing them as sites "that have been affected by the former uses of the site and surrounding land; are derelict and underused; may have real or perceived contamination problems; are mainly in developed urban areas, and require intervention to bring them back to beneficial use" (Ferber et al., 2006, 12). Consequently to the elimination of the majority of radiological risks and pollution, the brownfield becomes a "greenfield", marking the end of the decommissioning process and the beginning of a new one, as it can be used by the community. In June 2022 Sogin announced that the dismantling of the former

fuel fabrication plant at Bosco Marengo was completed. Bosco Marengo is the first decommissioned Italian nuclear facility to be returned to a brownfield site (World Nuclear Association 2022). Sogin has proposed a possible alternative future for some buildings of the plant, along with others of the nuclear power plants decommissioned in Caorso (Piacenza) and Garigliano (Caserta), to store and preserve in case of natural disasters the works of art of our country. This decision would be part of a project to protect the artistic heritage promoted by the Ministry of Culture and included in the National Recovery and Resilience Plan (ANSA 2022).

As well as being responsible for nuclear decommissioning, Sogin is also the company that studies the Italian territory to identify, construct, and operate the national near-surface repository to host LLW (Low-Level Waste) and ILW (Intermediate Level Waste) definitively and to temporarily store HLW (High-Level Waste) until its final disposal in a deep geological formation. According to the time schedule for its realization, the depository will be operative around 2030, while the vitrified waste will return by 2025. The discrepancy between the progress of the work and the approaching deadline led to the consideration of two possible scenarios: new agreements to postpone the return of wastes or the improvement (or construction) of new repositories in the existing nuclear sites to store them temporarily (Testoni et al. 2019). In 2020, sixty-seven sites were identified in Italy as potentially suitable for hosting a repository (Sogin 2020). However, a study from Borgogno-Mondino et al. has highlighted how the procedure followed by Sogin has shown significant weaknesses and criticalities, lacking in open data utilization, and proving that all spatial concerns are based on a “very limited number of data, mainly having a homogeneous coverage over the Italian territory” (Borgogno-Mondino et al. 2021, 3). The study focused on the Torino Metropolitan district or TO-10 site (Piedmont region, NW Italy), which develops on the right side of the Dora Baltea river, and is located about 7 km from the EUREX Sogin nuclear waste repository

and treatment area (Saluggia), and at about 26 km from the dismissed “E. Fermi” nuclear plant (Trino Vercellese). The TO-10 site is the first area appearing in the graded list contained in the published document (Sogin 2020). However, according to geological and geophysical data, the TO-10 area is located within a tectonically active geodynamic environment, is near a highly vulnerable and extremely superficial groundwater table, is a highly populated area, and is already hosting most of the Italian nuclear wastes making it a hot spot from the nuclear risk point of view (Borgogno-Mondino et al. 2020, 19). The findings from the study have shown how the TO-10 site resulted not suitable for hosting a safe, long-lasting nuclear repository (Borgogno-Mondino et al. 2021, 19).

1.4. Conclusions

This chapter has provided the basic information and framework for an overview of the nuclear landscape in Italy. What was intended to be demonstrated is the interconnection between the elements that make up the nuclear landscapes and how these have generated the contemporary situation. In particular, the chapter provided the elements to better understand the detailed analysis that will follow in the next chapter. Although Italy has faced two referendums on the nuclear issue, one in 1987 and one in 2011, the question seems to be still open. Discussions on the possible re-introduction of this type of energy production are recent, especially following the European Union's decision to define nuclear energy as “green” in its energy taxonomy.

To explore current political disagreements about whether nuclear can be qualified as sustainable, in 2020 the EU Commission launched in-depth expert research to gather the latest

facts. In March 2021, the Joint Research Centre (JRC), the Commission's in-house science and knowledge service, issued a technical report on nuclear energy (Abousahl et al. 2021). The JRC's findings about nuclear categorically reject the myths advanced by anti-nuclear campaigners and anti-nuclear Member States. According to the analysis, "nuclear energy does more harm to human health or to the environment than other electricity production technologies already included in the Taxonomy as activities supporting climate change mitigation" (Abousahl et al. 2021). The report stated how nuclear energy production is a low-carbon investment, as the "average lifecycle GHG emissions determined for electricity production from nuclear energy are comparable to the values characteristic to hydropower and wind. (Abousahl et al. 2021, 9); it produces low pollution levels because it " has very low NOx (nitrous oxides), SO2 (sulfur dioxide), PM (particulate matter) and NMVOC (non-methane volatile organic compounds) emissions. With regard to acidification and eutrophication potentials, nuclear energy is also comparable to or better than solar PV and wind" (Abousahl et al. 2021, 9); nuclear energy plants occupy " about the same as for an equivalent capacity gas-fired power plant, but significantly smaller than wind or solar PV" (Abousahl et al. 2021, 9). Regarding the risks of emitting dangerous radiation for the public and the accusation of being a cause of cancer for people living nearby nuclear plants, JRC's findings clarified that the average annual exposure to a member of the public is ten thousand times less than the average annual dose due to the natural background radiation (Abousahl et al. 2021) and that the probability of dying from long-term cancer " for a member of the public living within 10 miles of the [nuclear] plant is in all cases less than 1 in 1 billion per reactor-year" (Abousahl et al. 2021, 178).

Two of the elements that I found most interesting and most relevant to the state of nuclear decommissioning in Italy were the two points on radioactive waste. According to the JRC analysis, one of the long-term radioactive waste containment solutions that have broad

consensus amongst the scientific, technological and regulatory communities is the construction of deep geological repositories. This solution is "the most effective and safest feasible solution which can ensure that no significant harm is caused to human life and the environment for the required timespan" (Abousahl et al. 2021, 11). Secondly, the myth of the production of huge amounts of radioactive waste has been addressed. According to the publication, in volumetric terms, "the amount of radioactive waste produced by nuclear energy operated on the basis of PWRs (pressurized water reactors) is comparable with (slightly higher than) the amount of chemical waste from some solar PV technologies" (Abousahl et al. 2021, 52). Concluding, the research's results were a fundamental step towards 9 March 2022 when the Commission adopted a Complementary Climate Delegated Act which included, under strict conditions, specific gas and nuclear energy activities in the list of economic activities covered by the EU taxonomy. It was published in the Official Journal on 15 July 2022 and will apply as of January 2023. [4]

As suggested by Zorzoli, studying the processes that characterized the nuclear season in Italy may allow us to have some reference on the mistakes we should not make a second time. As the final word, while discussing myths on nuclear energy production is the starting point for re-opening the discussion with accurate and proven data, what should not be forgotten is the social components. Some of the crucial points to be addressed are a renewed interest and investment in technological and scientific education for the broader public with the main objective of assuring people's welfare. To achieve that, functioning institutions that can focus on communities' wellbeing and interests, and political and governmental stability with intentions of planning ahead in the remote future are fundamental.

[4] "EU Taxonomy for Sustainable Activities." Sustainable Finance. Accessed December 1, 2022. https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en.

2.1. Introduction

Within this chapter, the data collected from the interviews conducted with the artists will be presented, discussed, and analyzed. Each of the nine interviews gave me the opportunity to find out more about the messages that were carried and wanted to be communicated by the artists, as well as giving me the chance to investigate through them some of the thematic cores most relevant to the thesis' aim: investigating how to make sense and deal with radioactive invisible presences. What follows is a presentation of the cultural, spatial, and temporal framework in which I wanted to frame "Art Spaces: Nuclear Decommissioning. Science at the service of the future generation". I will present the heritage-making project "Nuclear cultural heritage," which recognizes the nuclear industry's past as made by technology, infrastructure, records, and communities. The project's statement is a useful tool to start a dialogue on common concerns which are shared in different sectors (organizations, stakeholders, governments) and to inform social practices to make better decisions on nuclear heritage and technology future. Secondly, the exhibition "Art Spaces" will be presented. Its intentions will be outlined, i.e. to inform local communities and stakeholders about the planned and ongoing activities on nuclear decommissioning, making them more transparent and accessible to the public at large, and whether this objective was reached. I will analyze the venue chosen for the performance, the interim storage facility, through the categories of space and time. First, I will provide some information about the site: its history and current state. Secondly, I will examine whether the space was really shared, i.e.

whether it created a dialogue between the groups considered (artists, JRC workers, public). Finally, I will investigate its temporal aspects: are decommissioning spaces places of ruin? Or are they potentially archives of information on radioactive waste for future generations?

Each interview and artwork will constitute a section of the chapter. In “JUNK” were analyzed the methods of making radiation visible and how to relate to the radioactive material, which was interpreted as a *milieu* for mental engagement with radioactive waste. In “Lorelei” the concept of “pureness” was investigated, while trying to define a threshold of contamination and pollution. The dichotomy between nature and culture was relevant in “Maybe there is hope,” together with the fuzziness of nuclear “spacetimemattering” and the results of nuclear slow violence or durational violence. “Inspired Landscape” offered the opportunity to ponder on who decides where waste goes and how to take care of it properly, how landscapes change, and what are the conditions of bodies living in “sacrifice zones”. “Germinal” offered the opportunity to observe the contradictory relationships and reactions to the nuclear presence, both traumatic and hopeful, as well as to consider the meanings of “becoming nuclear” and “nuclearity,” and the power that storytelling has on people's perceptions. “The Refuse Light” was an opportunity to think about “wasting relationships” (Armiero 2020), the banality of nuclear energy, as well as what it means to “be relational” and co-exist with radioactivity. In “Symphony” the limits of epidemiologic studies were discussed, as the anxieties produced by the proximity with nuclear waste repositories, and the metaphors linked with radioactivity. “Otherworlds” questioned the accountability of our actions toward future generations, how to make peace with damaged landscapes, and accepting the idea of living in “blasted landscapes” (Tsing 2015). In “For ever and ever” burials were the main theme: these spaces offered ways to think about vertical structures and rhizomatic labyrinths beneath, together with the relationship between monuments and power.

2.2. “Nuclear cultural heritage”: a new way to interpret nuclear legacies

The first steps in working towards embedding nuclear presence in culture and heritage have been made through *Nuclear Cultural Heritage: From Knowledge to Practice* (Rindzevičiūtė et al. 2019; Rindzevičiūtė 2022), a research networking project (2018-2022) which aimed to establish links between national and international nuclear cultural heritage researchers and the heritage sector on the one hand, and the nuclear sector on the other. The “nuclear cultural heritage” is a new notion to heritage studies, and encompasses a wide range of tangible and intangible items like abandoned power stations, museum exhibits, landscapes, and communities connected to the civil and military nuclear industries. While identifying “culture” can be a hard task, “cultural heritage” has been defined by UNESCO since 1972 as “the legacy of physical artifacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations” (UNESCO 1972); the definition of “industrial heritage” is from 2003, when the International Committee for the Conservation of the Industrial Heritage (TICCIH) described it as “the remains of industrial culture which are of historical, technological, social, architectural or scientific value” (buildings, machinery, warehouses, stores; places where energy is generated, used, transmitted; transports; spaces related to social activities such as housing, religious worshipping, or education). It follows that “nuclear cultural heritage” can be defined as “anything that has come into contact with nuclear science and technology” (Rindzevičiūtė et al. 2019, 4). Presented as a vast hybrid field, “nuclear cultural heritages” includes (but it is not limited to) “nuclear power reactors, research reactors, nuclear weapons, nuclear propulsion systems, and isotope technologies in medicine and precision measurement” (Rindzevičiūtė et al. 2019, 4). According to the 2022 final report on “Nuclear

Cultural Heritage," three are the key aspects that were debated and are considered the basis of making this practice: collecting, interpreting, and governing (Rindzevičiūtė 2022).

Collecting is a fundamental part of heritage-making, even if it has been widely criticized for being elitist and Eurocentric (Dercon 2011). However, the project aims to focus on collecting "as a form of active management of donor and recipient relationship" (Rindzevičiūtė 2022, 12) that should consider that collecting is not limited to technology, but it is also situated in landscapes and communities. In this sense, collecting becomes a way of value-making through documentation, archiving, and selective preservation of nuclear material culture (Rindzevičiūtė 2022, 13). This form of collection should recognize the implicit and explicit collectors of nuclear cultural heritage, as "nuclear heritage is in our DNA, whether we like it or not" (Carpenter 2019) and cultural institutions, recognized as capital-generating sites where social and political power is produced (Bourdieu 1987), are both "value banks" (Rindzevičiūtė 2022). In the case of nuclear decommissioning, museum collection-making actions can smooth the transition into new social and economic realities, accompanying them in their remaking of the community's identity: "collecting can act as a vital social glue that empowers collective identities" (Rindzevičiūtė 2022, 15). Heritage making and decommissioning are both about the future, and they are conceptually linked through intergenerational transmission, the imperative of care, and the importance of retaining and communicating meaning (Holtorf and Hogberg 2022; Storm 2020; Harrison 2020; Molyneux-Hodgson and Hietala 2015). Both fields (heritage making and nuclear decommissioning) require detailed documentation: informally kept knowledge (where materials originate, how much they were exposed, how they were stored) together with object-based research, oral history and heritage studies "can contribute to making the technical decommissioning process safer" (Rindzevičiūtė 2022, 16). Lastly, collecting intended as a social process and not a mere accumulation of objects, is also about

socio-economic development, as it can contribute to economic regeneration in areas where nuclear decommissioning is undergoing; can create a base for cultural tourism; and "forms an important component of local self-government, providing a framework for scrutinizing and assessing the industrial, social, infrastructural and environmental aspects of communities" (Rindzevičiūtė 2022, 17).

Secondly, interpretation shapes all the aspects of nuclear cultural heritage making. Meanings associated with the nuclear past are diverse, often conflicting, where narratives point at different approaches to nuclear legacies and futures. Among dilemmas and tensions, heritage-making strives for diversity and finding forms of existence that do not discharge differences, whilst confronting existing hierarchies where some narratives are considered "truths" and others are neglected. The numerous interpretations and narratives have to be contextualized, while segregation and compartmentalization of competing narratives have to be avoided. Master historical narratives are subject to governmental control and censorship, for instance when they question nationalist myths (Bauer and Penter 2022). This governmental control of the narrative can also produce non-knowledge on specific events: the negative consequences of uranium mining could be denied or censored, as well as the results of testing and nuclear accidents (Hecht 2012; Brown 2019). Governance of nuclear cultural heritage should aim to balance hegemonic discourses, "to create space for articulating the nuclear past in other ways than the national, celebratory narrative of the atom and for facing the difficult aspects of the nuclear past" (Rindzevičiūtė 2022, 23). To achieve that and to avoid blindness to inequalities, injustices, and limits, new actors could be introduced in the heritage-making process, such as contemporary artists and creatives (Rindzevičiūtė 2022, 23). Artists, especially in postcolonial contexts, where creative practitioners engage with no longer useful industrial infrastructures and disempowered communities (Dovydaityte 2020; Volkmar 2022), can also navigate different professional fields, making space for dialogue and

introduce new ways of communicating and articulating the values of the nuclear past (Carpenter 2020).

The third and last part was dedicated to governing, or governmental issues, politics, and policies of nuclear cultural heritage at different levels (local, regional, national and international). To transform nuclear sites into cultural heritage sites substantive conceptual innovation is required. Three different challenges have been addressed: developing models of participatory governance across the cultural and nuclear sectors; developing social justice and ethical approaches for the inclusive development of nuclear cultural heritage in its tangible and intangible characteristics; rethinking heritage-making in the horizon of extremely long-term and in the context of the governance of radioactive waste (Rindzevičiūtė 2022, 25).

The society-nuclear power nexus is problematized differently in various national and cultural contexts and while it is essential to address the legacies of atomic colonialism and nationalism (Rindzevičiūtė 2022, 25), nuclear cultural heritage can contribute to transitional justice, which could be beneficial to all nuclear societies (Rindzevičiūtė 2022, 25). Governability of nuclear cultural heritage has tackled three different issues: residual governance (Hecht 2018), participatory governance and inclusion, and sustainable development. Governing nuclear cultural heritage needs a wider gaze on more complex and cultural questions and, in this regard, the report is conceived as a way for "democratizing the nuclear sector, helping to shed its technocratic Cold War legacy" (Rindzevičiūtė 2022, 26). However, there is the risk of falling into the trap of what Gabrielle Hecht (2018; 2023) has described as "residual governance," or where industrial waste is managed as an afterthought, "where industries treat people and places as externalities, residual to their 'core' tasks of the technoscientific invention and industrial production" (Rindzevičiūtė 2022, 26). As far as the theme of community inclusivity is concerned, I would argue that the report has covered thoroughly all the issues and challenges connected to it, offering a radical leaning outlook on

it. Through stating that democratization through cultural heritage is not a given, that opening up elite institutions for wider access is insufficient, and by recognizing the need for longer periods to have proper participatory engagement, together with dealing with issues such as redistribution of power or the problem of trust, the project seems to have laid the basis for a true form of participation, genuinely inclusive, nuclear cultural heritage is not made to be "about the community" but "with and by the community". Governing nuclear cultural heritage-making concerns also strategic planning and sustainable development, where a focus on sustainability can act "as a window of opportunity" (Rindzevičiūtė 2022, 28): through the socioeconomic framework, culture enters the horizons of local authorities. The report suggests that nuclear cultural heritage projects could be integrated into regional development strategies that primarily target decommissioning (Rindzevičiūtė 2022). However, it is argued that socioeconomic frameworks require bureaucracy and accountability, which can both stifle cultural creativity and its impacts: corporations' values stress safety and seek to present a positive image; local governments are tied to cost-benefit analysis and focus on short-term impacts (Rindzevičiūtė 2022).

Even though it could be hard to balance these needs with open creative projects or impacts situated in the remote future, to face complex issues system thinking is required. Nuclear cultural heritage-making could be one possible solution to deal with nuclear past legacies. For the time being, the investigation into nuclear cultural heritage will continue in the project NuSPACES.

In light of the findings, it is necessary to specify that the researchers and academics who participated in the workshops belong to and focused on three main geographical areas, although the view widens to a global perspective: the UK, Sweden, Belgium, Germany, Norway, and Lithuania, with only two representatives from the USA, Canada, and France. However, as of 2018, Italy is one of only two countries, along with Lithuania, that completely

phased out nuclear power for electricity generation after having operational reactors. Given the project's nature and being the first step on a path towards realizing the objectives of nuclear culture heritage, the 2022 report did not take into account the Italian situation nor identified ways to make these heritage-making practices inclusive. The theoretical basis, however, and the ongoing work for NuSPACES (2021-2024), suggest that this topic will be addressed in the second part of the project.

