doi: 10.25038/am.v0i25.458

Maria Pantsidou*
Department of Languages and Cultures, Lancaster University, UK

Jade J. Li**
Department of Engineering, Lancaster University, UK

Nuclear Soundscapes: Exploring Sound in Radioactive Environments

Abstract: Just after World War II, mounting evidence marked the dawn of the geological epoch dubbed the *Anthropocene*. Nuclear explosions deposited radioactive debris in the geological strata, combined with an acceleration in resource extraction, population growth and energy consumption. In this light, this paper aims to explore the affective dimensions of the multiplicities of sounds that are interconnected to nuclear materialities. We argue that mediations of nuclear sounds in these forms of audio instances render nuclear sounds comprehensible and challenge existing representations of nuclear power. This paper will bring into conversation an archive of soundscapes of the nuclear epoch – for example the sound of beeping in a nuclear power plant that produces electricity, the Geiger-Müller counters that civilians used following the Fukushima-Daichii plant explosion, and the music composition by JLiat of the sonic representation of atomic testing on Bikini Atoll in 1946.

Engaging with these sounds serves to make sense of the nuclear sublime and offer a possibility of connecting with the "otherness" of nuclear materials. These sonic instances also bind people in collective ecological experiences, whilst making us more attuned to voicing the modalities of a damaged planet. Sound can serve as an articulation of affects that emerge between human and non-human materialities in a damaged planet. These conceptualizations of sound are used to articulate the ways individuals or groups embody their relationships to ecological environments. Through an interdisciplinary lens, the paper aims to explore the mechanics of sound in nuclear infrastructures and devices to challenge common metaphors about nuclear energy. Through the analysis of these soundscapes, we demonstrate that exposing these entanglements between human and nuclear materialities can help us make sense of the sociocultural dimensions of living in a radioactive planet.

Keywords: affect theory; nuclear soundscapes; sonic representations; ecological degradation; radioactive terrains; nuclear music projects.

*Author contact information: m.pantsidou@lancaster.ac.uk
** Author contact information: j.li74@lancaster.ac.uk

Introduction

This article will engage with a sonic archive of different conceptualisations of nuclear power and explore the multi-scalar infrastructural modes that are mediated through sounds related to nuclear energy: its historicity, materialities and artistic configurations. The main aim is to examine what kind of affective power these entanglements hold within the framework of the contemporary environmental predicament we find ourselves in, i.e., climate change and ecological degradation. The article is theoretically indebted to affect theory, as well as theorisations of ecological critique of affect. We want to trace these soundscapes at the site of ecological degradation, and attempt to analyse the ways in which engaging with sonic instances of nuclear energy offers a way to problematise the centrality of the human experience as a way to critically examine and trace affective connections between human/non-human interconnections onto radioactive terrains. Nuclear energy has altered the geological composition of the earth, and has featured significantly as a mode of artistic enquiry within the postwar western canon in literature and film. Looking closely at sonic instances of nuclear energy can help to illuminate previously invisible or inaudible nuclear materialities and the way they interact with listeners living in a planet deposited among others with radioactive waste. We argue that examining these instances and the ways they become embodied or affective, prompts us to expand our knowledge and experience of the planet in a critical moment. These soundscapes provide "techniques for listening to the world empirically and imaginatively"[1] and can serve as a conceptual tool to make sense of the nuclear sublime and its intersection with the current climate crisis.

Archiving the Sonic: Music projects and nuclear energy

Nuclear narratives have been explored in scoring dramatised re-enactments of nuclear disasters. The HBO series *Chernobyl* is a televised retelling of the accident at the Chernobyl power plant in 1986. Regarded as mostly historically accurate,[2] an "eerie" soundtrack composed by the musician Hildur Guðnadóttir accompanies the scenes.[3] Guðnadóttir and her team took field recordings for the soundtrack at a decommissioned nuclear power station in Lithuania, in hazmat suits, to experience how "a catastrophe feels like and sounds"[4]. They recorded "atmospheres, rhythmic beats

[1] Jacob Smith, "Introduction," in "Esc: Sonic Adventure in the Anthropocene" (Ann Arbor: University of Michigan Press, 2019): 9.