2.3. “Art Spaces: Nuclear Decommissioning. Science at the service of the future generation”

From 29 September to 15 October 2017, the Joint Research Centre of Ispra (Varese) held the exhibition “Art Spaces: Nuclear Decommissioning. Science at the service of the future generation” in their interim storage facility to present to the public the nuclear decommissioning and radioactive waste management program by combining art and science. The artworks center the “drum” which is customarily used to contain radioactive waste and which was used here by artists with different techniques and modes of expression to convey a message related to the exhibition’s message. At the same time, for the scientific part, an information path on nuclear decommissioning has been developed and accompanies the visitor in the various stages of the exhibition, from nuclear research to greenfield. Later, the exhibition became itinerant and reached its fourth edition in Italy (Ispra, Masnago-Varese, Venice, Genoa). This initiative, conceived with the JRC “Nuclear Safety and Security” department, aimed to inform local communities and stakeholders about the planned and ongoing activities on nuclear decommissioning, making them more transparent and accessible

to the public at large, while complying with the relevant Italian legislation in the nuclear field and the European Commission's transparency policy. Fifty-two artists have presented artworks related to nuclear-decommissioning activities starting from the drum used in nuclear decommissioning to contain nuclear waste. According to one artist who took part in the interviews, the objective of communicating in a transparent and accessible manner has been met: “the artworks, coming to life from the containment drum of the waste material, disrupt the perception of fear or dread in approaching and interacting with them and the material. There is a perceptive reversal in which what is potentially harmful can have another destination, another use”. For research purposes, it would have been of great interest to do a cross-field investigation between those who work at the JRC and those who participated as artists in the exhibition. Even if this was not covered by the research, I have collected data on the training the artists received and how they perceived the shared performance space (i.e. the interim storage facility). The artists recalled how they had taken part in an informative meeting, where all the features of the work being carried out at Ispra were explained through a series of more technical examples; the informative visit “allowed even non-specialists to understand what has been done for the storage of waste, together with a smattering of the activities taking place in the research center”.

Ispra-1 is a 5 MW research reactor, the last version of the Chicago-Pile 5 series developed by Enrico Fermi, built by the Consiglio Nazionale Ricerche Nucleari – CNEN, renamed in ENEA – between 1957 and 1958. Commissioned in 1959 and used until 1973, it was the first Italian research nuclear reactor. [5] With the establishment of the European Atomic Energy Community (EAEC) in 1957, the Ispra Nuclear Research Centre was ceded by Italy, for a period of 90 years, to the same EAEC in 1959, while the Ispra-1 reactor was entrusted to the management of EURATOM as of 1 March 1963.

[5] Unless stated otherwise, the information that will follow is taken from Sogin’s site: “Reattore Ispra-1” https://www.sogin.it/it/chiusuradelciclonucleare/sitinucleariitaliani/reattore-ispra-1.html.

The reactor was used for studies and research into core physics, new materials for commercial reactor construction, neutron fluxes, and their interaction with living matter, and played a role in training a new generation of technicians for the European and Italian nuclear programs. In 2018, the Italian government entrusted Sogin with the decommissioning (dismantling) of the Ispra-1 reactor located in the European Commission's Joint Research Centre (JRC) complex in Ispra (Varese, Italy). The same year Sogin started the first take-over activities at the plant. Sogin technicians worked alongside JRC staff to acquire the necessary knowledge of the site. The activities in this first period mainly concerned the perimeter and identification of the industrial area and the assets that will be affected by the works together with a cognitive reconnaissance of an administrative and technical nature. In particular, this involved, on the one hand, in-depth legal and accounting, and administrative analyses, and, on the other, analyses aimed at defining the environmental and radiological status of the area.

In 2019 Sogin assumed responsibility for decommissioning the nuclear plant. The decommissioning operations of the Ispra-1 reactor started in 2020 and are planned in three phases: preliminary activities, reactor decommissioning, and final site clean-up. In 2020, Sogin started its first activity the project to empty the pool containing approximately 200 cubic meters of water. This operation follows the removal of activated metal components and sludge sediments, completed in recent years by the Joint Research Centre in Ispra. The emptying of the pool will involve filtering the radiological purification of the water present through a special filtration and treatment system, based on the selectivity of ion-exchange resins for the radionuclides still present, already successfully adopted by Sogin for the reclamation of the EUREX pool in Saluggia.

The emptying operations, which began in February 2021, will be carried out progressively in batches of approximately 5 cubic meters each, a volume proportionate to the receptive capacity of the site's liquid effluent treatment plant. The final discharge of water will

take place in accordance with the site's discharge formula. Completion is expected in 2024. At the moment, the volume of radioactive waste present and managed by Sogin as of 31/12/2021, classified according to the provisions of the Interministerial Decree of 7 August 2015, is 113 cubic meters. The volume may vary from year to year as safety maintenance and decommissioning activities and waste treatment methods progress.

An Interim Storage Facility (ISF) at JRC Ispra is set to host the nuclear waste from the site, including already existing waste and waste deriving from the ongoing decommissioning of the JRC Ispra nuclear installations. [6] All nuclear waste from the Ispra site will be transported to the Italian National nuclear waste repository when this facility is completed. The construction of the new storage facility was completed in 2013. The facility meets requirements for hosting all nuclear waste already present and is expected to be created at the Ispra Site until the Italian national nuclear waste repository is ready and the waste can be moved there. Nuclear waste created during 60 years of Italian and EU research will be moved to the new facility from the different nuclear facilities at the Ispra Site. New waste is also being created in the process of decommissioning the different Ispra nuclear facilities including the two research reactors at JRC Ispra no longer operational. Until the Italian national repository is completed, the JRC will store temporarily its own waste. This also applies to the other nuclear sites throughout Italy. The JRC's Interim Storage Facility is 120 meters long and 40 meters wide, located in the so-called Area 40 of the JRC Ispra Site, which holds all infrastructures for radioactive waste management.

This area was also used as the exhibition space. According to the artists, the space was able to facilitate participation, as well as allow artists, JRC workers, and the public to connect. One artist commented on the lack of more effective communication of the event: “it might

[6] Unless stated otherwise, the information that will follow is taken from “Temporary Storage Facility for Nuclear Waste at JRC ISPRA.” EU Science Hub, June 15, 2017. https://joint-research-centre.ec.europa.eu/jrc-news/temporary-storage-facility-nuclear-waste-jrc-ispra-2017-06-15_en.

have been more appropriate to involve more of the public through some articles or publicity material". Post-industrial facilities have become increasingly popular spaces for adaptive reuse, namely reusing a building for a function other than that for which it was designed and constructed (Costello 2004). Adaptive reuse follows an interdisciplinary approach, as it focuses on aspects connected with conservation, art history, engineering, architecture, and spatial planning (Plevoets and Cleempoel 2019). One reason for adopting adaptive reuse is the willingness to use existing resources by fitting into the framework of sustainable development (Wilkinson et al. 2014). The effect of adaptive reuse implies that facilities in the broad group of post-industrial plants (power plants, post-mining facilities, warehouses, factories, mills) take on the functions of art exhibition spaces, museums, galleries, and art centers (Pieczka and Wowrzeczka 2021). Alternative spaces have known a spike in their popularity, so they have ceased to be something rare and alternative (Pieczka and Wowrzeczka 2021). However, due to their industrial past, these exhibition spaces can become unique as they constitute post-industrial heritage, they can reflect site-specific art, and they can become examples of "sustainable and resilient actions in terms of environmental and social aspects" (Pieczka and Wowrzeczka 2021, 22). In this case, the background (spatial context) is not simply that, and the mutual relationship between the artworks and the exhibition space is worth exploring: as Kowalczyk et al. argue, "the composition in paintings, their dynamics, forms, and colors impose a new character on the architectural space, just as the architectural space influences the painting content" (Kowalczyk et al. 2020, 26).

In this sense, post-industrial spaces are an example of spaces that go beyond the mere meaning of being places, as they are also located in a web of wider historical and social relations. In the extensive bibliography on space studies (Lefebvre 1991; Foucault 1995, 2003; Slater 2002; Tuan 2009; Massey 2005, 2006; Ewalt 2017), I believe that the characteristics of the site chosen for the exhibition, namely the interim storage facility, the

elaboration of the concept of "space" made by geographer Doreen Massey is fitting. The concept of "space" has been defined by Massey in *For Space* (2005) with three propositions. Firstly, space is a product of interrelations, and interactions, "from the immensity of the global to the intimately tiny" (Massey 2005, 9). Second, space can be understood as "the sphere of the possibility of the existence of multiplicity in the sense of contemporaneous plurality" (Massey 2005, 9) and, lastly, we recognize "space as always under construction" as "[i]t is never finished; never closed" (Massey 2005, 9). Moreover, as she argues, not only history but also space is open (Massey 2005, 12). To summarize, space is a "product of relations" and "for that to be so there must be multiplicity" (Massey 2005, 11) without coherence or closeness. A space, then, "is neither a container for always-already constituted identities nor a completed closure of holism" (Massey 2005, 12). The interim storage facility has been a space-event where people working in different fields – in the former nuclear plant for decommissioning activities and artists – met. However, I would argue that the use of this space has not been without challenges. The interim storage facility is a temporary solution for containing radioactive waste. In the future, radioactive waste will be moved elsewhere, as well as that which was produced by the decommissioning of the former nuclear power plant. The end of the nuclear decommissioning phase, and thus the transformation of the space from brownfield to greenfield, will result in the loss of this space, which will be transformed into something else. It would be needed to investigate to what extent this will have an effect on heritage collection and making, as the ISF contains artworks that will be moved elsewhere, thus losing the site-specificity.

Opening the space of the decommissioning power plant to artistic practices also adds new values and meanings to its timeline. Decommissioned places (and deindustrializing places at large) have commonly been interpreted with narratives of progress, decline, and ruination (Dawney 2019). More often than ever, research on such places in decline tends to

focus on their relationship with the past rather than future practices with which spaces are "made and remade, and through which their inhabitants endure processes of ruination" (Dawney 2019, 38). Going beyond those narratives of progress and decline means making space and bringing visibility to "the forms of living that burgeon in such ruins" (Dawney 2019, 47), focusing on the present and offering new modes of habitation in those types of spaces.

What about the future of the site? Would it become the ultimate radioactive waste collection site? What will it look like in millions of years? How will it look to future generations, and what role will the artworks produced by "Art Spaces" play in this? In *The Future of Nuclear Waste: What Art and Archaeology Can Tell Us About Securing the World's Most Hazardous Material*, anthropologist and archeologist Rosemary A. Joyce conducted an archeological study of the future of nuclear waste disposal sites in the US addressing decision-making processes, semiotics and memory issues, contemporary art, indigenous politics, and archetypes of meaning: how to dispose of high-level long-lived radioactive waste while considering the needs of future generations? Will future generations be able to interpret the messages we have left for them? Will nuclear materials behave as we suppose them to or, as other materials, will make us acknowledge their "feral" (Tsing et al. 2020) qualities and continually escape from any expectations humans have formed on their behavior? The task of designing for eternity, or at least a few ten thousand years, does not seem so easy. To accomplish the right archiving method is essential to consider different fields at the same time: the structural forms of permanent markers, the establishment of public records and archives, governments' regulations regarding land and resource use, together with other methods of preserving knowledge about the location, design, and contents of a disposal system (Joyce 2020). While archaeology could be useful in finding a possible solution to communicating this legacy to future generations, some proposals have been already advanced

by markers experts. As Joyce reports, a team of experts designed with having in mind a congruence between the archetypes required to create the specific sensations sensation they wanted to rouse and place itself (Joyce 2020). This led to the production of an imposing, impressive, yet unattractive space for a future nuclear waste repository marker. The design was named "Spikes Bursting through Grid" and "involved using 'menacing' features like sharply pointed elements, made of materials like stone or metal, disrupting any kind of orderly layout" (Joyce 2020, 122), and was accompanied by a verbal paraphrase which, according to the team, conveyed universal meanings. The place became a message, which asked to "pay attention to it!" (Joyce 2020, 122)

> Sending this message was important to us.
> We considered ourselves to be a powerful culture.
>
> This place is not a place of honor . . . no
> highly esteemed deed is commemorated here
> . . . nothing valued is here.
>
> What is here was dangerous and repulsive to us.
> This message is a warning about danger.
>
> This place is best shunned and left uninhabited [7]

Their aim was to leave indelible traces, messages that tied with the landscape. While the goal of the exhibition was different – to speak in a transparent way about nuclear decommissioning – I believe that similarities can be drawn between the meanings conveyed by "Spikes Bursting through Grid" and the results of the exhibition.

[7] Dieter G. Ast et al., "Appendix F: Team A Report: Marking the Waste Isolation Plant for 10,000 Years," in *Expert Judgment on Markers to Deter Inadvertent Intrusion into the Waste Isolation Pilot Plant* (Albuquerque, NM: Sandia National Laboratories, 1992), F– 49 to F– 50.

2.4. Ethnographic research

2.4.1. *JUNK*

As a part of the exhibition, the artist duo Urbansolid focused on the risky realities of wars and atomic radiation. Their artwork “JUNK” displays a drum filled with a green radioactive liquid where a human being, of which only the face is visible and whose nose is closed by its fingers, is rising to the surface after having dived into the container. The artists were the first to respond to my interview proposal and, despite their busy schedules, it was easy to organize a moment that was right for both parties. The video call interview took place in two different spaces: their office and my room. I initially received questions from them: why had I taken this interest and contacted them? Had I found their site easy to navigate? I imagined that from such a situation both sides could gain some useful information. After answering their questions, I asked them to give me some information about their origin and artistic background. “We are Urbansolid, we mainly focus on sculpture, and how it can communicate powerful messages to the public. We love to blend classical techniques with modern materials and bring art to the streets for all to see”. While one explained, the other smoked and only after a while took the floor. “Exactly, we believe that art should not be limited to galleries or museums, it should be accessible to everyone and that's why we choose to install our sculptures on the walls of cities. The urban environment provides the perfect backdrop for our message to shine”. The artwork is one of the few in the entire exhibition that explicitly and directly gave form to radioactive waste: together with “No Title,” where a

Figure 2. Urbansolid. JUNK. 2017.
Mixed technique.

radioactive liquid (green) leaks from the drum marked with a white skull, the other work showing some form of waste is “BP Nature,” where plastic waste (used containers) is displayed. The use of the color green in “JUNK” enables each observer to recognize the presence of radioactive liquid material, otherwise untraceable by human senses, inside the drum. Green creates a reference with a shared and “pop” background culture, such as that of media pieces like films or video games, where the presence of radioactivity is made perceptible through the use of signals such as the color mentioned above or the luminescent effect. In an attempt to transform something invisible into visible, by adopting the green color, the artists made an abstract concept into a physical one. As art critic Noi Sawaragi notices, one should be attentive to the differences between “radioactivity,” “radiation” and “radioactive substances” as the three elements are not interchangeable synonyms but have to

be used with concision. Sawaragi argues that "radioactivity" is an "abstract concept, therefore invisible" (Sawaragi 2016, 79). On the other hand, "radiation" is a "concrete force with substantial effects," but radiation too is invisible but manifests depending on how its particles or waves affect their surroundings" (Sawaragi 2016, 79). Lastly, radioactive substances (or waste) are not visually identified but immediately act upon their surroundings when released: plumes from meltdown explosions fell to the surface and affected the physical world. Radioactive substances are moved, they gather, and in their movement their presence becomes evident: these invisible traces were made visible through engaging with the world. Similar reasoning, as Sawaragi argues, could be applied to art, imagined as visual arts, but invisible, like radioactivity or radiation. Only in "radioactive contamination, new metaphors which might not ordinarily occur to us are revealed: the relationship between radioactivity and art; the power of radiation and art; the affinity of radioactive substances and artworks" (Sawaragi 2016, 80). In the interim storage facility of Ispra, the artworks are integral to its location, merged with the radioactive substances (radioactive waste) that are and will be stored in the ISF, an intrinsic part of the area: the artworks, in this sense, are embedded in the unknowable passing of time and will eventually become contaminated by radioactive substances over time, while the "site" remain off-limits to visitors. Furthering the discussion on radiation and radioactivity, Noi Sawaragi concluded that while radiation can be detected, radioactivity has to be interpreted as the "ability to emit radiation," so it is an abstract concept (Sawaragi 2016, 84): through invisible actions emitted by the target (artwork as well as radioactive material), the observer's body is changed, even if each individual can be influenced and affected very differently. There lies the "sensibility": the use of a Geiger counter or cloud chamber, and the ability to feel the synergy with art.

I find questioning these kinds of invisible traces interesting: how to make it possible and accessible to a wider public to realize the presence of these traces? In the artwork

"JUNK," the artists decided to color the radiation green. Is this a useful aid? In 1958, in a letter to the President of the International Conference for the Detection of Nuclear Explosions, Yves Klein put forward an argument for using blue as a coloring for radiation connected to bombs' detonation: using the pigment not only would render atomic tests a spectacular cultural event but would also pragmatically call for greater public information. As Klein argued, "explosions should not be recognized by only those who have a vested interest in concealing their existence or (which amounts to the same thing) revealing it for purely political purposes, but by all who have the greatest interest in being the first to be informed of this type of disturbance, which I deem to say is all of my contemporaries" (Brougher and Ferguson 2013, p. 48). In this sense coloring radiation, be it in green, blue, red, yellow, or purple,[8] is a political act that transforms the relationship with radiation into a democratic practice of shared knowledge: clear signals such as color potentially allow people to recognize the elements with which they share the environment they live, and give them the possibility (and power) to detect the presence of radioactivity through eyesight. Lastly, coloring radiation could offer another powerful tool to use together with the Geiger counter, a hand-held radiation survey instrument that has become very popular due to its robust sensing element and relatively low cost.

Another element to look into is the materiality of the radioactive liquid, which becomes a *milieu* that allows physical and mental engagement with radioactive waste. While in the description of "JUNK" the artistic duo expressed their skeptical view about the use of nuclear energy (describing it as "obsolete" and "expensive"), during the interview, a less deployed position emerged on the theme, opening a space for discussion. When asked about the use of nuclear power, the artists agreed that the benefits and risks are to consider, and only that "by immersing the human being in the context is it possible to begin to reflect on the

[8] Kurosawa, Akira. *Dreams*, 1990. "In Kurosawa's film, coloured clouds of radioactive elements billow across the landscape: red signifies deadly plutonium-239; yellow represent strantium-90; and purple is caesium-137" (Carpenter 2016, 162).

co-existence between the elements". The human in "JUNK" is diving into the fluid and at the same time is engaging with the material. I asked them if this was a typical trait of their way of making art. "Actually, yes. 'The Head that Plugs its Nose' is one of our earliest sculptures and represents a man emerging from the floor or wall into our dimension. The gesture of holding his nose symbolizes the frustration and anger we feel toward the world today. It's a social denunciation of the state of things and a call to action for change." The human has gained the role and agency of another "actor" (Latour 2005), apparently another interactant, in the toxic system. However, as Ingold argues while looking into the relationship between knowledge and movement in the weathered world, for humans, non-humans, elements, and materials to interact means that "they must be immersed in the flows, forces, and pressure gradients of the surrounding media" (Ingold 2010, 132). If "the medium is a condition of interaction" (Ingold 2010, 133), the drum filled with radioactive waste is not simply an element to think *about*. In this case, it becomes a key feature in the interaction, that acquires the role of *milieu* and environment to think *with* and *through*. Furthermore, by immersing oneself under the surface and inside the liquid, one can discover a new point of view. As Melody Jue argues in *Wild Blue Media: Thinking through Seawater* (2020), seawater can become a filter that discards terrestrial biases in understanding media. In her *milieu*-specific analysis, she claims that gazing down into the depths (psychological, textual, or other) by adopting a "hermeneutics of suspicion" helps in identifying the anthropocentrism embedded in the act of reading a surface from above (Jue 2020). As an oceanic diver, the human reaching for the radioactive liquid's surface has looked and ventured down into the drum's depths, experiencing the toxic environment. In the role of a submerged observer, the human adopts an "amphibious point of view" (Jue 2020, 57). I think this ties in perfectly with what artists have expressed about their relationship with the materials they use: "our sculptures are made of plaster or cement and are a blend of classical bronze sculpture techniques with street art ready-made. We wanted to

create something that was both contemporary and modern, yet rooted in tradition and classical foundations".

The final material destiny of radioactive waste, high-level waste (HLW) in particular, is to be vitrified and then stored in facilities or permanent isolation from the environment. High-level waste contains highly radioactive and long-lived radionuclides, which produce heat. HLW is typically concentrated as part of reprocessing and solidified using vitrification to produce a glass-like substance suitable for interim and long-term storage. It is considered to be one of the safest and most effective methods for the long-term storage and neutralization of radioactive waste. However, how are fluids (green radioactive waste depicted and imagined as such) different from solid matter (vitrified radioactive waste)? To what extent are they distinct? Tim Ingold and Cristian Simonetti (2022) invite us to rethink the distinction between the alleged "hardness" of matter and the "softness" of meaning. The interrogation of the solid-fluid conundrum considers not only the field of materiality but also a wider scope than that of the Anthropocene: the contributions assembled in the special issue call for a "deeper history of relations between matter and meaning both within and beyond the Western intellectual tradition" (Ingold and Simonetti 2022, 20). By arguing that matter exists as a continuous flux, both as solid and fluid, Ingold and Simonetti's exploration offers an opportunity to reflect on how to live with planetary forces, not against them, and how to "develop the necessary skills for living with a solid fluid planet" (Ingold and Simonetti 2022, 25), altered by previous activities. One of the contributions focused on the massive campaign of environmental engineering and reclamation of Pontine Marshes, 40 miles south of Rome, during the 1930s directed by the fascist regime under Benito Mussolini, when the entire region was drained. In this article, Paolo Gruppuso explores spatial and temporal zones in-between fluidity and solidity, suggesting understanding solidity and fluidity not as mutually exclusive but as patterns of social and ecological relations. The Pontine Marshes' landscape

was intensively levelled for cultivation and urban development, while ditches and channels moved the aqueous effluent. In the end, perpetuating hegemonic narratives of control over nature led the interventions to separate solid and liquid, matter states that co-lived over the centuries when “human lives had both shaped and been shaped by the rich and heterogeneous ecology of the Marshes” (Ingold and Simonetti 2022, 21). Either way, once abandoned, solid grounds reverted to an earlier fluidity, leaving a legacy of “rusting machinery, abandoned quarries and encroaching swamp” (Ingold and Simonetti 2022, 21). Could similar reasoning be applied to the ways we deal with and conceptualize radioactive waste: how can we learn to distinguish and isolate radioactive waste from the flux of matter? While discussing this topic with the two artists, they expressed their opinions in light of what they had presented for the exhibition, and how their opinion had changed over time. They were open to dialogue and said they did not have a definitive answer to give, "also because I don't think I have the right knowledge to determine whether or not the use is right or wrong," commented one. Energy dependence on non-renewable sources is an issue that is very much on both sides' minds. "If a way could be found to safely disconnect from power, [nuclear power] would be the solution. If, on the other hand, this form of energy gets out of control... then you would pay the consequences in a very serious way as well.”

But what about the future of radioactive waste? The ultimate goal of dealing with radioactive waste lies in transforming it and storing it in a safe and isolated environment. Is it possible to accomplish such a goal by creating a sterile and hermetically sealed environment? How? Nuclear waste, as Peter van Wyck argues, is different from other types of waste as it can not be entirely contained or disposed of over a time scale consistent with the human life span, or even multi-generational memory: “there is always leakage” (Wyck 2004, 19). When introducing this concept to artists, they expressed themselves in a manner akin to the statements: “is it possible to define boundaries between the use of nuclear power and the

non-use of nuclear power? I don't think so, at least not geographically. Here [in Italy] we live in a particular situation, so we are surrounded by countries that use nuclear power." Reflecting on the isolation of radioactive waste, and under the suggestion of Ingold and Simonetti who have connected matter to knowledge, it would be suitable to question how and if this can have any effect or connection to the isolation of knowledge on nuclear power.

At the moment, the responsibility for storing radioactive waste is ethically and legally bound to each country involved in nuclear activities (WNA 2020). While countries like Finland have officialized their plan for the long-term underground storage of spent nuclear fuel, other governments are still debating methods for future communication and care for these archives. While different nuclear archives exist – monuments, archives, or even bodies (Alaimo 2010), archives of radiological mutation that can be passed through reorganized cells to future generations –, the concept could be expanded and evolve to acknowledge the complex forms of nuclear knowledge's embedding in culture. How is nuclear knowledge re-inserted in flux? A point of convergence that could resolve the process of understanding radiological time in the human experience is constituted by uniting personal legacy and public markers. As a matter of fact, through the development of social and creative structures for cultural inheritance (a possible future for Ispra's ISF?), contemporary and even generations could fight the process of forgetfulness. While it is impossible to determine how future generations will react to (or comprehend) these archives in deep futures (McPhee 1981; Irvine 2014) [9] a work towards a constant and open operation of sharing knowledge could pave the way for paying continuous attention to the goal. An example in this sense is constituted by visual artist Cécile Massart's work. By addressing the isolation of different kinds of nuclear knowledge, Massart's series of seven prints visualize a conceptual proposal for an architectural marker, specifically "laboratories," to be located within the perimeter of waste

[9] As a concept, "deep futures" derives from "deep time," often attributed to the Scottish naturalist James Hutton in his work "Theory of the earth; or an investigation of the laws observable in the composition, dissolution, and restoration of land upon the globe," *Transactions of the Royal Society of Edinburgh* 1: 209–304.

storage sites to facilitate multidisciplinary research on nuclear issues for the future. While hosting biologists, scientists, artists, and archaeologists, these laboratories could become the space where knowledge of the place, together with memory, would be maintained, translated, and transmitted through generations. The feeling of sharing knowledge in this way has also been expressed by artists. "I think it is a complex and constantly changing subject, also because of the ever-increasing demand for energy. The other concluded in this way: 'The curious thing is that for us Italians, nuclear power equals death. In our culture, nuclear power is something negative. Is it really? Is it not? I don't know, but it is a fact, it is a reality. Even if it is no longer the nuclear power it once was... since we are increasingly talking about fusion. We need more knowledge and more awareness. Nuclear power is a fact. We must learn to use it and know it." Of course, opening Ispra's ISF to the wider public constituted a moment of (re)connection with the community of citizens or visitors, but there was not a real exchange between the "insiders" and "outsiders". More than offering an exhibition to the public with the role of observer, radioactive waste storage sites should strive to become spaces where real interdisciplinary is built. If it is fundamental to cease the material flux of radioactive waste to protect environmental health and well-being, the flow of nuclear knowledge should not be interrupted, making it accessible, shared, and horizontal.

2.4.2. *Lorelei*

The artist, born in Ardore (Reggio Calabria), graduated from the Academy of Fine Arts and is currently living in Bologna. The interview with the artist was the one I was most looking forward to, as "Lorelei" was the artwork that seemed most enigmatic to me. I was

glad to receive a response from him. Establishing a virtual meeting was easy and the artist's availability was prompt, as he was motivated by curiosity for the interest shown in him and in the artwork. Even after the interview, the artist was always very helpful and answered questions that later emerged in a short time. Initially, I wanted to know more about the modus operandi and artistic vision adopted by the artist, as I was captivated by his paintings which project toward an intimate dialogue, exploring the sense of incompleteness in human existence in relation to nature; moreover, while studying his works online, I noticed how together with a focus on human faces, the artist has been recently painting lots of natural elements, in particular plants or flowers. As he explained, “my painting investigates the mystery of the human face, but not in the traditional sense of capturing a pure resemblance. My portraits aim to answer a two-fold enigma: what are the most penetrating images that we can keep within our memory to evoke the traits of someone we have held dear and what specific instruments can painting offer to oppose the disappearance of faces and bodies?”

“Lorelei” shows on the bottom of the black drum a video in stop-motion (53.4’') where the Germanic water nymph, which has German mythological roots and gives the name to the work, is depicted while moving in a liquid environment. The intended message of the artwork was “to emphasize the risky duality concealed behind the spells”: through the use of myth, the artist was able to create a space for reflection on the charm that the nymph, representing the potential linked to nuclear, had on sailors who were victims of shipwrecks and disasters. In this sense, the link between myth (abstract) and narration (physical) could be compared to the ones between radiation and radioactivity, or art and artwork. When asked about the difficulties of dealing with an invisible element - radioactivity - the artist replied as follows: “I did not question myself on this, because it is not something we are mentally accustomed to perceiving - just as in the air we breathe, the synapses of the brain do not frame

the actual consequences well… The thing I have tried to do is, through 'Lorelei', to react with a fairy tale, with something that does not exist".

The reflection on the presence of waste, defined by the artist as "dangerous" and whose existence would have "real consequences, not to be underestimated," led the discussion on possible scenarios that could open up in the future: what will become of that space, that territory, that environment that will be destined to contain the waste? How to choose a space destined to be sacrificed? I was interested to find out what the artist thought about it, and whether "Art Spaces" could be assessed as a memorial to what is to come in the future. Although uncertain about the potential of "Art Spaces" as a future archive, the artist commented on how restoring "what was there before is a very complex thing. You can never restore a previous state. The land will remain as a symbol of something that has been... in the underground something will remain forever. Like a grave. Or a memorial. The reclamation will take place, the land will be reclaimed... but in the land will remain the womb containing the waste until it is disposed of." Although Italy has not yet chosen a definitive place to contain the radioactive waste, "a womb in the soil," a similar analysis applies to nuclear power plants in the process of decommissioning. In the interview, the artist's concerns emerged about the processes that concern nuclear decommissioning, especially those of reclamation and regeneration of the territory, as foreseen by the projects. The final objective of decommissioning and demolition would be to reach the state of "green field," that is the site is restored to its original condition before the nuclear facility was built. As it has emerged from the final *Nuclear Culture Heritage* report, here the future of nuclear industry planning objectives (namely transforming a former nuclear plant into a green field) intersect with heritage planning: if nuclear sites are expected to be entirely remediated into "green fields," complex heritage protection *in situ* could become difficult (Rindzevičiūtė 2022, 27). Because of that, they advise "policy innovation to find a working model for nuclear cultural

heritage-making so that it is embedded in strategic development and does not become yet another form of residual governance" (Rindzevičiūtė 2022, 27).

As a greenfield, the land can then be given a new use, as it could be considered pure and uncontaminated again. The status of pureness, expressed in the artwork through the mean of water – as the artist has explained himself "hypothetical liquid that the drum might contain, identifying this liquid with the idea of purity that itself has" –, has been thoroughly investigated by Alexis Shotwell in *Against Purity: Living Ethically in Compromised Times* (2016). As Shotwell argues, while purity as a concept itself does not exist, as we are "complicit, implicated, tied into the things we abjure" (Shotwell 2016, 7), the diffusion and prevalence of purity politics or purism are real and have worrisome consequences. Purity politics, Shotwell continues, constitute an attempt to "meet and control a complex situation that is fundamentally outside our control" (Shotwell 2016, 8). Echoing the concepts expressed by Anna Tsing, such as living in "blasted landscapes" (Tsing 2014, 92), Shotwell thinks about the implications of believing in the actualization of the concept of purity, which in reality "is never possible in the world, and it is only unevenly possible in concept" (Shotwell 2016, 192). Believing in purity leads to the existence of its opposite, which is impurity. In this sense, it is easy to connect activities, situations, realities, and ways of doing or being with one or the other category. This would involve dangerous implications that would strengthen harming ideologies against everything that is not considered pure and is rendered as "other". Being against purity also means recognizing our degree of complicity with certain realities: from the way we eat, what we decide to consume, and the way we use energy (Shotwell 2016). However, just as Shotwell explains, being against purity does not equal being for pollution. In Italy, reclamations are complex projects, and usually in a planning state or low rate of progress. I would argue that although restoration is necessary, creating a narrative of a "return to initial purity" can be problematic.

The first problems in cases of decommissioning arise in determining what and how much has been contaminated: how much material has to be removed from a radioactively contaminated room? On the one hand, the remaining structure has to be clean; on the other hand, the aim is to try and keep the volume of radioactive waste as small as possible. The Belgian Nuclear Research Centre explains that "the conventional measurement method consists of taking drilling samples from several locations, slicing them, and then breaking and grinding them" (SCK CEN 2013, 38). The powder resulting from the process is then characterized radiologically. However, this type of sampling is time-consuming and does not represent the entire surface area, as it provides data only for specific locations. Another measurement method is done through on-site gamma-ray spectrometry followed by a geostatistical interpretation of the measurement results (SCK CEN 2013, 39). This method,

Figure 3. Grenci, Domenico. Lorelei. 2017. China, inkjet and pastel white schminke on paper, 53.4'' stop-motion video 307 frames + 6 black.

while not damaging the concrete, can help measure larger surfaces relatively quickly. More importantly, it can help with sampling the complete surface area and not just a few locations.

Defining a limit through collecting data on materials is a process that helps to discern what has been contaminated by what is not. The absence of boundaries was expressed in two ways by the artist: initially through an explanation of the choice behind the video loop and then with a comment on the travelling nature of the exhibition, which according to the artist gave "a different feeling to the whole exhibition, gave it momentum". However, as the video suggests through the images' continuous loop, where Lorelei appears from the water and disappears into it, just as it is difficult to define a beginning and an end in the continuum of the artwork, it could also be to define a radioactive threshold: "the stop-motion video, made up of photographic frames repainted by hand one by one and then reassembled to reconstruct a 58-second video, depicts a woman immersed in water swimming and dancing. There is no reference to a boundary, it is not clear whether it is a sea, a lake, or a pool, one perceives that she is underwater because of the movements; the game had to be this: liquids also end up inside the drums, so with Lorelei I wanted to communicate the non-perceptibility of the boundary of the drum, just a matter of vision-screen without a closure; to leave the mind open to imagining a hypothetical scenario of undefined and indefinable water". Reflecting on the artist's statements, I perceived the corporeal dimension of the artwork's message, as well as the relevance of the body component (in this case, Lorelei's). While it is true that tools and measurements can be useful in this regard, expanding the concept of contamination and the way it is experienced and negotiated is equally crucial. Often radiation does not only resides on objects or parts of industrial structures but has an essential impact on humans and non-humans: on their bodies (Brown 2016), their life experiences (and deaths), and their minds. I propose that to better comprehend stories of contamination we should focus also on the exact moment of passage between something – an environment, human or non-human

body – that is contaminated and something that is not. According to specific scientific disciplines, this threshold is known as assimilative capacity, which refers to "the amount of waste material that may be discharged into a receiving water without causing serious ecological effects" (Krenkel and Novotny 1975, 604). However, there are lots of versions of this term according to different scientific disciplines: reference dose (RfD), no observable adverse effect level (NOAEL), and lowest observable adverse effect level (LOAEL). As geography professor Max Liboiron argues, there are political relations behind the "threshold theory of pollution" (Liboiron 2021, 5) and those can be identified in colonialist reasoning which allows "some amount of pollution to occur and its accompanying entitlement to Land to assimilate that pollution" (Liboiron 2021, 5). Liboiron explains that at the basis of theories of pollution and scientific analysis tools such as "assimilative capacity," there is the premise of "an old colonial system of land relations where the land is a Resource" (Liboiron 2021, 39): if the land is a given, then polluting under a certain threshold is acceptable. But why 15 units of pollution are fine but 16 units are too many? Where should we draw the line? How do the lines that were drawn include or exclude some consequences of pollution? Situating radioactivity or radiation is not an easy task. In this regard, the artist argued how "it is difficult to carry out such work. The radioactivity today I don't know whether to put it: in a grey area of possible danger? Or not? I don't know exactly whether it can be a danger or not. What I have perceived from the work in Ispra is that in reality once again, from a serious, huge, problem, a positive way of going beyond this has been identified."