[2] David Christian, "*Chernobyl*: re-creating a nuclear tragedy," *History Australia* 16, 4 (2019): 763–5.

[3] Shane Hurlbut, "What Makes Guðnadóttir's Chernobyl Soundtrack Better Than Her Golden Globe Winner?," *Hurlbut Academy*, January 6, 2020, https://www.hurlbutacademy.com/what-connects-joker-with-hbo-smash-hit-chernobyl/, acc. on March 26, 2021.

[4] Hildur Guðnadóttir, "Hildur Guðnadóttir needs an outlet for her darkness," interview by Robert Kraft and Kenny Holmes, *Score: The Podcast*, Epicleff Media, May 21, 2019, audio, 27:33, https://www.score-movie.com/single-post/2019/05/21/season-2-episode-6-hildur-gu%C3%B0nad%C3%B3ttir-needs-an-outlet-for-her-darkness, acc. on March 26, 2021.

and the sound of metal impacts bouncing around these huge spaces,"[5] taking away timbres at the plant to support the moods of the scenes.[6] By gathering environmental utterances at past dwellings for radiation, and by simply experiencing a site where radioactive elements were processed, much like the operations that transpired at Chernobyl, the emotions transmitted to viewers of the series are ultimately materialised through the soundtrack. Additionally, in portraying the accident at Chernobyl with a soundtrack eliciting particular affects, HBO's *Chernobyl* ultimately shows its viewers that inasmuch as Chernobyl itself was very much a globally felt disaster, global populations have consequently learned from the repercussions of carelessly managing nuclear power.

The sounds at disused nuclear infrastructures have allowed for conversions of environmental and sociocultural meaning regarding nuclear technologies. Whilst nuclear soundscapes are predominantly characterised by fear and uncertainty, some groups have reconstructed the narrative surrounding nuclear power by repurposing the spaces that previously enabled the function of nuclear-related activities. The Satsop Business Park in Washington is one example where deserted nuclear power sites have been adopted for new ventures. Originally, the buildings at this site were established for a nuclear power plant but was never completed, leaving only two large cooling towers, one incomplete, as a sign of sustainability.[7] The once-abandoned Satsop power plant is now a community-owned facility,[8] and provides acoustic architecture, with rooms within layers of concrete repurposed into an acoustic testing lab for various construction materials.[9] The cooling towers in particular have drawn much interest from sound artists, some of whom have used the towers as an instrument, seeking to capture the "reflective, skittering echo that literally cycles and circles up the walls"[10]. Thunderpussy's song *Torpedo Love* and audio elements of the online game *Guild Wars 2* were recorded at Satsop; both projects cultivating "eeriness" from the echoes arising from the unique structure of the cooling towers in order to generate particular

[5] Jennifer Walden, "Why 'Chernobyl' sounds so sublime, authentic – and haunting:," *A Sound Effect* (June 6, 2019), https://www.asoundeffect.com/chernobyl-hbo-sound/, acc. on March 26, 2021.

[6] David Puhl, "Our Perception of Scary Sounds: A Comparison of Films and Popular Music" (B.A. diss., California State University, Monterey Bay, 2020), 5–11.

[7] "About Us," Satsop Business Park, https://www.satsop.com/about-us.html, acc. on March 26, 2021.

[8] "Satsop Nuclear Power Plant – Elma, Washington," Atlas Obscura, https://www.atlasobscura.com/places/satsop-nuclear-power-plant, acc. on March 26, 2021.

[9] "NWAA Labs – Complete High-speed Speaker and Material Testing," NWAA Labs, Inc., http://www.nwaalabs.com/, acc. on March 26, 2021; Tom Banse, "Acoustic Lab Right At Home In Former Nuclear Reactor," *NPR*, December 16, 2010, https://www.npr.org/templates/story/story.php?storyId=132123281, acc. on March 26, 2021; John Dodge, "Sound lab developed in old Satsop reactor building," *The Seattle Times*, December 17, 2010, https://www.seattletimes.com/seattle-news/sound-lab-developed-in-old-satsop-reactor-building-01/, acc. on March 26, 2021.