In "The Last Sink: The Human Body as the Ultimate Radioactive Storage Site," (2016) historian and professor Kate Brown reports her fieldwork in Chelyabinsk, Russia, seven kilometers distant from a plutonium plant and a site where radioactive waste was dumped into ponds, lakes, and swamps around the area. While surveying people who lived

there, drinking and bathing in those waters, Brown observed how their bodies [10] (mostly of elderly women) were sinks for toxic inheritance: physical maladies, reproductive histories, and genetic legacies. And while people developed and were clandestinely diagnosed with chronic radiation syndrome (CRS), US agencies started to fund research projects in post-Soviet nuclear installations. However, US scientists focused on occupational illnesses (linking quantifiable exposure with physiological effects, such as thyroid cancer or disease), monitoring local landscapes and workplaces, and not bodies (Brown 2016): "[t]heir focus was on exposures, not on bodies and their symptoms, as researchers recorded long lists of estimated doses and depositions in isolated organs" (Brown 2016, 43). Because of that, there was "body blindness" (Sellers 1994): bodies and their pain were completely invisible. The reference scales on which what is considered acceptable or alarming are based did not consider different histories and landscapes. In this way, the estimated exposure of the survivors of the Hiroshima and Nagasaki bombings became the assessment threshold for the effects of radioactive waste dumped into the interior American West during the Cold War (Brown 2016). People had no space in defining the thresholds. Brown's invitation to "learn to read bodies as historical texts" brings with it the message of the "art of noticing" (Tsing 2015) invisible elements, those who have been put away, scarcely accessed, and most of the times overlooked in nuclear sacrifice zones.

To conclude, the discussion that began with a position of skepticism expanded to the possibility of also considering the efficiency and necessity we have concerning the use of energy - specifically, energy from nuclear sources. Returning to the mythical passages that the artwork suggests, the artist wanted to propose a fitting metaphor: "[nuclear energy] is bigger than us, and it could be compared to fire: this may frighten us, we may get burnt by touching

[10] A whole lot should be said about feminist studies of material ecocriticism, which investigates the complex representation of the body, and inter- and trans-corporeality. Cfr. Serenella Iovino (2013) and Stefania Barca (2014) for their studies on Italian workers' bodies, unionist and feminist militancy related to the Seveso disaster in 1976.

it, but we all make use of fire and use it". In this sense, such a position may sound realistic and this kind of feeling was shared by several of the interviewed artists. Given that we are at a time of increasing demand for energy use, implementing nuclear energy (rather than continuing to depend on a fossil-based economy) is seen as a viable and feasible alternative to embracing a degrowth economy. In any case, I would argue that having recognized the potential of nuclear power, the hypothetical reactivation of energy with all its consequences shows in the background the shadow of the "lesser of two evils" principle. The discussion ended on the different time scales that have led to the production of radioactive waste and the time that will have to pass to ensure that it no longer constitutes a danger to the health of the environment, human beings, and animals: "it is a paradox. To build nuclear power plants and to create waste did not take many years, and yet [radioactive waste] will remain for a long time".

2.4.3. *Maybe there is hope*

What caught my attention about the artist's profile is that he was born in Taranto, Apulia: a highly environmentally problematic area. He currently works in Varese, where he has his ceramics studio. When I asked for more details about the connection with his home territory, however, I did not receive much information: "Taranto was only a starting point, I was born there. I have never lived there. The area where I live [Varese] fortunately still preserves an oasis of almost unspoiled nature". At the time of the interview, which took place via a phone call, he was on vacation. I proposed to speak at a later time, however, the artist seemed interested in continuing the interview, which in any case had a shorter duration than

the others. The wood-drum artwork “Maybe there is hope” shows a wooden human skull emerging from the surface of the black drum. However, the human is not the only protagonist of the artwork, as wood branches (without leaves or flowers) pierce the metal drum to “re-capture space and thrive again” (Art Spaces 2019, 102). The artist, whose personal research has focused for some time on the relationship between humans, nature, and matter, has decided to refer to two separate moments in the same work: the first moment of destruction, depicting through the skull and bare branches the negative impact of nuclear waste on nature; and a second moment, showing "vindication" made by nature to "re-capture space and thrive again" (Art Spaces 2019, 102). Going deeper with his intention, the artist explained how “I have almost always worked on this relationship, I consider it fundamental and urgent both humanly and artistically. I think we must necessarily have hope of finding a balance that is essential to us sapiens”. Taking some steps back, the interpretation that sees the existence of a “nature” divided by “culture” (or technology, human action, etc.), with the former trying to regain its space over the latter when the latter fails, is still shared by the common imagination. This idea, supported by flora and fauna regeneration in areas that are no longer inhabited by human beings because they are abandoned, highly militarised or where access is restricted or even forbidden, or have become uninhabitable following disasters, reduces the prismatic concept of ecologies to a binary existence: the presence of human beings and their disturbing structures does not allow for the proliferation of animals or plants, and the absence, on the contrary, generates richness in form and a general sense of ecosystemic health. At the same time, while in certain territories one can witness the “reconquest” by nature, one cannot ignore the connections with spaces that have been transformed into “toxic sacrifice zones” (Fowkes and Fowkes 2022, 24). Here, mining practices for precious metals (copper, uranium, tungsten, cobalt, etc.) have devastating

impacts on local communities linked to colonial, military, and mining complexes, scarring landscapes and people's bodies, minds, and emotions (Fowkes and Fowkes 2022, 27).

Imagining a nature "out there," vengeful and which thrives without humans, would lead to ignoring the existence of heterogeneous "naturecultures", a concept introduced and originated by Donna Haraway's *The Companion Species Manifesto: Dogs, People, and Significant Otherness* (2003), for which it is difficult to "keep good distinctions between natures and cultures straight" (Haraway 2003, 9). In these naturalcultural spaces, relationships between humans and non-humans, living and non-living objects or entities, organizations, hopes, and despairs entangle. While non-humans animals, plants, and fungi might thrive in resilient biodiverse ecosystems or techno-systems (e.g. "radiothropic" fungi thrive on radioactive emissions, using melanin ionization for "food"), these "natures" are not something unrelated to political aspects. They connect to the logic and consequences of human relations of power, control, and infrastructure. These "natures" are therefore profoundly political and have to be considered part of a complex web of relations between humans and non-humans. Rather than compromised spaces awaiting the return of nature to go back to being untouched, pristine, and pure areas contaminated by human presence (on multiple levels and modalities) must be understood as hybrid landscapes – or better naturalcultural ones.

From the reflection on absence and presence, the artist then shared the feeling and perception of being in front of two different temporalities or passage of time: "nature can regain its space fairly quickly. The problem is for humans who just as quickly must become aware of the damage they are creating for themselves by altering their relationship with those who allow them to live". In a sense, "quickly" can be interpreted as a wake-up call, an adverb belonging to neo-liberal rhythms, which can generate a state of anxiety and alertness but can not arise a shared sense of belonging in time or an invite to reflect on our degree of agency in it. This type of alarmist approach has become increasingly popular, to the extent that

philosopher Claire Colebrook argued that we are suffering from a "hyper-hypo-affective disorder" (Colebrook 2011, 45). Even though we are constantly surrounded by alarmist messages, predictions about catastrophic changes that we will not be able to adapt to (or are not adapting too quickly), and media constructions about the end, panic does not freeze us and we can not pinpoint "any apparent affective comportment that would indicate that anyone feels or fears" the threat posed by climate change (Colebrook 2011, 53).

In this lack of responsitivity and implication of our bodies and our time, deeply entangled in environmental changes (and damages, at large), is where Astrida Neimanis and Rachel Loewen Walker's reflection fits in. Whilst drawing on feminist new materialist and posthumanist approaches (Elizabeth Grosz, Stacy Alaimo, Karen Barad), Neimanis and Walker invite us to "rethink the 'spacetimematter' of climate change and our implication therein" (Neimanis and Walker 2014, 559). As observed by Neimanis and Walker, the imageries and discourses around climate change's temporalities are saturated mostly in "neoliberal 'progress narratives' of human-directed salvation," which control the future, or "environmental 'sustainability narratives' of holding onto our even reverting to a pristine almost-past" (Neimanis and Walker 2014, 560). To these, one could also add the rhetoric of urgency (and crisis) that characterizes contemporary popular environmentalism, partly recalled by the artist's words. To intervene in the cultural interpretation of temporalities, Neimanis and Walker offer the concept of "thick time" (2014, 561), described as a "transcorporeal stretching between present, future, and past, that foregrounds a nonchronological durationality" (Neimanis and Walker 2014, 561). Whilst specifically aiming at the distance reduction between "the enormity of climate change and the immediacy of our own flesh" (2014, 562), their arguing can be extended to humans' actions on the environment and ways to deal with them. Although awareness is a fundamental part of starting to question our role in the wider ecosystemic balance, should we act, adapt, and overcome "quickly"? Or

should we be guided by a new way of thinking of our presences, bodies, and legacies, and how they are hardly distinguishable, yet again, from "nature(s)"? The concept of "staying with the trouble," introduced by Donna Haraway in *Staying with the trouble: Making Kin in the Chtulucene* (2016), may provide an answer to these questions. This practice, which has no connection with the concept of future times and refuses the adoption of technofixes, requires "to be truly present," and to be open to "making oddkin" with other species by recognising the relational dimension of becoming as "[w]e become-with each other or not at all" (Haraway 2016, 4). Together with that, concepts such as "thick time" allow us to explore the *making* of time as an encounter between matter and weather, and that "[t]o think a temporal

Figure 4. Presta, Giorgio. Maybe there is hope. 2017. Wood sculpture.

transcorporeality as weathering means to think of bodies as part and parcel of the making of time" (Neimanis and Walker 2014, 569).

Reconnecting to nuclear "spacetimemattering," other categories should be introduced to think about spacetime, in which one does not only have a dimension in which past-present-future combine, but one in which one emphasizes buffering and the "fuzzy" characteristic of the nuclear time, which shuffles and messes up timelines. Together with the spatial extensions of nuclear trajectories, which are often difficult to trace or delineate in a single geographical area ("[w]e are all carrying a piece of Congo in our pockets, constantly connected to its conflicts" [11]), as an architect and scholar Pablo DeSoto argues, "nuclear catastrophe is one of the troubles with fuzzy boundaries that challenge our capacity for comprehension" (DeSoto 2019, 119). In this sense, also nuclear time thresholds and boundaries are questioned. While investigating a landscape linked to a violent event (execution during the Spanish Civil War), researcher Kyvely Mavrokordopoulou addresses how an element is often absent from landscape aesthetics and studies: time. In connecting Fernand Braudel's "Longue durée" and Rob Nixon's "slow violence," the researcher shows how these concepts highlight the persistence of the past in the present, the multiplicity of durations, the tight relationship between space and time, and the "invisibility of some forms of violence that extend into the present" (Mavrokordopoulou 2019, 131). Seen in this sense, even the nuclear presence in a landscape can be read as a form of "durational violence". In light of the above, even the nuclear presence in a landscape can be read as a form of "durational violence", consisting of the combination of a brief moment and a long period. If

[11] Revital Cohen and Tuur van Balen, while referring to coltan, a metallic ore used in electronic products including smartphones (Fowkes and Fowkes 2022, 28). Also cf. *The Gadget 3D* (2017), unravelling the entangled histories of cotton and uranium by using a traditional Belgian bobbin lace and referring to the nickname given to the first atomic bomb detonated in the Manhattan Project, "[t]he work drew attention to the parallels between the colonial trajectory of the uranium mined for the first atomic bombs in the Katanga province of what was until 1960 a Belgian colony but is now the Democratic Republic of Congo, and that of the slave laborers, many of whom came from the Congo, destined for cotton plantations in the southern United States. These [...] provided the raw materials for the bobbin lace industry of Belgium, completing the circle of colonial domination, extraction and exploitation" (Fowkes and Fowkes 2022, 19).

the former, such as the firing in the execution, can be referred to as the actual use of nuclear energy, or the triggering of a bomb, the long period can be identified in the aftermath of an explosion, the creation of radioactive waste, or fallout. Therefore if we can apprehend and critically assess hidden (or invisible) and durational forms of violence as inscribed on the landscape in an execution scene, similar reasoning can be done inside the nuclear "fuzzy boundaries". By expanding the temporal dimension, which in the case of nuclear fallout pierces the concept of deep time, we are deprived of the conception of a future as safe, predictable, and therefore manageable. In uncertain temporalities, made up of encounters that linger within the presence, it is difficult to imagine nature trying to re-appropriate a contaminated space to make it pure again, as that timematter dimension is barely conceivable. In poetess Ryoko Sekiguchi's words, "[t]oo often, we hear that nature has regained its rights since men have deserted the place; a discourse that shows a real lack of consideration for the environment, as contaminated as we are" (Libération 2021).

On an ending note, the discussion moved on to two last topics: living with radioactivity and its presence as a natural element and, finally, what "Maybe there is hope" can continue to communicate, in the present and in the future times. While talking about our shared living with radioactivity, the artist argued how "[r]adioactivity exists in nature but we must not underestimate the toxicity and permanence of contamination". The political differences between the two interpretative claims of radioactivity, those who considered it an exception and those who labeled it as mundane, have been thoroughly investigated by nuclear historian Gabrielle Hecht (2009; 2010; 2011; 2012). While anti-nuclear groups highlighted the qualitative and quantitative dangers posed by exposure to radioactive substances, the nuclear industry ascribed radioactivity to the realm of mundanity, day-to-day life: "radioactivity was a part of nature, nuclear power merely a form of energy among others" (Hecht 2010, 4). However, when the banal nature of radioactivity and nuclear things was strongly challenged

after the Three Mile Island (1979) and Chernobyl (1986), the industry re-branded itself: the industry spent more than other industries on death prevention from occupational exposure. At that, as Hecht argues, “the stakes of exceptionalism were amplified by morality-talk: nuclear things were either sacred or profane” (Hecht 2010, 4). While Hecht’s wide work on “nuclearity” will be addressed later, I think that for this flow of reasoning, it is important to notice how, historically, what counted as “nuclear” – a nation, a program, a technology, or a material – hasn’t always been a matter of consensus (Hecht 2010). Where in some cases, nations, and projects radioactivity was regarded as an exceptional element (for which the right precautions had to be taken), in others, it was interpreted as trivial and de-nuclearised. Lastly, what makes things “nuclear”? How do we know? According to Hecht, “nuclearity is a regularly contested technopolitical category,” which can “shift in time and space” (Hecht 2011, 101). Nuclearity is distributed, and its parameters depend on history, geography, science, technology, bodies, politics, radiation, race, states, and capitalism (Hecht 2009). The discourse around “nuclear normalcy,” (Schmid 2019) regardless of how we envision our future, must be taken into account with all its criticalities. In the artist’s words: “for me, this is a very sensitive issue, but one that must be approached without prejudice, with extreme seriousness. 'Maybe there is hope' would like to communicate the criticality of this choice”. Whilst the ecological future is being written, we have to deal with a deeply troubled present.

2.4.4. *Inspired Landscape*

The interview held with the artist behind “Inspired Landscape” was quite brief. It was the artist who told me he preferred a phone call to a video call, which took place while the

artist was preparing for a conference. However, the artist demonstrated to be willing to do the interview and preferred to continue it despite my suggestion that he reschedule the call for a later date. I initially asked him how he had approached the art world and what meanings he attributed to sculptural art: “sculpting is not just a hobby but a calling that has been with me since I was young. Despite having a career in the publishing industry, and working for some of the most prestigious Italian publishing houses, I have never let go of his passion for sculpting. During his time as a bookseller, I kept developing my art and perfecting my techniques”.

The battered black drum in "Inspired Landscape" has been described as a deposit with the feature of collecting dust. The artwork, composed of several parts, is divided into the main body, the drum, to which is attached the arm of a vacuum cleaner, and on whose upper cover

Figure 5. Castelli, Fabio. Inspired Landscape. 2017. Earth, moss, bricola wood, box-wood, grasses, water.

houses a landscape inhabited by moss, a rock, and some dwellings. At the foot of the drum, we can notice a piece of wood (an object that in this case represents dust or waste) which through the device will be cleaned. Starting from the description provided by the dialogue, which was very brief, I tried to get more information about the sculpture so that I could reconstruct the traces of the relationship with radioactivity. Talking about his participation in "Art Spaces", the artist confessed how "I was a bit polemic in my contribution. I wanted to reflect on greenwashing. Initially, I was perplexed about my participation. Was I supposed to participate? Or not? In the end, I worked with great enthusiasm instead". Many elements make up the sculpture. One, in particular, is dust, which is also a waste material. As a particular vector of meaning, here dust and ashes trace a link with the passage of the end, or even the apocalypse, which comes and ends "not with a bang but a dimming" (Cohen 2013, 270). Author Jeffrey Jerome Cohen has dealt with "gray ecology," one that is described as a realm of "slow loss, wanness, and withdrawal, a graveyard space of mourning" (Cohen 2013, 270). While the author argues that grey can reveal our anthropocentrism stubbornness, as if Earth should mourn and lament with us, it also contains potentiality as a liminal space: the "grey hour [...] is a turning point," where non-humans or more-than-humans creatures "continue indifferent to our proclivity to think that an evening's color drain is a metaphor for human impermanence, a cosmic acknowledgment of our little fits of melancholy" (Cohen 2013, 270). I agree with the author when he describes grey ecologies as means of remembering our difficult past, full of exclusions, brutalities, of things left outside or "othered". Dust, and gray at large, paints the unfinished business and mark histories of injustice, trauma, and violence (Cohen 2013). Also, grey ecologies could be considered a "process more than a color" (Cohen 2013, 272). In this process, inhumane practices and hegemonies of the humane emerge through the sorting of who and what gets to dwell in the house and own proper life, who and what will be excluded" (Cohen 2013, 272).

This resonates with Achille Mbembe's *Necropolitics*, whose approach builds on Michel Foucault's critique of the notion of sovereignty and its relation to war and biopower (2003) while demonstrating that the category is insufficient "to account for contemporary forms of subjugation of life to the power of death" (Mbembe 2019, 39-40). By offering a powerful reading tool on the social and political conditions of racialized people, "necropolitics" as a concept opens up a new interpretation of social and political power that has control not only over how one lives but also over how one dies. In this case, grey and dusty tracks put before us the existence of debris that perhaps, at least in the case of radioactive waste, will be difficult to get rid of or that we may not be free of for years. In representing the waste and the tools to hide it (namely, the drum that functions as a vacuum cleaner), the artist wanted to express his critical view on the mechanisms adopted to solve the problem: "hiding problems under the carpet, collecting waste and putting them in the bin, will not be the solution. It is not by hiding the containers loaded with radioactivity underground that the environmental problem can be solved". As in the other cases, the questions that arise are: in which ways radioactive waste should be "cleaned" and taken care of? Where should it be deposited, once collected? This decision-making process and the outcomes must take into account not only the grey ecologies mentioned above but also necropolitics. As will be discussed below, it is necessary to question which spaces and thus which communities will have to share existence with this kind of waste and legacy.

While in the description we can read an invitation to active participation by human beings to keep clean the environment we live in, as our survival depends on it (Art Spaces 2019, 42), during the interview with the artist other interpretative elements emerged. Born in Varese, the artist shared his experience of living in that area, reflecting on the ways it changed through the years. As the artist stated, "I don't remember as it was before the plant was built, I was too young. There were many green spaces that are now not there, but this issue concerns

the whole Italian territory". The remark on the loss of green areas might be reminiscent of Rachel Carson's novel *Silent Spring* (1962): changes in the landscape have certainly had an impact on the residents living closer to the area, but since this is a generalized trend (uncontrolled urbanization, loss of green areas, overbuilding), some have been able to recognize the same processes throughout the country. Often, observations of such changes are linked to negative perceptions and are communicated as such. In the end, observing the perceived environmental degradation becomes a key factor in assessing the impact of pollution, and over the years citizens and communities have become, as Davies argues, "slow witnesses to environmental violence" (Davies 2018, 1548). The artist also commented on other types of changes, especially economic, that the area has experienced: "Ispra has the peculiarity of sharing space with the JRC, which has changed the appearance of the landscape also in the sociological aspect: those who work within the JRC earn a much higher wage than the local population". Given that Ispra's economy is mainly based on agricultural, industrial, and tourist activities, it is not difficult to imagine the wage difference between citizens and those working within the JRC, even if it has been noted that the establishment of the site has resulted in a significant increase in the economic activities of the territory. Since 2013 Ispra is also the place for the temporary storage of waste conditioned to low and very low activity, and the temporary storage or Interim Storage Facility (ISF) contains waste from the site of Ispra, both from research activities of the past and decommissioning activities.

Construction of unwanted facilities is a theme widely discussed, in the NIBMY (Not In My Backyard) and LULU (Locally Unwanted Land Use) literature, and local communities with some social identifiers such as ethnicity, race, and class have gotten closer to the right of veto. However, as lawyer Ciprian N. Radavoi argues, the same does not hold for communities defined merely geographically, or "fenceline" communities. Fenceline communities geographically occupy "sacrifice zones" (Lerner 2010; Maldonado 2019) where residents live

near polluting activities (industries or military bases) which expose them to dangerous chemicals and health risks. On this topic, communities have the power to turn governmental decisions, but do they have the right? The lack of equal distribution of environmental harm has been addressed by the environmental justice (EJ) movement, which proved to be extremely potent, leading racialized communities in developed countries to improve their capacity to veto a project (Radavoi 2015). However, this might clash with NIMBY opposition, which is usually perceived negatively and thought of as a selfish act to "pass on harmful projects to poorer, less organized communities" (Radavoi 2015, 6). This conundrum leaves geographically adjacent communities or fenceline communities as disadvantaged over poorer or racialized communities, "due to the activation of the EJ master frame" (Radavoi 2015, 6). If usually governments offer compensation for siting a project in a precise location, the fact that the payment can be rejected on one hand "reinforces the idea that each community has a right to veto a polluting project" and on the other that not every community has it, "because the landfill or electric plant has to be sited somewhere" (Radavoi 2015, 15). In the end, it is a matter of distribution and, Radavoi suggests, "the solution lies in procedures" (2015, 17). With a two-step process this could become feasible: listing the most appropriate technical locations and the location with less nuisance should be selected. However, as Radavoi argues, "[t]he problem is that [...] it is almost impossible to convince communities that their neighborhood is indeed the most suitable location" (Radavoi 2015, 17). This would result in new imbalances. And even if fenceline communities would be more involved in decisional processes, as the author notes, when the right to say "no" is not granted, "the whole participation thing is only a masquerade" (Radavoi 2015, 20). Whilst not aiming to give solutions, Ciprian Radavoi's article is a useful tool to think in which ways cases of environmental local opposition to industrial projects (waste disposal facilities, oil refineries, thermal or nuclear energy plants, extraction projects, factories generating high

pollution, large-scale agricultural projects, and even airports) may include some degree of arbitration between suitable for hosting or fenceline communities, investors or corporations, and local representatives.

One of the (declared) limits of this investigation lay in a statist assumption that does not consider anarchist proposals for self-governing, sustainable communities. However could stateless environmentalism help in unraveling the knot? To a certain extent, environmental claims recognize the State as "the most powerful human mechanism for collective action that can compel obedience and redistribute resources" (Duit et al. 2016, 3), despite limitations and inefficacy. Francisco J. Toro argues that "this transformation of the statist paradigm is a continuity of the same administrative procedures and organizational model but disguised as *green*" (Toro 2021, 190). Nation-states, as Toro claims, "have lost power in their capacity to unilaterally regulate important environmental dues and duties" (Toro 2021, 191) as they sponsor and promote private and national projects which have had non-reversible damages to the environment (e.g. extraction activities, dams, land grabbing); most of the time, nation-states have a counterproductive effect, albeit the shared belief that liberal state constitutes a synonym or an equivalent to democracy (Toro 2021). In the end, the author's analysis of the incompatibility between free, local, sustainable communities and the State (hierarchical, oppressive, coercive body) leads to the conclusion that a "sustainable future would involve the dismantling of governmental institutions" (Toro 2021, 201). At the same time some proposals, such as that of the anarcho-primitivists, are deemed by Toro as "extravagant and unrealizable," which might be a good starting point for thinking about ethics and politics. Maybe one of the solutions resides in going beyond the State.

Ultimately, toxic geographies, such as those where radioactive waste disposal facilities are sited, are also lived environments, where space is shared between humans and non-humans. Most of the time, they are polluted by chemicals or dangers that are not always

perceptible by the senses as they leave invisible traces behind and all over the environment. While investigating communities in the region of Louisiana (or “Cancer Alley”) exposed to petrochemical infrastructure, environmental and political geographer Thom Davies highlighted the deep connections between structural violence and slow forms of harm (2022). As Davies argues, Rob Nixon’s description of slow violence (2011), which is understood as unspectacular, invisible, and out of sight, could limit the power of participation of communities directly affected by these forms of harm. In contrast, Davies' approach, by asking to whom the pollution is out of sight, brings to the fore those who inhabit those sacrificial zones. If it is agreeable that, in Nixon’s words, environmental harm (e.g. chemical, nuclear exposure) can be “driven inward, somatized into cellular dramas of mutation that—particularly in the bodies of the poor—remain largely unobserved, undiagnosed, and untreated” (Nixon 2011, 6), Davies invites to look closer into the phenomenon. By centering communities' knowledge of their own space, and the ways they notice, observe, and reconnect with the environment they live, informal knowledge gains new significance. As informal knowledge is frequently overlooked and undervalued compared to official and scientific accounts, sometimes this bias leads to a “narrative mismatch” (Ottinger 2017). This changes toxic geographies making them uncanny, [12] ambiguous, and disputed spaces. In which modalities are memory, anecdotes, testimonies, and personal history interlaced with the construction of knowledge? Could they be useful in drawing up new methodologies to deal with contamination? In the study with a historical narrative approach carried out by Adams et al. (2018) on fenceline communities, the group of researchers provided insights into how residents deal with exposure and contamination, concluding that “[w]hile many studies of contaminated communities focus on the technical rationality associated with scientific proof

[12] “The nuclear uncanny exists in the material effects, psychic tension and sensory confusion produced by nuclear weapons and radioactive materials”. Masco, Joseph. (2006). *The Nuclear Borderlands: The Manhattan Project in Post-Cold War New Mexico*, Princeton: Princeton Unversity Press, 28. Masco's definition of the haunting psychic effects of radiation, where nuclear materials can produce powerful psychic resonances because of radiation fundamentally distorts how people experience an orentation in time and space.

and evidence [...] residents' interpretations and subjective understandings are equally important in mapping exposures over time" (Adams et al. 2018, 218). Although I have not had the opportunity to delve into the inner dynamics of these communities in the vicinity of the JRC, a study that could be of just as much interest and could be expanded upon, it is legitimate to ask: is it enough to be located in a contaminated space to realize that you are contaminated? What work (imaginative and practical) is required to become aware as community? How much work has been done to enhance and give importance to the testimonies of those who live in a "sacrifice zone"?

During the last bits of the interview, the discussion went beyond the topic of the connection to the landscape and the changes we have witnessed in it, and the artist then shared his views on the aesthetic aspect of nuclear power: "if one looks at the stars, as the stars are nuclear, they can be seen as 'beautiful'. In this sense, nuclear can be beautiful. We just have to look at the sky. The Sun also burns us, but we depend on it". One could interpret an aesthetic reworking as a way of transforming something feared into something beautiful, in a sense redeemed, just as in the artwork, skepticism and distance from certain possibilities emerge through in the artist's words: "as far as nuclear energy is concerned, it is hard to say that there is a beautiful part. Building the power plants, the problems with emissions, they are not such easy issues to deal with". To conclude, the role of art in the artist's interpretation is not secondary, or subsidiary. "Art has a role that is shared with other disciplines: science and art, economics and art... but this should not turn art into a commodity. Art, like all the other human sciences, must have a correlativity and co-responsibility with all the sciences".

2.4.5. *Germinal*

The conversation with the artist who created 'Germinal' took place via video call. On this occasion, I was not received in a studio, or a room, but inside the artist's car. Through the screen, I was able to see what the artist was carrying - materials of various kinds, such as wood and polystyrene, or discarded materials - and the ticking of the directional arrow punctuated the rhythm of the conversation. Right from the start, the artist showed interest in the opportunity to talk more about the exhibition he had taken part in, reiterating the fundamental aspect of doing research and asking questions: “it is important for young people to approach certain topics. That they ask themselves questions. That they ask questions of others, especially adults and those who have handed certain issues to them”. The artist has chosen to engage with the exhibition’s theme by placing on the metal drum an organic shape, enhanced by a powerful vital energy. The bright white organic form seems to be erupting from the cover and lid of the black drum, expanding vertically only to recoil on itself. The result is interpreting the matter as if it were alive or had the ability to pulsate and breathe. Once again, the interview conducted with the artist, who is from the Varese area, started from geographical proximity, and sharing perceptions of how the territory has changed over time: “[t]hey have built a lot. They have built with concrete. Even in small villages. They have distributed permits from farmland to buildable land”. Shortly after, the conversation focused on the presence of the former Ispra nuclear reactor. “It is a bit far away [from where I live]. I know that the presence of the plant was much discussed by the inhabitants. The radioactive waste is there and it is a big problem”. However, what emerged from the conversation was not a totally negative (nor positive) stance, but rather an optimism towards a possible, future solution, which was nonetheless counterbalanced by a pragmatic look set to the present. While the discussion centered on the problem of finding a final repository for radioactive waste, the

Figure 6. Ravasio, Paola. Germinal. 2017. Fibreglass and metal drum.

artist put it this way: “using nuclear energy is inevitably going in this direction: the technological means that human beings develop are also very powerful and sometimes unmanageable,” and to that she added, “it will probably also have very important future developments. I like to leave the doors open to possibility: there is an unsolved issue, but we can overcome it”.

This feeling of hope – quite new in this entire ethnographic study – reminded me of Kate Brown’s use of the theme of “ghost,” or human harm, in her chapter for *Arts of Living on a Damaged Planet: Ghosts and Monsters of the Anthropocene* (2017). Brown writes about Kupny, a partisan spelunker who freely chose to investigate and photograph Chernobyl to “visualize… his lost world of socialism with all its possibilities and promise” (Brown 2017, 49). In her Marxist analysis (Brown 2017, 48), together with recognizing the social and

political implications of spelunking a nuclear power plant, “ghost” hints at two different meanings. The first one is related to Chernobyl, interpreted as the ghost of the USSR’s nuclear power program and proof of modern abuses against its citizens. The second meaning is stored in the photographs, the ruins of a nuclear power plant, which can lead to a reflection on the history of the USSR. In Brown’s account, she argues how in Kupny’s lifetime, “Soviet socialist modernization delivered a great deal” (Brown 2017, 45). Like many other citizens, Kupny learned to read, and started to forget epidemics and famine, replaced by indoor plumbing, public bathhouses, and central heating. Socialism significantly enriched their lives from an economic point of view, with pensions, health care, education, and other fundamental services from libraries to clubs. This state focused mainly on training, urban, blue-collar workers like Kupny, who was a radiation monitor, “while outwardly focusing political rhetoric on equality and the ascendance of the working class” (Brown 2017, 45). As the author notes, making a comparison between past and present reality would be impossible: “[i]n postsocialist, post-shock-capitalism society, working classes have been left in chronic poverty and joblessness, while pensions have evaporated, paid vacations are a nostalgic memory [...]. On this panorama, the achievements of the Soviet technocratic planning state look better and better” (Brown 2017, 45-48). Through Kupny’s experience, Brown shows a ghost that brings with it hopefulness, the hopefulness that nuclear energy provided constituents of the USSR.

What does it mean to create artwork out of a ghost, or waste material? Can an object that is normally seen at the end of its time, as no longer productive and, therefore, “dead,” be categorized differently and looked at with a different gaze? The artist commented on how, at first, she did not think she could get a good result as these are not the topics she normally deals with. “The drum conditions your range of action, as it is the emblem of radioactive waste, which I wanted to use conceptually”: to the questions made earlier, the author seemed

to answer positively. According to the artist, waste has not to be considered rubbish, or something to eliminate completely, and this way of thinking leads to suggesting a new way of life for it: “at first I didn't think I would be able to do something decent, because these are not subjects I normally deal with. Then I thought about it and eventually went in that direction”. When the conversation with the artist touched on certain kinds of topics, she expressed herself with a view driven towards reusing elements commonly ignored: “[From waste] something can be generated that is still living, that is energy, that can be useful in the life cycle. There is no point in polemics: the problem is there and must be addressed”. Her observation seems in tune with the description of “Germinal,” where the two apex phases of the life cycle, birth and death, come together in the work. Here, the metal drum is not just the place to store radioactive waste but has the potential to become a "vital substance ready for a new beginning" (Art Spaces 2019, 106).

In reworking radioactive waste by inserting it in the cycle of life again, ours in particular, could we “become nuclear”? This type of proposal, to become *something* (usually, something else), while it might sound naive at times, could help us in imagining the new transformation of human societies. In the artistic experiment “Becoming Aerosolar: From Solar Sculptures to Cloud Cities” by Tomás Saraceno, Sasha Engelmann, and Bronislav Szerszynski (2015), the artists invite us to think of new ways to move and sense the circulation of energy. Becoming aerosolar would open the possibilities of realizing a new society’s energy relation, far from “solar societies” (that monopolize land area) or “fossil-fuel” ones. By becoming aerosolar, society would shift towards an alternative future that is truly solar-powered, liberated from land use to “become airborne” (Saraceno, Engelmann, and Szerszynski 2015, 59): that would be the promise of a future “*solar-cene*” (Saraceno, Engelmann, and Szerszynski 2015, 59). The project of “becoming aerosolar” resulted in the creation of the *Museo Aero Solar*: a flying museum, a solar sculpture made

entirely from reused plastic bags. The core of the Museo does not reside in its image, but in working together, melting edges of reused plastic bags "in an act that embodies an ethos of care and generosity, transforming waste plastic from the iconic material of the 'bad' Anthropocene into a shared aerial canvas for a possible 'good' Anthropocene" (Saraceno, Engelmann and Szerszynski 2015, 61): from primary schools to The Anthropocene Monument with Bruno Latour, to the growing Global Climate Strikes, more than 20,000 plastic bags have been collected by the displaced, open-source community, which is situated, among others, in Argentina, Colombia, Cuba, Germany, Italy, Palestine, Switzerland, the United Arab Emirates and the United States of America (Aerocene 2022). According to the artists involved (even if wider authorship is hoped), interested in locating contemporary changes in the relationship between humans, the environment, and technology, together with the political and aesthetic dimensions of air and atmosphere, becoming aerosolar is not *just* an art project. For them, "activating the potential of an aerosolar society would require us not only to cultivate a new, thermodynamic imagination but also to challenge the existing, politically demarcated volumes partitioning the atmosphere" (Saraceno, Engelmann, and Szerszynski 2015, 62). Art in this sense can become a connecting bridge. Returning to the exhibition and discussing with the artist her role - and that of her colleagues - in the dynamic and discussion between art, science, and technology, she was quite skeptical. "The way I see it... art in this type of exhibition is penalised, because it does not convey anything. In this sense, it becomes purely scenic. There might as well be no such intervention. Perhaps more than art one can speak of design, the way it is presented and installed. In my opinion, art in certain contexts can take a marginal, non-incisive position. For me, art produces something".

The practical consequence of "becoming nuclear" have been investigated by Gabrielle Hecht in *Being Nuclear: Africans and the Global Uranium Trade* (2012). Through her in-depth analysis of African uranium and the techno-politics surrounding it, which are

entwined in the continent's colonial past and postcolonial existence, Gabrielle Hecht's *Being Nuclear* refocuses attention on Africa. She has produced a comprehensive history of uranium mining and trading in Africa that has been long overdue, drawing on extensive archival and ethnographic research. As has been argued before, Hecht coins the concepts of "nuclearity" and "nuclear exceptionalism" (2012, 3-6) to emphasize the uniqueness conferred on nuclear items and thus their divergence from the mundane. However, this mundane nuclearity affects the daily activities of black miners who must risk radioactive pollution in order to survive economically in the uranium mines of Gabon, Niger, Madagascar, Namibia, and South Africa. Hecht makes a strong case for this paradox by describing how racial injustice, colonial exploitation, and financial gain have led to the disregard for people's radioactive vulnerabilities. *Being Nuclear* shows the contradictions of nuclear things, which stand at the intersection of stigmatizing radiation anxiety and radioactive invisibility. As a result, Hecht illustrates how human lives are being trivialized across cultures for the economic goals of empires, nations, and companies, and her statement that "radiation does not discriminate" is very strong (Hecht 2012, 323). Most importantly, Hecht expands the scope of the nuclear study, which is often restricted to reactors and warheads, by focusing on uranium. These kinds of struggles highlighted and studied by Hecht are ascribed, according to the historian, to "regimes of perceptibility" or "assemblages of social and technical things that make some hazards and health effects visible but leave others invisible" (Murphy 2006). Not only such regimes included protective gear, laboratories for assessing exposure results, means for transmitting them, national regulatory systems, manuals, policies, and conferences, but these regimes also showed intricate links on different levels – local, national, and international. Hecht claims that radiation specialists in apartheid-era South Africa purposefully refrained from researching black miners' radon exposures. As the artist suggests – as well as observed in other interviews -, "the fundamental process in art is to make visible what is not visible.