[10] Gabriel Spitzer, "This Sound Artist Used His Ears To Explore The Tunnels Beneath Washington's Abandoned Nuclear Plant," *KNKX*, November 21, 2015, https://www.knkx.org/post/sound-artist-used-his-ears-explore-tunnels-beneath-washingtons-abandoned-nuclear-plant, acc. on March 26, 2021.

moods.[11] Arguably, it is the buildings themselves that present their voices here; with arias of the past written in the reverberations from the cooling towers. Humans have diachronically engaged with the material world through various media such as film and music and have been affected by the agentic properties of said materials, hence nuclear infrastructures can rewrite their own meanings and reframe their histories, providing an expression for the materiality and agency of radiation as a character in the ongoing story of society's connections with nuclear power.

Materialities of Affect: Sonic encounters with nuclear energy

Affect has been theorised in two dominant discourses. The first is rooted in psychology and neuroscience and the second is seen as an intensive force and follows the "affective turn" in the social sciences and humanities, with leading proponent the philosophy of Gilles Deleuze. In their introduction to *The Affect Theory Reader*, Melissa Gregg and Gregory J. Seingworth write:

> Affect […] is the name we give to those forces – visceral forces beneath, alongside, or generally other than conscious knowing, vital forces insisting beyond emotion – that serve to drive us toward movement, toward thought and extension, that can likewise suspend us (as if in neutral) across a barely registering accretion of force-relations, or that can even leave us overwhelmed by the world's apparent intractability.[12]

We find this iteration of affect particularly relevant to our argumentation as this force that denotes a dynamic movement between sonic instances of nuclear energy and a way to connect to the "otherness" of nuclear materials. British composer JLiat used the recordings of the second hydrogen bomb test in the Pacific island of Bikini Atoll which took place on 28 February 1954 and resulted in the worst radiological catastrophe in American history to create a 'noise work' called *Bravo*. The audio sequence of the piece bears no discernible familiar musical narrative, which makes listening to it an uncomfortable experience. The encounter with these nuclear materialities either in the form of infrastructural constructions like on Atoll, with its displacement and subsequent evacuation and suffering that the Rongelap populations endured, or in the form of the clicking noises of the Geiger-Müller (G-M) counter which was used by the citizens following the Fukushima-Daichii explosion, marks

[11] Jacob Webb, "Watch Thunderpussy Explore Romantic Fallout In 'Torpedo Love,'" *NPR*, February 8, 2018, https://www.npr.org/2018/02/02/582850810/watch-thunderpussy-explore-romantic-fallout-in-torpedo-love, acc. on March 26, 2021; Brenna Hillier, "Guild Wars 2 sound effects captured in nuclear plant," *VG247*, October 21, 2011, https://www.vg247.com/2011/10/21/guild-wars-2-sound-effects-captured-in-nuclear-plant/, acc. on March 26, 2021.

[12] Melissa Gregg and Gregory J. Seigworth, eds., *The Affect Theory Reader* (Durham and London: Duke University Press, 2010), 1.

an entanglement of the human and non-human entities that create affective schemas between human and material agencies. Nuclear energy has co-existed with humans for over a century now, and the process of nuclear fission is one where materials are brought together and split, heated, cooled, steamed, crackled and formed into reaction chains. These sequences contain sounds of the affective lives of nuclear materials and also the scientists who work in their mechanics.