Working with feelings, and giving them a shape, is a process that goes from the invisible to the visible. Here the discourse had to be explicit about something dangerous, to be handled with care, but also to give a reading: positive, negative, rejection, contrast, openness". In this specific setting, such as an art exhibition on nuclear decommissioning, an invisible or imperceptible hazard might be understood by the public in a facilitated way through theatrical, dramatic, artistic demonstrations that can have the potential to shape public opinion. [13] The artist continued by addressing how the exhibition and its creations could have a relevant role in addressing and highlighting the issue of nuclear decommissioning. On the hypothesis that this type of communication could be useful in bringing the public closer to the discussion on nuclear power and decommissioning, the artist was skeptical: "I have some doubts about rendering nuclear power something 'friendly'. Since humans need narratives, if this process is expressed in the right way then something can come of it". I would argue that these artistic translations have the power to create images and stories that frame and give meaning to thorny issues while providing a language for debate across boundaries of difference. According to communicator scholar Walter Fisher, who in 1987 theorized the "narrative paradigm", humans can be conceived as *homo narrans*, or storytelling animals persuaded to make decisions based on the coherence and fidelity of stories. In this sense, storytelling (and art at large) can be perceived as a powerful tool that has a high impact on people's empathy and emotions.

[13] This could recall DeLuca and Delicath's suggestions on "image events" (Delicath and DeLuca 2003), while not sharing all the features which characterize them, as "image events" are described as acts of social protest where the participants are clearly advocates; they are intended to shape public opinion; they are designed for media dissemination; they are broadcast on television news and photographed for newspapers and the images are of acts of protest (Delicath and DeLuca 2003).

2.4.6. *The Refuse Light*

The interview was both one of the most challenging and one of the most interesting. Born in Crema, the artist is also a professor and teaches in high schools, as well as at the Academy of Fine Arts in Crema, Bergamo, and Brera. The interview took place via video call and the artist welcomed me into his office, positioning himself in front of a large conceptual and geometric painting, which also reflects the artist's production. His aptitude for teaching led him not only to explain aesthetic concepts that he shares but also to listen, not to verify but to gather stimuli. The drum in "The Refuse Light" is divided into three parts. While the base shows the original material of the drum for two-thirds, the space just under the lid is surrounded by a geometrical digital painting. In my opinion, the upper part of the lid is the most interesting part. Above the lid is a neon coil that emits a very strong light, as well as indicating the passage of a small (and almost invisible) snail. I think that this is quite a curious presence. The snail, together with being the symbol of "rebirth," for the artist has the role of the one who traced the spiral on the lid. In the whole exhibition, non-human animals appear scarcely. Together with "The Refuse Light," only another artwork depicts the non-human presence, specifically of birds; however, they are mere symbols, as they indicate "the determined efforts being made to develop alternative clean research projects that respect the environment" (Art Spaces 2019, 86). Birds in radioactive biocenosis have been thoroughly studied by biologist Zhores Medvedev, which stated that "[b]irds have one of the most active types of erythropoiesis or red blood cell formation, and they are among the most radiosensitive of animals" (Medvedev 1979, 74-75). In the years following the 1957 Ural nuclear disaster, hunting of birds was prohibited. Still, in other countries and southern parts of the USSR – where flocks migrated from the Urals – hunting was not banned. Once again, "nuclearity" turns out to be an element that depends on more factors than scientific data.

Together with that, I would argue that, while non-human animals are mentioned from time to time during interviews (albeit in the wider category of “nature” which will *eventually* take back its space), little to no space is given to them in the whole exhibition: they are metaphors, symbols, means to communicate something else, and still far from being considered artistic objects or subjects. [14]

In this particular artwork, the theme of regeneration is not embodied only by the use of radioactive waste, but also by the presence of the neon light which illuminates the lid or top part of the drum. The light here, as the artist explains, “dazzles the spectator, gives a vital sense, a shock from which something can be born. The light, the spiral, the circuit... they are all references to clean energy and light. I wanted to include many symbols of our contemporaneity. The mobile phone, the spiral that becomes a coil, the center of communication”. Light coming from nuclear energy – be it in electricity production, ordinance, or explosive events – has fascinated many artists, among whom I’d like to briefly remember Joy Garnett’s painting. “Poof (2),” as part of a series of paintings, reflect on the US government’s nuclear experiment and their technopolitical significance, together with their aesthetically extreme appearance (Armitage 2011, 62) but by depicting the decontextualized incident. The series could evoke painterly tropes and pop iconography on its surface, in reality, the explosive shapes in Garnett’s work could echo cultural and economic cycles of creation and destruction, seismic contraction, and cosmic expansion (Carpenter 2016).

As the artist explained during the interview, the will behind the artwork lies in "investigating contemporaneity; in seeing the bin as an emblem of waste, therefore with a rather relevant thematic weight. It is true, however, that a container can both conceal and can reveal a reflection on something dangerous”. The main aim of the artist, as he clarified, is working on a "regeneration of a new nature" through new materials, new components, liquids,

[14] One could argue that all beings have agency in managing, modifying, and even making their ontologies and “worlds”. Some essential mentionings here are Eben S. Kirksey and Stefan Helmreich (2010), Eduardo Kohn (2013), and Anna Tsing (2015).

Figure 7. Macalli, Gianni. The Refuse Light. 2017. Bin, synthetic material, neon light and digital printing.

and solids, "posing a new image, a reflection where the art or concepts represented invite questioning and reflection on the subject". Although a similar theme has already been addressed in “Germinal,” I believe that there are other nuances that can be analyzed when observing “The Refuse Light”. How can this practice differ from recycling? Is it really feasible to give new life to a kind of waste in the first place, especially when working with such material could be potentially dangerous or even lethal? Could (re)production of nuclear energy be ever free from wasting relationships? I believe that while there is a vast scholarship on waste (see Gille and Lepawsky 2021) one scholar who has cast his gaze beyond the material nature of waste is environmental historian Marco Armiero. In *Wasteocene* (2021) Armiero considered waste not as a mere thing, “but rather as a set of socio-ecological relationships aiming to (re)produce exclusion and inequalities” (Armiero 2021, 1). In the

larger scope of Capitalocene (Moore 2016), Armiero did not simply propose (yet) another "-cene,"[15] but revealed a radical and deep rethinking of the socio-political materiality of waste, describing "Wasteocene" as made by "the wasting relationships, those really planetary in their scope, which produce wasted people and places" (Armiero 2021, 2). The Age of Humans or Anthropocene is said to be marked by a stratigraphy of wasted matter (carbon sediments, radionuclides, microplastics, etc.) accumulating both on Earth's surface and in our bodies. However, the focus of Armiero's analysis moves from waste as an object to focus on waste as "wasting, that is, as socio-ecological relations creating wasted people and wasted places" (Armiero 2021, 10). The Wasteocene is both planetary and place-based, containing cleanliness, aseptic, grim, and contaminated environments (Armiero 2021, 10). The key element of Wasteocene is that it is based on the social organizations and practices of "othering": determining "what" and "who" is waste, and "where" it should go – usually somewhere else (Chakrabarty 1992; Gille 2007). To free ourselves from these practices, we should work towards commoning practices (Armiero 2021), such as building communities, mutual aid practices, and practicing solidarity, because the nemesis of wasting is not just simply recycling.

From an archaeological point of view, the accumulation of trash is the most enduring thing humans have created: garbage will survive longer than expected, and the durable and enduring nature of trash, together with its volume, is what makes spaces such as landfills (or nuclear storage facilities) *unintended* monuments (Joyce 2020). While discussing "Art Spaces" potentiality of becoming a future artistic archive for nuclear waste, the artist conveyed that the right path towards this goal could be "shortening the distance between everyday life and nuclear memory". As the artist argues, "archiving radioactive waste should become part of everyday life, so that a contamination can take place between historical and

[15] Scholars have introduced lots of *-cene*: "Plantatiocene" (Haraway 2015, Tsing 2015), "Ecocene" (Norgaard 2013), "Technocene" (Hornborg 2015), "Anthrobscene" (Parikka 2015; Ernston and Swyngedouw 2019), and "Manthropocene" (Raworth 2014; Di Chiro 2017).

domestic, monumental and personal". While this type of reasoning can be placed within the broader discussion between the exceptionalism and banality of nuclear power, it can also be compared with what has been addressed in Rosemary Joyce's study:

> Archaeology helps us imagine the unimaginable future best when it presents the past, not as retrospectively predicted from the present through assumptions of uniformity, but as exceeding our present understanding and experiences. Art offers a vocabulary particularly attuned to helping us express the inexpressible and, in concert with the kind of knowledge production engaged in by archaeologists as specialists in living materials, might help us project futures (Joyce 2020, 14).

What could happen if the radioactive presence could become part of our day-to-day lives? According to the artist, only "embedding the radioactive presence in a social context will facilitate its acceptance. For this, contemporary art may prove useful in achieving the goal". I think this attitude and will, also shared in other interviews by other artists, can fit well within the broader framework of heritage-making and nuclear cultural heritage in particular. Using contemporary art, always with a view to true inclusiveness and participation in constructive dialogue towards a nuclear heritage, can be a good communication tool to make complex, ambivalent, or divisive issues more accessible.

Lastly, delving into the theme of a shared space with a radioactive presence and thus a possible, everyday, coexistence, the artist wanted to share his position on the very concept of what is the meaning of "living with it". At the center of a broader discourse, amid a reflection on how difficult it is for the artist to conceive of his work as another section divided, hermetically, from his daily life, the artist argued how, in his opinion, "accepting coexistence means being contemporary, relational, with who and what we have inside and outside". The possibility to question our being as multiple and not singular comes from the critique of the

concept of identity that has its roots in feminism. Feminists were the first to examine the Western concept of identity, based on a Kantian interpretation that defined the rational subject as a disembodied mind, and identity as genderless, raceless, ageless, or out of the class hierarchies, masking a masculine idea of self. With the exposure of "normative underpinnings of supposedly neutral metaphysics" (Anderson et al. 2020), a reconceptualized idea of selfhood was proposed and interpreted as a dynamic, relational, and multilayered phenomenon. This critique on the rational, masculine, and individual idea of selfhood and agency led ecofeminists such as Val Plumwood, Greta Gaard, and Chris Cuomo to express some dissatisfaction towards the traditional idea of self that, as they advise, must not be put against the relational understanding of it as it would generate another dichotomy. Instead, ecofeminists are searching for a definition of self "that provides a foundation for ethics that includes more than human/human interactions within its framework but does so without endorsing either the absolute separation of self from other or the absolute merger of the two[16]" (Fast 2002, 28). In this regard, there are three fundamental aspects of the ecofeminists' idea of the relational self. Firstly, Plumwood (1991) emphasizes the importance of relationships, which are the base of self-identity, and Cuomo (1998) defines humans as relational. Secondly, by taking distances from the merging of "self" and "other", Plumwood introduces the idea of "simultaneous recognition of sameness and difference" or mutuality, by which she means "recognition of both kinships (we are alike) and difference (we are not the same) in dialectical movement" (Fast 2002, 28). Lastly, there is the distancing and questioning of the more anthropocentric aspects of feminists' conception of the self. As Greeta Gard argues, the ecofeminist's version of "an ecological, relational self needs to acknowledge the way that human identity is shaped not only in relationship with other humans but also in a relationship

[16] By offering a critical outlook on deep ecology, ecofeminists express how the replacement of the characteristics of traditional understandings of selfhood, individuality and separateness, with their so-called opposite, characteristics of indistinguishability and self/other merger, is inappropriate (Fast 2002).

with other animals and with nature" (Gaard 1997, 14). To conclude, even if referring to the Gaia theory, I think that Anne Primavesi's (2000) words still apply and could be useful to summarize the line of reasoning just delineated: if the planet is a system where elements evolve together, on a smaller scale, one could say that humans function just the same. Human beings are formed by networks, systems, and environments of smaller components (e.g. bacteria, viruses, elements) to which humans are connected by "membranous boundaries" (Fast 2002, 81) and from which they depend to survive, and vice versa.

How does art enter into a true relationship with art and how does art enter into a relationship with nuclear presence? Can we speak of it as an element of everyday life in this sense? Specifically, on the relational aspect, the artist expressed himself in this way: "This was the theme of my work. I wanted to socialise nuclear power, which we have to deal with. Do we have to coexist? What is coexistence? I played on the metaphor of the snail becoming something new: the snail [home identity] sweeps to other places with its wings. Art must immerse itself in the contemporary, becoming an existential part of the artist's qutidianity. An artist must never separate the two things: art and domestic. I don't know if this is right. In my opinion, being an artist means not changing the logic of every day - bringing the socialisation of the nuclear into every day". How to live together in this particular environment? "If we maintain the quotidianity that is a way of the present, every form of life will have to come to terms with what it is living and doing. Accepting coexistence: being contemporary... being relational, with who we have inside and outside: to concretise through living yourself". Being *relational* means that not only our identities are co-built in a shared and communal way, but that we all are co-implicated and co-responsible as our bodily and social relations are woven. I would like to conclude this part by referring to Shotwell's (2016) reading of a story by Hiromi Kawakami in 2011, written after the earthquake, tsunami, and reactor meltdown in Fukushima. In "God Bless You, 2011," Kawakami describes the encounter between a human

and a *kami*, the god of uranium. Through the story, the author staged questions about intimacy, proximity, purity (who a person is who is a human person, bodily boundaries, about animal odours), and at that is added the "boundary-crossing, bodily entanglement of radiation exposure" (Shotwell 2016, 200). According to Kawakami, there was no intention in preaching against nuclear power, but to express the amazement linked to our daily lives, which can go uneventfully for so long until they are changed dramatically. While generating a self-inflicted "quiet anger" in the author, this feeling also allowed co-implication to be expressed with a simple question: "who built today's Japan if not me–and others like me?" (Kawakami 2012, 47-48). The reading offered by Shotwell, whose ethical and political response refuses the purity politics involved periods of crisis, and attempts to counter the way in which they are interpreted as signals of a "before and an after harm" (Shotwell 2016, 201), and Kawakami's story offer a possibility for responding adequately to events which hardly finds a response: "if we stand in the right kind of relationship we might help with some collective and contingent salvation" (Shotwell 2016, 201). Accordingly Harawayan's invite of *becoming*, there are no other ways of doing it if not together, even if that means recognizing our co-responsibility during "troubled" times.

2.4.7. *Symphony*

The conversation with the artist took place outside of studios, rooms, or ateliers. Being on holiday, the artist answered the video call from a hotel room, trying to get some space from the family that was accompanying him. Of all the interviewees, perhaps because of the particular time or his situation, the artist seemed to be the most hesitant. It seemed to me, in

talking to him, that he had a lot more to say but preferred to remain vaguer. The artwork represents a stylized violinist sitting on the drum while playing a very detailed violin. The violinist has a double meaning. In the first place, it is reminiscent of the figures by Marc Chagall, where the violin represents the means of meeting his God and the unfathomable mysteries of life and death. Here, however, the violinist and the violin suggest that "music and art, in general, are the only antidotes to the violence and inhumanity that surround us [...] the ecstasy of music against the evils of the world" (Art Spaces 2019, 76). During the interview, the artist shared his feelings and impression on the changes he was able to observe in the area, as he currently lives twenty kilometers away from the JRC; his comments align with those already raised in other interviews with artists who have lived or live in the Varese area. He explained, "I can tell you that I am 72 years old. I live twenty kilometres from the Research

Figure 8. Martinoli, Lorenzo. Symphony. 2017. Wrought-iron.

Centre. I have experienced its evolution over the years. Now the centre only does research and does not have an active reactor, but I know that they are storing the bins because in Italy they have not yet established a place to put them. So for its part, the CRN has built two solid sheds where they are collecting the bins with the waste inside reinforced concrete containers that are being stored on-site, waiting for a definitive location". The shared feeling is that a lot has changed and over time there has been a decrease in green areas to make way for buildings. "My guess is that the drums containing radioactive waste will remain there for many years – I don't know how many – before they find a permanent home". The concern shared by the artist is in line with the progress of the process of choosing a final repository in Italy, where the final site that will contain all radioactive waste has not yet been decided. For the time being, each nuclear plant is obliged to store within its perimeter the waste produced during the power generation or decommissioning phase. Finally, the artist also recalls the discussion already addressed on the difference between informal and formal knowledge, or technique, in stating that: "Over the years I have seen the leukemia rate increase in the area" or that "a lot of the information has not been clearly disclosed: this is not said explicitly, but there must have been some radioactive leakage". After talking about the area where he lives, the conversation turned to the exhibition and participation in it. The artist seemed most enthusiastic about the itinerant character of the exhibition, and told me that he had participated in the exhibitions in Venice and Genoa, but had not followed the exhibition abroad, informing me that the works are currently stored in some warehouse. In explaining the invitation he received, he recounted how he had been called by the Director, who suggested he participate: "We met at an exhibition in Varese. The director got me involved in this, and he seemed happy to have me as a collaborator". Recalling the openings, the artist informed me that "in each city the local or provincial press was present. There were local

journalists, but national newspapers never showed up, as they did not reach that level of notoriety".

A work reviewing the most recent information on waste arisings and waste disposal options in the world and the potential direct and indirect impact of waste management activities on health concluded that the overall assessment of the literature is that the evidence of adverse health outcomes for the general population living near waste facilities (landfills, incinerators, composting facilities and nuclear installations) is usually inconsistent and inconclusive (Giusti 2009). While advocating for new and improved monitoring techniques, and sufficient statistical power, the author argues for establishing well-designed epidemiological studies that can provide proof of the impact of exposure to low amounts of potentially harmful compounds (Giusti 2009). Moreover, direct human exposure data, particularly from exposure biomarkers, should be acquired as early as possible – and not just during and after the opening of a waste management facility (Giusti 2009). One element that cannot be ignored in epidemiological studies is the category they investigate since they mostly focus on exposure to ionizing radiation for nuclear industry workers. Despite what emerged, a second epidemiological study has concluded that "consistent with the low levels of exposure detected, and despite the fears of the local people, no incidence excesses of cancers were found in Ispra, the town closest to the JRC, or in the surrounding areas" (Pisani et al. 2009). However, in places where nuclear reactors, spent fuel storage facilities, and nuclear waste reprocessing facilities are operating or in the planning stages, the risk of excessive exposure to ionizing radiation is a very emotive subject. Fear is often combined with mistrust, the same as that communicated by the artist in stating: "What I fear are the ways they are going to organize the management of nuclear power in Italy, as there may be a lack of maintenance of the power plants". In particular, he seemed quite critical of Italy's approach to nuclear power. "I can see this as I also have experience with public bodies: you

get a lot of funding at the beginning and then no maintenance is done. Nuclear power must be handled with 'leaden feet' [very carefully]. You cannot think of building a plant and leaving it to its own". To this must be added the more general situation of fragility in which certain deposits find themselves, such as that demonstrated following the flood events in Saluggia in 2000. Saluggia (a small agricultural municipality 40 km from Turin) is home to 96% of Italy's radioactivity. It is part of the Vercelli province and is close to the Dora Baltea river, one of the main tributaries of the Po, bordered by irrigation canals that bring water to the Vercelli rice fields and crossed by the aquifer that feeds the Monferrato aqueduct. In this triangle of water, starting in the late 1950s, a nuclear research center an experimental reactor, and a reprocessing plant were built in which techniques to recover uranium and plutonium from irradiated fuel elements were developed – both in the civil and military spheres. Nowadays, the situation in Saluggia is addressed as a dangerous paradox (Gaglianone et al. 2014). In 2000, a flood of extreme magnitude caused the Dora Baltea to overflow and the Farini canal to burst its banks, eventually flooding the nuclear sites. On that occasion, the Nobel Prize winner for physics Carlo Rubbia, former president of ENEA - which managed the Saluggia plants - spoke of a "planetary catastrophe" that had been almost avoided: if some drums containing liquid high-level radioactive waste had been dragged by the flooding Dora river to the Po, the effects would have been devastating for the entire Po Valley (Gaglianone et al. 2014).

With this, the conversation shifted to other topics, bringing the focus back to the artwork. One element that certainly stands out is the presence of the violin, which was made in great detail. In addition to reconfirming the power of music as the only antidote against "the evils of the world," the artist associated the violin and the violinist with a particular image that did not emerge from the description of the work in the catalog. As he explained, "Music is therapeutic, so it is always involved. Music is part of everyday life - for each of us

in one way or another. music and the violin are a reference to the concentration camps when the violinist before entering plays one last time". After his explanation, I wondered if the artist was a musician, however, he answered that he did not practice any kind of music while placing in it such a high value. During the last century, nuclear imagery represented various narratives and psychological models in different pieces of literature. [17] For instance, Hiroshima witnesses link their memories of the nuclear attack to childhood fears of the end of the world, being alone or helpless, or disappearing. (Weart 1988, 107). The image of the nuclear holocaust was from its very beginnings associated with national and humanitarian tragedies, but the imaginative elaboration of such tragedies has shown both freedom and limitations in trying to capture the complexity of the atomic age (DiNitto 2021). Philosopher Jean-Luc Nancy theorized how global capitalism is threatening to homogenize catastrophes, making them all equivalent (2014), and while resisting this capitalist comparison between Auschwitz and Hiroshima or Hiroshima and Fukushima, the philosopher warns how "not all catastrophes are equivalent" (Nancy 2014, 3). Still, he focuses on the incommensurability of these events which lies in the threat of annihilation they posed to the human race (for Auschwitz and Hiroshima). On this subject, Nancy argues that these events "signify an annihilation of meaning" (Nancy 2014, 13) which destroys the ability to compare them. On a wider scope of analysis regarding Holocaust scholarship, Michael Rothberg's work could help in evaluating the viability of such comparisons. Rothberg re-narrated the history of Holocaust memory through comparative memory or "multidirectional memory" which was conceptualized in *Multidirectional Memory: Remembering the Holocaust in the Age of Decolonization* (2009) as "what happens when different histories of extreme violence confront each other in the public sphere" (Rothberg 2014). In *Multidirectional Memory*, Rothberg offers a framework based on three core arguments: memory works productively,

[17] For instance, in Margaret Atwood's novel *The Handmaid's Tale* nuclear holocaust and the resulting environmental toxicity have produced widespread infertility.

collective memories emerge dialogically, and the borders of memory and identity are jagged (2009). Firstly, Rothberg argues against the understanding of memories that marginalize other traumas: “too much emphasis on the Holocaust is said to marginalize other traumas or, inversely, adoption of Holocaust rhetoric to speak of those other traumas is said to relativize or even deny the Holocaust’s uniqueness” (Rothberg 2014). The author suggests memory-making as a process of negotiation, cross-referencing, and borrowing. Secondly, Rothberg argues how collective memories of seemingly distinct histories are not easily separable from each other, as they arise dialogically: Holocaust’s memory served “as a vehicle through which other histories of suffering have been articulated” and the emergence of it “was from the start inflected by histories of slavery, colonialism, and decolonization that at first glance might seem to have little to do with it” (Rothberg 2014). Indeed, Rothberg maintains that the memory of the Holocaust does not erase the memory of other events, but rather: “[t]he emergence of Holocaust memory on a global scale has contributed to the articulation of other histories” (Rothberg 2009, 9). Lastly, Routhberg's “multidirectional memory” casts doubt on the taken-for-granted link between collective memory and group identity. According to the author, “[g]roups do not simply articulate established positions but come into being through dialogical acts of remembrance that take place on a shared, but uneven terrain” (Rothberg 2014). In this sense, without offering guarantees, multidirectional memory creates possibilities for unexpected forms of solidarity. To conclude, as Rachel DiNitto argues, even if atomic metaphors “risk betraying the veracity of first-hand victim narration or distracting readers away from actual victim suffering, they are suited to expressing relationships that resist causal narratives because they do not fix meaning” (DiNitto 2021, 11).

2.4.8. *Otherworlds*

As he is living between New York and Varese, establishing an interview with the artist was quite difficult. However, I was able to schedule a video call with the artist while he was in Italy. He is the artistic director of the Missoni Archive, responsible for preserving the historical and artistic heritage of the Missoni brand, through innovative research and communication projects. The artist held his first solo exhibition in 2002 at the Arthur Roger Gallery in New Orleans. The conversation lasted less than the other interviews but I was glad to have gathered some very useful data for my research. The artist was very relaxed, and seemed to be thankful for the interest, and showed a certain ease in speaking. Inside the drum, raised off the ground by a wooden construction, it is possible to observe a photograph of some planets. The reference to space, space exploration, and distant worlds would not be an invitation to think of remote, inhospitable, and desolate places on our planet as potential waste dumps to be forgotten, but instead as enchanting, uncontaminated, glorious environments that make our global biosphere the extraordinary place that it is (Art Spaces 2019, 78). Interestingly enough, from the description available in the catalog, it is possible to deduce a line of reasoning not dissimilar to that presented before: there is a nature that is at the same time remote, inhospitable, desolate, and enchanting, uncontaminated, glorious. This pastoralist interpretation of nature sees the original form of landscape as untouched by human projects, which reveals itself as an unrealistic romanticization. When the interview focused on this point, the artist explained how the other planets, or the alien planets, are actually the Moon, “close to us, but representing other worlds; different, that might exist even if unknown, and that may harbor life even if we do not expect it: perhaps on those planets there are no human beings, but animals, insects, bacteria, and so no place, after all, can be considered inhospitable”. This reasoning, according to the artist, opens up the realization that what we do

not know or what does not belong to us can equally exist in its own dimension, in its own ecosystem. I asked more clarifications on the charm that the Moon has on him, and the artist explained how "I have been infatuated with the Moon since childhood, observing it through a telescope and collecting maps and books about it. Later on, What began as a personal fascination has morphed into my personal photographic exploration".

Besides this, *Otherworlds* calls for accountability for our actions toward future generations. As the artist argued, "we have to learn not to 'unload' our barrels of waste onto future generations by hiding them in faraway isolated places. Their management must not be a component of a dystopian future but must become an integral part of the active and responsible culture of the present day". Together with resonating with conclusions already drawn, such as Cécile Massart's Laboratories or the recognition of the central role played by culture in contemporary societies done by the nuclear cultural heritage project, the dystopian future recalls Tsing's theorization of "blasted landscape". In these types of landscapes, it is undeniable to recognise traces. An example of this is radioactive waste, a material that artists have had to deal with. Can they be interpreted as portals to new interpretations? Do they have potential, be it negative or positive? One of the answers coming from the artist was that "In its own right, bins are not a waste material... but obviously the thought turns to the waste material for which these bins are used. It is therefore the use to which they are put that is called into question... that of being filled with radioactive material for a disposal process that then turns out to be actually burying... putting out of sight a problem that will remain for a long time into the future... Seeing the complexity of such a disposal system, including the time, cost and technology involved, one realises that it is indeed a very serious problem to manage and one that is not easily solved in the future by continuing to produce energy from nuclear power". Ruins and ruined or blasted landscapes' epistemological potentialities have been explored by Anna Tsing in her volume *The Mushroom at the End of the World*, where

she argues that "[t]o know the world that progress has left to us, we must track shifting patches of ruination" (2015, 206). Also, in *Arts of Living on a Damaged Planet* is explained how according to ecologists usually the human reaction to landscape modification is forgetfulness: "as humans reshape the landscape, we forget what was there before. Ecologists call this forgetting the 'shifting baseline syndrome'. Our newly shaped and ruined landscapes become the new reality" (2017, 6). In the same book, the authors have argued that "every landscape is haunted by past ways of life". But this haunting does not just involve one interpretation of time, as they merge temporalities, showing us their unruly patterns. The authors comment on how we as a species are willing to destroy for pursuing progress. However, reading their words more closely, the authors do not invite us to embrace nostalgia towards older, lost, landscapes, or to desire purer landscapes. On the contrary, they argue for recognizing them as haunted and shared landscapes (Tsing et al. 2017).

Figure 9. Missoni, Luca. Otherworlds. 2017. Duraclear color photographic print, LED, steel barrels.

According to the artist, we have to continue to point out the negative effects on environments of our actions, behaviour, and habits "which in the long run lead to negative results on our quality of life". Like other artists who participated in the exhibition, the author of *Otherworlds* also commented on the solution of burying radioactive waste as insufficient, albeit stating that through the project "one is informed of the need to create such a system for the removal of radioactively contaminated waste. If anything, an attempt is made to make it visible as waste for disposal". Could adopt the posture suggested by the authors of *Arts of Living on a Damaged Planet*, namely recognizing ourselves as part of blasted landscapes, point towards possible solutions? Should we think about solutions at all? As environmental geographer Jamie Lorimer argued in *The Probiotic Planet: Using Life to Mange Life* (2020), where he focuses on the probiotic turn's reasoning while keeping in mind both its political implications and the possible advantages of probiotic methods, we have an "antibiotic ways of managing life" (Lorimer 2020, 3). We are always trying to manage and clean things up in a systematic and controlling way. This effort involves eradicating, controlling, rationalizing, and simplifying life, landscapes, cities, homes, and bodies (Lorimer 2020). But we are all implicated: there is no exclusion zone, and there is no division between what is "pure" and what is not. [18] Moreover, the desire for a "cure" has taken the form of an ideology within Western thought and culture. As author and activist Eli Clare writes in "Meditation on Natural Worlds, Disabled Bodies, and Politics of Cure," the concept of cure "rides on the back of normal and natural. Insidious and pervasive, it impacts many, many bodies" (Clare 2014, 206). He goes on juxtaposing ecological landscapes and bodily landscapes, arguing that the reasoning applied to landscapes, and how they should be cured back to the idealized, not ruined form of the past, could be applied even to damaged bodies, returning them to some former, and nondisabled, state of being (Clare 2014). In doing so, "we try to undo the harm,

[18] See Shotwell, Alexis. *Against Purity*, 2016.

wishing the harm had never happened" (Clare 2014, 207), and while the wish to restore an ecosystem is understandable, Clare reminds us that often the "return may be close but never complete" (Clare 2014, 207). To conclude, restoring ecosystems should aim to reshape the dynamic ecological interdependencies more than re-creating static landscapes (Clare 2014): the same reasoning, as Clare writes, is often applied to chronically ill and people with disabilities. Even if we want to move the problem elsewhere (to other planets) or to another time (rewinding time), the other offer to stay within the trouble could also be formulated in this way: "how do we make peace with the reshaped and damaged bodies themselves, cultivate love and respect for them?" (Clare 2014, 210).

Lastly, when the artist was asked whether or not it was feasible to consider nuclear power as a possible energy source, he replied as follows: "seeing the complexity of such a disposal system, between time, costs and technologies employed, one realizes that it is indeed a very serious problem to manage and in the future not easily solved by continuing to produce energy from nuclear power". Investments in nuclear could play an important role in accelerating the energy transition and decarbonizing the energy sector (Bersano et al 2020). However, there are two main criticalities: the management of nuclear waste and the public perception. Radioactive waste, as illustrated above, is stored at the production sites, while the wastes from the industrial, research and development, and medical sectors are stored in temporary facilities (Bersano et al 2020). For the time being, spent nuclear fuel was transferred to France and the UK for reprocessing, and it will return as vitrified waste by 2025 (Bersano et al 2020). To solve the problem, acceleration in the construction of the final repository and more effective communication on the benefits of using nuclear energy would be required. Regarding the second problem, which was raised by the artist's comment but also shared by the other interviewees, a possible solution could be investing in a communication campaign. As Bersano et al. points out, "few efforts were dedicated to the communication

with the people of the real risks and potentiality of nuclear energy" (Bersano et al 2020, 8). Therefore the Italian government should engage in a public energy informative campaign so as to illustrate the risks and potential, disadvantages and advantages.

2.4.9. *For ever and ever*

The interview with the artist was the last of the entire research. I remember with pleasure the conversation I had with the artist via telephone, who gave me some of her time despite her busy schedule. I wanted to start the interview by asking her a few questions about her life experience. Born in Milan, she started her artistic research at an early age. She told me about when she was a child and spent a lot of time looking through her parents' books at pictures of expressionist and cubist works: "it was when I saw *Guernica*, exhibited at the Palazzo Reale in Milan, that I knew, I decided, I understood, I was going to be a cubist artist". "For ever and ever" is divided into three different parts, and the declared message was to highlight the "evident contradictions of today's material and spiritual culture" (Art Spaces 2019, 106). The drum for toxic waste is protected, but also exhibited, inside a framework of burnt wooden planks salvaged from a demolition site; then there is a photograph that shows a row of trees, enclosed in a box of broken wood, "as a testimony to the concept of care, beauty, and then neglect" (Art Spaces 2019, 106). The third element is an abstract symbol, a spiral that expresses energy. Altogether, the three parts of the narrative are described as enriching for one another, taking on a more complex value. As with the other interviewees, I asked the artist what led her to decide to participate in the exhibition. She explained to me that she was invited through the director of the Nuova Galleria Morone, who often worked with the curator

of "Art Spaces": "at first it seemed strange, as a subject, and we considered together whether or not to accept the invitation. But then I accepted, because I always hope that from a given theme, some new creative, compositional formula will jump out, or that in the worst case scenario I will be able to adapt to the new theme the language born with that laborious but exhilarating work, which is the relationship between a thought, a concept, and the concreteness of the work of flesh and blood, born from my personal experience". During the interview, the artist referred mainly to the tension between life and death, and the conversation with the artist focused on burials, being beneath the ground, and disposal of radioactive waste as if we were talking about funerary practices. These two themes are intrinsically related to the issue addressed by the exhibition: how does radioactive waste link to narratives about life and death? As I wanted to better understand the steps of making the piece itself, I asked about the choices which led to the creation of the artwork. As the artist explained, "I cut it in half, in a vertical line, and that half I immersed in the whiteness of chalk, a material that refers to the white lime with which corpses were disinfected in mass graves; [the same half] is in turn imprisoned in a case built with planks from a demolition that has one last chance to be of any use: it delimits the field in which the action takes place. A drum designed to last for millennia is cracking, the protections put in place are falling apart, tombs coming to light". I found it very interesting to introduce another material, chalk, to make on the one hand visible what is hardly perceptible and, on the other hand, to create a symbolic bridge with meanings related to the theme of death. Indeed, when asked about waste, the artist used metaphors of this kind: "waste is protected in concrete casings, buried like a corpse that you never want to see again, but until then can you fill the subsoil with drums containing radioactive waste? Until when will it remain intact?"

Talking about dealing with radioactive waste and the aftermath of nuclear uses in a metaphorical way is now commonplace: storytelling allows one to approach problems in a

more imaginative way. While discussing with the artist, I imagined immersing myself in one of these narratives and it was not difficult to notice the use of a creative, imaginative language. As she described, talking about the methodology adopted to respond to the theme of the exhibition, “My language over the past decades seemed to exemplify such a scary subject as nuclear power, with all its pros and cons, the obvious need for energy, accompanied by the danger of generating monsters, and gradual annihilation”. In the frame of trauma and representation, literature works and Greek tragedies have arisen frequently recently as a means of working through traumatic political events (Ballengee and Kelman 2021), together with being reinterpreted eco-critically. One of the most common references is Sophocles' *Antigone*. [19] I would argue that interpreting the drums as coffins that will be buried underground, with radioactive waste as bodies occupying them, references to mass graves, to purification rituals (the use of white lime), echoes with Moira Fradinger’s acknowledgment that at the center of *Antigone* there is the urgency of material contamination and the threat to the living posed by the decomposing corpse, desecrated by politic (Fradinger 2010). References to Antigone are also present in some fragments from *The Chernobyl Herbarium: Fragments of an Exploded Consciousness*. The book is a collection of thirty fragments, meditations, and recollections, one for each year that has passed since the explosion that destroyed a portion of the Chernobyl nuclear power station in April 1986. Published in 2016, it is an open invitation to reflect upon the event of Chernobyl, described as “unthinkable and unrepresentable,” of the meaning of energy and its procurement, and to find new environmentally attuned ways of living. To do so, Michael Marder and Anaïs Tondeur use “plants as their guides” to transport us inside the Chernobyl disaster's “exploded awareness” by fusing philosophical reflections with radioactive plant specimen photograms, created

[19] As an abbreviation of the plot, Antigone defies the edict by Creon, her uncle, and the King of Thebes, that her brother Polynices cannot be buried as he is a traitor. Antigone gives Polynices a symbolic burial, for which she is punished by Creon by being buried alive in a cave, where in the end she hangs herself.