Nuclear fission is the primary process utilised by a nuclear reactor for energy generation. Nuclear fission involves the splitting of a heavy nucleus into lighter nuclei, accompanied by a release of energy. In a reactor, this takes place in the fuel, which often contains an actinide – elements on the periodic table with atomic numbers 89 through to 103 – commonly uranium or thorium.[13] The fuel is arranged in rods, forming fuel assemblies which are then placed inside a reactor vessel. Reactor types can vary, in coolants (used for transferring heat away from the fuel) and in moderators (used to slow down fast neutrons responsible for activating fission). For a boiling water reactor (BWR), water is used as both the coolant and the moderator. As nuclear fission takes place in the fuel, thermal energy is given off from the reactions and boils the water. Boiling water transforms into steam, which turns a turbine that drives a generator, generating electricity. This precise choreograph of processes is the result of decades-long research into atomic power, proceeding through an ångströmic journey, carrying deep connections with the people who handle them and create intimacies with every aspect of nuclear materials and their sonic instances. Through nuclear soundscapes we can navigate spaces of radioactive deposits and contamination but at the same time encounter the mundane side of nuclear infrastructure as in the instances of the sonic configurations of a nuclear power plant that produces electricity, and contemplate its existence in our world, its categorically material presence. Walter S. Gershon writes about the entanglement of the human and the material world:

> Resonance is theoretically and materially consequential. Theoretically, if everything vibrates, then everything – literally every object (animate or inanimate), ecology ("natural" or "constructed"), feeling, idea, ideal, process, experience, event – has the potential to affect and be affected by another aspect of everything. It is the ability of one's self and/or not-self's affect (object/not object, ecology/not-ecology etc.) to effect in a multidirectional fashion.[14]

These soundscapes tell a story about co-existence in the planet and reveal or co-create affective narratives of the human and material worlds. A large part of the nuclear sublime is focused on the G-M radiation counter and the way it has been portrayed in music. Indeed, the clicks from G-M counters have often featured in various musical

[13] Rodney C. Ewing, "La gestion des actinides dans le cycle du combustible nucléaire: le rôle de la minéralogie," *Comptes Rendus Geoscience* 343 (2011): 219–29.

[14] Walter S. Gershon, "Vibrational Affect: Sound and Theory Practice in Qualitative Research," *Cultural Studies, Critical Methodologies* 13 (May 2013): 258.

projects. From giving "a voice to measurable radiation" on Ant Dickinson's *Music for Hacked Geiger Counters*[15] to the German band Kraftwerk's track *Geiger Counter* from their 1975 album "Radio-Activity" (*Radio-Aktivität*), the distinguishable clicks lend a sonically corporeal texture and weight to the construction of a human response to an imperceptible threat. Dickinson's work is part of the Power in the Land project, created to investigate the now-decommissioned Wylfa nuclear power plant in Wales. In the track, Dickinson "hacked" into the circuitry of the G-M counter; a "metaphor for the futility of trying to control something that can't be […].". Dickinson in particular states that other artists involved in the project "felt that the Geiger sound had a really powerful emotional impact ... It instantly gets you thinking about radiation and the dangers that you can't actually see". This extreme affect perceived by the artists due to the clicks from G-M counters heavily centres around the risk of radiation and arises from the human inability to sense radiation unaided by technologies. This cautiousness is also hauntingly echoed in Kraftwerk's album Radio-Activity, where lyrics sung in *Geiger Counter* ("Radioactivity/ Is in the air for you and me") allow listeners to envision their spatial connection with radioactivity, and reflect on the significance of living around, and within, radiation. Certainly, *Geiger Counter* invites the listener to conjure their own images of environments with high radiation levels, and "manipulates the fears surrounding radiation"[16] for a more personal reflection on interhuman connections with radiation, by virtue of the words "you" and "me". In fact, Grönholm argues that dystopian tones are present in other tracks from the album; the warning from Kraftwerk that "technology must be well-guarded in order to be able to serve mankind"[17] is a formidable lesson learned from previous nuclear tragedies. To artists like Dickinson and Kraftwerk, by contextually featuring the telltale clicking of G-M counters, they allude to the significance of radioactivity embedded in the geological strata of the planet. Here, music is used as a cultural mainstay to remind, but also to warn, of the dangers of devastating changes for future societies in nuclear power.

Furthermore, the inclusion of the clicks symbolises the artists wielding control over radiation, whilst simultaneously acknowledging its capacity to cause harm. Hence, the clicks may therefore signal wariness pertaining to the possibility of harm. These art projects turn momentarily away from the visual and concentrate on the frequently neglected acoustic dimension of nuclear energy and the ways we are connected to it. In her book *The Rhythmic Event: Art, Media and the Sonic* Eleni Ikoniadou contests that "this emerging audio culture echoes an attempt to resist the tyranny of ocularcentrism - the western prioritisation of vision for acquiring knowledge, experience and truth about the world."[18] JLiat's composition for example, is a work of

[15] "Music for Hacked Geiger Counters by Ant Dickinson," Art Gene, https://www.art-gene.co.uk/digital/music-hacked-geiger-counters-ant-dickinson/, acc. on March 26, 2021,

[16] Alexei Monroe, *Industrial Activity: Kraftwerk's Radio-Activity as dystopian sonic template* (Leeds, UK: University of Leeds, 2016).

[17] Pertti Grönholm, "When Tomorrow Began Yesterday: Kraftwerk's Nostalgia for the Past Futures," *Popular Music and Society* 38, 3 (2015): 372–88.

[18] Eleni Ikoniadou, Brian Massumi, Eric Manning, eds. *The Rhythmic Event: Art, Media and the Sonic.* (Cambridge, MA: The MIT Press, 2014), 2.

art that is fused with aesthetics that produce sensations in other bodies at the level of matter and energy.[19] In *Powering Britain*, a BBC documentary about the different forms of energy that fuel Britain, the episode on nuclear energy can be seen as a study on the sonic event, apart from its impressive visual imagery. In order to denote that everything is working well, there is a constant beeping sound which is divided into four beeps, the first two slightly slower than the last two. These sounds are designed to be recognised by everyone on the plant and their continuity marks a collective sonic instance between infrastructures of energy and the people that exert power but also are suspected to the agentic properties of this infrastructure. Through affect, the sounds of the nuclear power plant assert their presence, and call for new meanings to be created by merging human and non-human agents through time. In "Affect and embodied understanding in musical experience", Robert DeChaine asserts that "affect is thus the circuit through which the past and present, as well as imaginings of the future, become confluent. It enables the process of becoming, entangling our bodies, minds, memories, histories, thoughts, and feelings to the point where they can't be imagined apart from each other."[20] These soundscapes of nuclearity reconfigure alternative modalities and are worth our attention as they tend to the human non-human relationship that breaks away from the discourse of environmental degradation, in that they illuminate aspects of nuclear 'otherness' and create spaces for affective encounters with materialities of the nuclear. The clicking sounds in the nuclear power plant mark the deep interconnectedness shared with the employees, as they are keeping them safe, and calls attention to how enmeshed we are in the material world, and highlights the precariousness but also the pockets of hope that we can co-create, humans and non-humans, in a damaged planet. Attending closely to these soundscapes and the potential narratives of co-existence they reveal can be part of the growing body of theories about the disruption of human predominance in the ways we generate knowledge about environmental degradation. In "Material Ecocriticism", Serpil Opermann calls for the need to look at the assemblages formed ontologically between human and material hybridities and the narrative agency that they hold denoting social and power relations. She argues:

> When these narratives congeal in material forms, we have narrative agencies actively producing configurations of meaningful expressions that merge with our modes of knowing and being, making us, other species, and all material forms and processes, with varying degrees of compounding relationships, ontologically inseparable in the animate earth.[21]

[19] Brian L.Ott, "Affect in Critical Studies," *Oxford Encyclopaedia of Communications* (2017): 10.

[20] Robert DeChaine, "Affect and embodied understanding in musical experience," *Text and Performance Quarterly* 22, 2 (November 2010): 86.

[21] Serpil Opperman, "Material Ecocriticism," in *Gender/Nature*, ed. by Iris Van der Tuin (New York: Macmillan Press, 2016), 89.

This approach can open up different trajectories in the ways we view our relationship with the planet, and possibly offer a new iteration of our engagement with nuclear materials, which is an entity whose existence cannot be denied. Problematising the centrality of the human subject re-frames the underpinnings of the contemporary environmental narrative discourses as incomplete in tacking the climate change emergency.