Figure 10. Squatriti, Fausta. For ever and ever. 2017. Multi-material work in wood, steel, plaster, watercolours, photography.

through the direct imprints of radioactive herbarium specimens, grown in the soil of "the exclusion zone" and arranged on photosensitive paper. In fragments twenty and twenty-three, there are references related to Antigone and humanity's fate. In fragment twenty the authors argue how contemporary humanity is at the same time Creon and Antigone. Humanity is the sovereign with no respect for ecological realities, is the one who buries alive the ones caring for them, and the suffering prisoner deprived of the elements and of everything that makes life possible. Together *with* radioactive waste, the authors claim, we are both inside and outside the Sarcophagus (Marder and Tondeur 2016, 50). [20] In fragment twenty-three, the authors describe radioactive decay as "indigestion of matter as well as that of the psyche" (Marder

[20] The Chernobyl Nuclear Power Plant sarcophagus or Shelter Structure is a containment structure built with metal-and-concrete, meant to prevent radioactive materials from seeping into the ground and being liberated into the atmosphere.

and Tondeur 2016, 56): it indicates stuckness, non-biodegradability, and material constipation. The "radioactive fire" they refer to does not destroy beings in a blazing instant, but it slowly annihilates them:

> This fate is, by the way, one that Creon inflicts on Antigone, who has no other choice but to take her own life in the cave, to which she is confined. The insidiousness of radioactive debris: its residual energy signifies counter-work, or anti-energy, insofar as those who have been touched by it are concerned (Marder and Tondeur 2016, 56).

The symbolic reading of radioactive waste and the points of contact with the story of Antigone also open up new interpretations of nuclear energy itself. As Simon Ryle argues, in fact, nuclear power becomes thus "the most desired gift, and the most abject pollutant" (Ryle 2018, 35). Also, reflecting on the Greek etymology Ryle points out how "nuclear radiation is our *pharmakon* and *pharmakos* in one substance, our sacred poison that we use and expel to keep desiring and consuming our desires" (Ryle 2018, 35). For instance, chemotherapy offers a suitably complex inroad to other encounters with the *pharmakon*, or poison that doubles as a cure (Stengers 2011). This ambivalent meaning cannot be even more relevant at a historical moment like ours, where the demand for energy consumption is continuing to increase. In this sense, associating the presence of radioactive waste and the complex process of its placement as well as the acceptance of it, can be done with the character of Antigone - who will find death inside a quarry - or with her brother, the character of Polynices, who will not find a burial except a symbolic one. While sharing her concerns about the future and the permanence of radioactive waste, she stated as follows: "Producing energy in addition to natural energy required the exhilarating intelligence of scientists, who were able to get to the heart of the planet's resources, risking no return. What has always fascinated and dismayed me is the eternity of the nuclear energy produced; it cannot be stopped, if I understand correctly".

Ideas are affirmed in space, and in turn, give rise to new mental patterns (Lefebvre 1991). Through the artist's words, one can see the implied spatial and psychological division we establish with the “graves,” or waste deposits that are to contain the “corpses,” or radioactive waste. In the dimension of “beneath,” there are the speculative images of vertical structures “above” the surface: to buildings and houses correspond sewage systems or bunker systems and to nuclear power plants' nuclear waste depositories. Beneath are structured like tentacles or rhizomes, hidden from the eyes of those who inhabit the surface. One of these structures is Onkalo, a monumental underground nuclear waste repository in Finland. To avoid chances of high-dose radiation being exposed to living organisms, the bunker has to be sealed for 100,000 years: what is contained in the bunker, and the bunker itself, will go beyond the scale of human time, losing itself in the toxic unconscious. The architecturally constructed cave, as Atsuhide Ito argues, is a “radioactive underground rhizome,” which “disqualifies the notion of an architectural monument as a triumphant technological achievement to manage height” (Ito 2016, 481). In Ito’s analysis of the cavernous space, the cave where Antigone chooses to commit suicide is described as a womb, hidden from the public and out of reach from authority and law. The cave is the place of crossing boundaries between life and death. At the same time, the cave takes on a different meaning. Philosopher Luce Irigaray, while analyzing Plato’s “Allegory of the Cave,” has pointed out how the cave as a metaphor generates various images (1985). The cave is both the uterus and the speculum, an inferior copy of reality for Plato but also a space where Antigone can act against the normative law adopting a subversive role.

Caves, waste repositories, bunkers, and burials at large have to undergo a process of beautification: mourning has to be domesticated. According to Armiero, the domestication of memories, plastically built, “goes hand in hand with the fabrication of toxic narratives” (Armiero 2021, 21). In the realm of Wasteocene, where histories reproduce the wasting

relationships that make some places and people disposable (cf. *Necropolitics*), it is essential to take into consideration another master's narrative. This narrative should center memories and subjectivities wasted out of history, and highlight how that master's narrative functions to justify that very exclusion. I'd argue that this claim resonates with Antonia Riguard's analysis of Robert Smithson Land Art creations in Australia, or "new monuments," which are subverting the classical notions of "monumentality as verticality" and that rather "monumentalize what is traditionally anti-monumental, or even non-material" (Riguard 2012). How we construct space influences and is influenced by how we control nature, how direction and meaning-making are inscribed upon the landscape, and what limits pertain to the use of nature (Riguard 2012). Here we have observed the space of "verticality" and "above" against that of "rhyzome" and "underground" or "beneath". How to make invisible dimensions into something perceptible? To this question, the artist explained how transformation lies in art. "Art is always a matter of making the invisible visible, and this happens independently of the subject. A basket of fruit painted by Cézanne, through the fruit intends to say something else, the subject is only a medium. The subject matters, but it is not everything, the same basket painted by another artist says something else. The discourse would go on and on, but I would like once again to distinguish between the value of the depiction, and its meaning. A painting by Matisse in which a lady is resting on a deckchair dressed in white, on a terrace that one imagines as facing the sea, and one deduces this from the type of blue that designates the space of the canvas as sky, tells us that the lady is well-to-do, that the dress is of a light fabric, that the woman's obsession is certainly not reading about philosophy... etc. It is there to speak of colour tones, of inlays. We can read in the geometric compositions of the 20th century, a problem of depicting society contemporary to the artist, contrast, war and peace, the disorder of war, or the order of a project, its balance. These are instances that can be expressed in form and colour".

As author Darren Jorgensen argues while focusing on Aboriginal land art, one of the commonly proposed solutions to signal and mark underground nuclear waste dumps are "giant monuments: massive concrete structures, surrounded by rings of monoliths inscribed with the signs of death" (Jorgensen 2009). More often than not these solutions have failed: remains of ancient civilizations have been dug up by professionals and not alike, and structures built to be difficult to get to or to avoid attention have been discovered, reached, and, most of the times, not understood by visitors. Not only does Jorgensen point out how "the human condition changes over the centuries so that what was recognizable is no longer so," but also the tight relationship between monuments and power. Monuments stand in the place of power, often "conceived by ruling classes who are anxious not to be forgotten, or at the very least to appease the gods that lie in wait for them after their death" (Jorgensen 2009). In conclusion, to achieve a signal design that will last for at least enough time continuous work is needed. This goal could be reached through the creation of Cécile Massart's Laboratories, or by bridging the gap between day-to-day life and nuclear presences, but also by moving from verticality to beneath, and likewise from the center to the margins. In this way, one could move from the "wasting relationships" described by Armiero, letting the subaltern, much like Antigone in Irigaray's reading, enter the nuclear discourses. To facilitate this rapprochement, as also advocated by the Nuclear cultral heritage project, artists and their work may be needed. I believe the words of the artist herself can help in this regard: "the role of the artist, it is immersive, like that of a judge, the centripetal force of creativity, it is a cry in the wilderness, but then it ends up influencing the beholder, and he understands, because art teaches".

2.5. Some final remarks

As Kate Brown concisely put it, “invisibility takes a lot of work” (Brown 2016, 45). “Art Spaces” has provided insights into why and how radioactivity is, and forever will be, a difficult entity to handle physically and perceptually. This chapter aimed to investigate the role of contemporary art in opening the public discussion on themes such as dealing with radioactivity, which at times it is invisible and impalpable, even though its effects are not. As it was shown, while radiation and radioactivity are abstract, radioactive substances are not (Sawaragi 2016) and they must find a definitive site: the issue of constructing repositories for radioactive waste has been the second most relevant theme in the entire investigation. Related to this are many of the artists' doubts, anxieties, and hopes, translated into their respective artworks: concerns are mainly about future generations, about the toxic and radioactive legacy, but also the present, with anxieties about the health of citizens and ecosystems in general. However, while recognizing their role as “mediators” as artists between the technical areas and the less specialized areas (the wider public), they have not communicated an awareness of having realized a project that could be ascribed to the formation of a nuclear cultural heritage. Through this thesis project, it was possible to investigate the themes of nature-culture division, contamination, and waste. Although the most agreed narrative interpreted “nature” and “humans” as distinct categories, it was possible to glimpse arguments in favour of relational identity, or a possible seamless immersion within toxic ecosystems. In addition, questioning contamination, its exceptionality and banality, has opened up the possibility of studying how this is determined. The limits imposed by thresholds do not always give an exact picture of the harm done to bodies or ecosystems. The reflection carried out on radioactive waste has opened up the possibility of thinking about the concept of waste more broadly. Whether it is unveiled or hidden, rejected or made an integral part of the

construction of society, waste is always interpreted and communicated by artists as a problem that must be placed at the center again: it cannot be put aside, it cannot be hidden, it must be tackled with seriousness and responsibility. Waste as a category has been the lens for reading spatial, geographical arrangements, and social hierarchies (Shotwell 2016; Mbembe 2019; Armiero 2021).

Making sense of these toxic and radioactive legacies turned out to be a complex task, as it is difficult to predict the future activities of humans and materials, whereby a highly imaginative process and constructing a future narrative is necessary. Accomplishing the right archiving method is essential to consider different fields at the same time: the structural forms of permanent markers, the establishment of public records and archives, and governments' regulations regarding land and resource use, together with other methods of preserving knowledge about the location, design, and contents of a disposal system (Joyce 2020). The result should be "imposing, impressive, yet unattractive" and "menacing" enough to transform a radioactive waste site marker into something more than a place, transforming it into a message (Joyce 2020) for future generations. Since the main objective of "Art Spaces" was not to transform artistic results into messages for the future, it is not possible to verify the fulfilment of this purpose. However, I think that the presented artworks have the potential to convey a message in this sense, and could become a starting point to reflect on the nuclear situation in Italy.

The thesis research's core was investigating the relationship between the invisible radioactive and the artists, together with discovering the modalities the observed group has adopted to live, work, and think with it (or despite it). To achieve this, I started the thesis with a chapter on the historical events surrounding nuclear energy in Italy. Structurally, as I have had direct experience, these environments are difficult to access. The nuclear industry forbids visual recordings of its sites, its workers, their operations: no photography nor videos would

be allowed by the company I contacted. This reveals serious concerns for safety but at the same time it obscures the nuclear economy from view. I would argue that the “invisibility” of radiation is a political project as well as an optical deficit. For this reason, starting from the political, socio-economic, historical, nuclear-related events in Italy was the essential starting point for recognising the traces of nuclear history in the country. Added to this was the in-depth study of the works of art that emerged from the "Art Spaces" exhibition: as traces to be interpreted, the works of art also reflected the relationship with the structural obstacles encountered in dealing with nuclear environments. In a way, they unveiled parts and mechanisms, putting the focus on certain issues. In their interpretation of the invisibility-art relationship, most artists agreed on the role that art has to transform something in reality, i.e. to make the invisible, visible. Harm and traumas generated from nuclear accidents, radioactive leaks and proximity to radioactive waste, are becoming more visible: their stories are shared, reinterpreted, and obtain new significance. The objectives of the artists were very different. As I could see from the attitudes, the tone of voice, the vocabulary used in their responses, the vision that was presented was heterogeneous. Each artist in responding to the call for performance brought with them their own experiences and opinions. Some were more open, others did not hide their scepticism, and still others refused to 'celebrate' nuclear power. I found particularly interesting the (hypothetical) lack of censorship by the JRC, which allowed these messages to be shared despite not fully aligning with the intentions of the exhibition.

To conclude, it could be fruitful to surpass the dichotomy between visibility and invisibility, not only to materialize and give form to what these presences leave behind, sometimes harm and scars, but also to look more closely at what has remained unseen. In this sense, I believe that Ele Carpenter’s reading on going beyond (in)visibility can help us obtain a new perspective on the issue (Rindzevičiūtė 2021):

> So the whole concept of nuclear culture today has been transformed beyond 'making the invisible visible' and beyond iconographic representation. Instead, we have a more plural, critical, embedded and reflective set of practices that seek to problematize and contradict, revealing not just the visual but the instrumentalization of the visual or the mathematics of data, or the thousands of years of storytelling needed to make sense of the uranium in the rocks under our feet.

Art practices could play a critical role in creating new discourses around nuclear presence and radioactive waste, one that is closer to social issues of nuclearity (Hecht 2010). Although the arts-based approaches might not be the definite solution, they have the potential to generate benefits for discussion, research, and developing diverse knowledge practices. However, to do so they have to be transformative and reach everyone. That is possible only when the excluded get to see themselves represented in languages that do not replicate oppression but are, instead, a bridge between experiences and imagination.

Conclusions

This thesis has been a valuable opportunity to move through and get to know different disciplines and their approaches. By striving for an intra- and cross-disciplinary approach, this dissertation's goal is to offer an example of how bridging distances between art, science, and anthropology is possible. Moreover, it aims to institute a valuable contribution to the field of nuclear humanities. Unlike life science approaches, which focus on isolated parts of the nuclear cycle, the social sciences and the humanities have the chance to engage with nuclear energy from a wider sociopolitical perspective. I would argue that the visual arts can supply a nuanced exploration of nuclear representation, site, scale, materiality, and inheritance. Focusing on the influences of the invisible presences in nuclear landscapes, which affect each body and life experiences very differently, has allowed me to investigate other hidden layers of our shared living: the creation and dissemination of knowledge, nuclear legacies for future generations, and economic cycles of creation and destruction. The thesis adopted an ethnographic research method, which was carried out together with a group of nine artists who took part in the "Art Spaces" exhibition. Through the testimonies that emerged from the interviews and data collected in a survey, it was possible to open up a space for discussion on issues related in a more or less visible way to nuclear decommissioning: contamination, security, power, and economic imbalances, and relations between science, technology, and art. I would argue that communication through artistic language has made it possible to approach topics that may seem difficult to decipher or to tackle them through alternative ways than those of technical-scientific language.

In the first chapter, I have introduced the nuclear landscape in Italy. To define what a nuclear landscape is, moving away from the perception of it as a simple surface, Donna

Haraway's (2003), Anna Tsing's (2014), and Doreen Massey's (2006) works have helped me interpret it as a naturalcultural zone of contact, as a blasted landscape which is the product of interlacement between time and space. For this reason, the first chapter focused on the historical, political, and social analysis of the nuclear era in Italy. In addition to being a fundamental starting point for understanding the dynamics that were developed in greater depth in the second chapter, the first chapter served the following purposes: to highlight the national and international relations that characterized the nuclear industry in Italy; to show how political groups, ideologies, and protests have led to the end of the nuclear era in Italy; and finally, to illustrate the nuclear decommissioning situation and the problems encountered in finding a definitive repository. While the discussion on the use of nuclear power as an energy source emerged a second time despite the 1987 and 2011 referendums, analyzing the events that defined the history of the nuclear industry in Italy allows us to understand the mistakes, failures, and what to avoid (or adopt) in future energy plans.

The second chapter was devoted to the discussion and analysis of the data collected during the ethnographic research. Firstly, I presented the Nuclear Cultural Heritage project, and then I discussed the intentions of the "Art Spaces" exhibition, together with the characteristics of the venue, its history, and the current state of the site (ISF). Secondly, data extracted from the interviews were crucial in order to better understand how contemporary art can open up a space for dialogue on topics that can be thorny, such as nuclear decommissioning and negotiating nuclear legacies. Each interview and artwork corresponded to a section of the chapter. Through the artworks, I have discovered methods of making radiation visible and how to relate to the radioactive material. They have sparked discussion on concepts of "pureness," contamination and pollution, on who decides where waste goes and how to take care of it properly, or what it means to inhabit a "sacrifice zone". Among the main relevant themes, there were: the dualism between nature and culture, the fuzziness of

nuclear “spacetimemattering,” and the results of nuclear slow violence or durational violence. More often than not contradictory relationships emerged, like the one formed with the nuclear presence, which can be both traumatic and a source of anxiety or hope. Lastly, deep geological repositories of radioactive waste were read also as burial sites: these spaces offered ways to think about vertical structures and rhizomatic labyrinths beneath, together with the relationship between monuments and power.

The intention of the thesis was to problematize the understanding of the landscapes of techno-science and question how to think about invisible contaminations through new languages, as well as to identify what happens when radioactive waste becomes part of our culture. However, it would have been interesting to extend the research to other areas as well. For example, investigating the perception of the communities living near the ISF would have made it possible to map the area in more precise and in-depth ways. In addition, dedicating space to Ispra site workers or, in general, getting in touch with those involved in decommissioning, would have meant opening a window of dialogue also with the labor force, technicians, and people specialized in the field, offering a second perspective.

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