Nuclear Disasters, Radioactivity, and Harm: The G-M counter telling the story one click at a time

In order to offer more evidence of this iteration, we would like to look at the G-M counter's significance in the aftermath of the Fukushima-Daiichi nuclear accident and the affective responses to a materiality that offered empowerment to citizens in the wake of a radioactively saturated catastrophe. Radiation narratives can temporally pervade using G-M counters as a sociocultural larynx. Harada explores the intertwining concepts of radiation as a non-human material with its intra-activities with society.[22] Here, Harada highlights the materiality of radiation in permanence using the example of the *Radium Girls 2011* CD by Project UNDARK. The focus of this music project was to commemorate the Radium Girls – women who worked in factories painting watch faces with radioluminescent radium and suffered from severe radiation sickness as a result of exposure. The CD was also an expression of the release of radiation from the Fukushima accident. The invisibility of the radiation is captured through the 'eeriness' of the electronic music, and G-M counter sounds enabled the Radium Girls "to have their voices [heard] about a century later". It is clear that the clicking of the counters not only represents the cruel longevity of radiation, but also the ability to pass on the stories of actors affected by radiation; a conversation through the ages.

In 2011, after a massive earthquake and a consequent tsunami struck Fukushima, Japan, a series of explosions took place in the Fukushima Daiichi power plant. As radiation exposure started to spread all around Japan and the entire world began to focus attention on the events, the Japanese government tried to contain information coming out by releasing a series of pictures and media that infantilised the issue and making it seem less serious than it actually was. In response to the way the state and TEPCO, the company that owned the nuclear reactors, handled the situation, a growing number of the public took matters in their own hands by buying G-M counters to measure radiation themselves. When these sold out, citizens started collaborating with scientists to make their own counters to measure radiation[23] Kath Weston calls this entanglement with materialities bio-intimacy. She argues: "Where bio-intimacy prevails, bodies and ecologies do not so much inter-act as co-constitute. Care for one is never separate from care of the other. Treating the body as something to be protected from an environment imagined as 'out there' and potentially hostile makes no sense."[24]

[22] Kazue Harada, "Visible Matters; Radiation in Kobayashi Erika's Multimedia Project in Post-Fukushima Japan," *Japanese Studies* (2020): 1–21.

[23] Kath Weston, *Animate Planet: Making Visceral Sense of Living in High-Tech Ecologically Damaged World* (Durham and London: Duke University Press, 2017), 70-81.

[24] Ibid., 79.

In the aftermath of the accident, the authorities introduced a set of tools to mitigate radiation such as hazmat suits, radiation counters, iodine tablets, segregation and quarantine to those areas affected by high readings. These measures were designed to increase trust in the state that the situation was being handled efficiently, but the contradicting news reports and seemingly unsubstantiated data created a diffused sense of anxiety and fear among citizens. Uncertainty grew, and people started demanding the 'truth', to counteract what was seen as mismanagement of information about radiation safety. So, when citizens started buying or making radiation counters, they became both generators[25] but also mediators of knowledge about radioactivity and levels of harm. The clicking sounds of the radiation counter bound together in affective resonance the bodies holding the object and the sound rendered the inaudibility of the danger tangible almost, in a moment where nuclear materialities and human corporealities existed together within a highly toxic terrain. What's more, as Roelvink and Zolkos argue in "Climate Change as Experience of Affect", "In contrast to the cross-fertilizing affects of fear and optimism, sorrow makes it possible for hope to arise from within the recognition and daily lived experiences of environmental degradation, rather than in its opposition and avoidance."[26] Home-made G-M counters gave to citizens a sense of control over their bodies and the environment and created an open access database where people could share their findings and exchange material testimonies in the form of videos of radiation exposure. Societies and radiation have been tightly bound through epochs such that G-M counters have been used to inform further narratives. Phillips Stearns' 2014 piece *A Chandelier For One of Many Possible Ends* is a "cosmic wind chime"[27]. This installation is made up of G-M counters and LEDs, and due to low level radiation from objects, buildings, and a remnant from the Big Bang – cosmic microwave background radiation, loud clicks and frequent flashes are emitted when the counters detect this radiation. Of this work, Stearns states that it "subtly engages the memory of nuclear catastrophe", citing the Fukushima accident, "while maintaining a contemplative environment"[28]. As the work is housed in a mostly closed space, the loud clicks in particular could evoke a deep emotional understanding from a close confrontation with the radiation itself. The notions of 'hope' and 'impacts of humankind' are the foci of this piece; amongst a land tainted with radiation, there are lessons and knowledge for future societies who must deal with radiation from nuclear accidents or weapons. Perhaps, it is reasonable to view G-M counters as storytellers of the ubiquity of radiation through a material precognition.

The mundane aspects of nuclear sounds in power plants, together with the urgency they denote following a nuclear disaster, as with the citizen scientists of

[25] Ibid., 74–75.

[26] Gerda Roelvink and Magdalena Zolkos, "Climate Change as Experience of Affect," *Angelaki* 16, 4 (January 2012): 53.

[27] Beckett Mufson, "The Geiger Counter Chandelier Is a Dark Data Visualizer," *Vice*, March 10, 2015, https://www.vice.com/en/article/8qv8qp/the-geiger-counter-chandelier-is-a-dark-data-visualizer, acc. on March 26, 2021.

[28] Phillip D. Stearns, "A Chandelier For One of Many Possible Ends," https://phillipstearns.com/chandelier/2015/1/24/a-chandelierfor-one-of-many-possible-ends, acc. on March 26, 2021.

Fukushima, call for a new trajectory to view our co-existent lives on this planet, as there seems to be no way out of this situation. We do not argue this from a pessimistic point of view. On the contrary, what these soundscapes offer us, if we are willing to hear, is that these spaces can function as zones of contact between humans and large structures like nuclear energy sites, where heterogenous forces come into play and mediate global issues, like the effects of nuclear energy, to the personal and social affects that emerge from this intersection. Kath Weston argues about the ways we form bio-intimacies as "real entities contain time and space, exhibiting nonlocal effects and other interobjective phenomena, writing us into their histories."[29] It is precisely at this level of interweaving histories that fold onto one another that create affective ripples that can have transformative effects on the ways we view living together in the material world and suggest knowledge pluralities that are mediated through sonic instances that are sometimes overridden by visuality.

Final Considerations

Music has clearly been used for a sonic postmortem of history, leading to a richer sociocultural nuclear afterlife, in which communities have dissected their learnings from past accidents at nuclear power plants and around radiation in their environments. In the framework of tackling climate change, industries have sought to advance past humanity's overdependence on fossil fuels. Although nuclear power has proved itself to be a reliable source of energy generation amongst alternatives such as wind power and solar technologies, the materials used and produced in nuclear energy come with a risk, and ultimately, a societal cost. Accidents have occurred, and although unlikely, possibly will occur again, and there are ongoing efforts to combat nuclear proliferation. As a global community, the responsibility lies on the cooperation of societies worldwide to ensure future generations will be able to understand their relationships with nuclear power, as many have done previously. By exploring nuclear soundscapes, the meanings in the materials and histories of nuclear power are uncovered in order to make important reflections and progress as a society on a damaged planet. Severe consequences await if the lessons learned from nuclear history are not heeded. To draw upon the words of T. S. Eliot, if the control of nuclear is somehow lost on the planet during its irreversible death, the world, and society, will end, not with a bang, but with a whimper, and unequivocally, a stream of G-M counter clicks. Opening up the space where listening can become a way of asking questions and critique the present ecological moment can lead to new configurations and potentially about living on an increasingly damaged planet.

[29] Kath Weston, *Animate Planet: Making Visceral Sense of Living in High-Tech Ecologically Damaged World* (Durham and London: Duke University Press, 2017), 44.

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Article received: April 15, 2021
Article accepted: June 21, 2021
Original scholarly paper