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The Phenomenon of Waste-World-Making

Myra J. Hird

Abstract

Contemporary critical theory contemplates the potential openings created in a world composed of nonlinear heterogeneous assemblages. What if, in all of its connectivity, most assemblages remain unknown to us, are devoid of human presence, and are indifferent to human intention? Karen Barad's research offers timely provocations that push this world of assemblages beyond human exceptionalism. This paper considers constitutive inhuman inclusions through the phenomenon of waste. If the concern with the Anthropocene is that it characterizes humans' de-stratification of billions-year-old fossil fuel and other material layerings from the earth's strata, then landfills and nuclear waste repositories articulate a concern in the opposite direction, with a kind of earthly re-stratification or re-layering. A landfill's contaminating lifespan is estimated at hundreds to thousands of years, and nuclear radiotoxicity endures for upwards of 100,000 years, or 3,000 generations, making the consequences of this re-stratification indeterminate. This in turn draws our attention to the *imprescriptibility* of our ethical responsibility to future human and environmental sustainability. Adjoining Barad's central concern to articulate a theory of ethics, this paper acknowledges indeterminacy itself as the difficult ground of a social obligation toward the future, as it explores an ethics of indeterminacy in waste-world-making.

Introduction

[1] Karen Barad's agential realism offers a rich theory concerned with phenomena's relationality, and is inspiring new ways of engaging in philosophical discussions about longstanding concerns with ontology and epistemology, naturalism, realism, constructivism, and with more recent calls for interdisciplinary modes of theoretical and empirical engagement.^[1] In this short intervention, I want to outline how my research puts Barad's theory to work empirically. My research is situated within feminist science studies, and contributes to concerns with problematizing the nature/culture distinction, paying attention to inhuman phenomena, and foregrounding social justice concerns. Beyond my appreciation for the painstaking care, reflexivity, and nuance of Barad's writing, what I find significant about agential realism is not only its refusal to separate ontology from epistemology and nature from culture, but also the challenge of producing empirical studies (the brittle star is my favorite example) from an agential realist perspective. Of the many possible avenues to explore, in what follows, I highlight Barad's writings on constitutive inclusions, responsibility, and ethics in a consideration of landfill and nuclear waste. If

phenomena (humans, strontium 91, landfills, recycling, non-renewable fossil fuels, anaerobic bacteria) are always already relational and marked as different/distinct through ongoing processes of "cutting together-apart," what might this add, challenge, or otherwise provoke in discussions about the politics and ethics of waste?

The Constitutive Inclusions of Waste as Phenomenon

[2] Despite its ubiquity, "waste exist[s] in the twilight zone where no clear, 'natural' definition of [it] can be given, within wide margins of uncertainty and variation" (Wynne 1). From an inhuman deep time perspective, the earth is "one big waste world" fuelling the world's organic and inorganic metabolism (Volk 31). Animals, for instance, breathe oxygen as a waste product of trees and bacteria. The earth's soil and water consists in large degrees of the built-up waste products of living and nonliving matter. As such, waste is materially world-making, connecting geosphere, biosphere (the mass of once living organisms that have returned to base matter is estimated at somewhere between 1,000–10,000 times the mass of the Earth itself (Davis, "Cosmic Dancers" 73)), and stratosphere (beyond the various gases and solid particles expelled as waste from organic and inorganic matter, myriad space junk orbits the earth).

[3] From a human perspective, anything and everything can become waste, and things can simultaneously be and not be waste, depending on the perceiver and context. For example, municipalities define and regulate waste as everything removed to a landfill, incinerator or energy-from-waste facility that is not diverted, while industries define waste as the failure to utilize the contents of a landfill for profit. Postcolonial, feminist, and political theories focus on the global context of our 'planet of slums' (Davis *Planet of Slums*), where millions of people who increasingly live on 'wasteland' and scrounge a bare life by picking through dumps are often considered to live wasted lives (Bauman). Mary Douglas's cultural theory conceptualizes waste as that which allows purity (community, good) to be distinguished from danger (outsiders, bad, unclean) (Douglas; Douglas and Wildavsky). As such, nothing is in its essence waste, and everything is potentially waste. And if *nothing* and *everything* is waste, then it is conceptually vacuous.

[4] Distinct, overlapping, contradictory, and variously concurrent conceptualizations suggest that waste isn't a 'thing' or even a distributed set of things: waste requires material-discursive constructions that create, bring to the fore, and sustain particular relations and deaden, obfuscate, and otherwise limit other relations. Barad refers to our "thingification" of relations, which requires things to have at least partial autonomy that precedes their relating to each other ("Posthumanist Performativity" 812). This attention to things obscures the primacy of phenomena as "dynamic topological reconfigurings/entanglements/relationalities/(re)articulations" ("Posthumanist Performativity" 818). I am particularly drawn to this provocation for two reasons. First of all, when waste is considered a thing it appears to be rather static, like the garbage dumped in landfills or the plutonium buried in nuclear repositories, as though materiality is just waiting there, passively, not doing much. But waste, my research suggests, is anything but static and submissive: waste flows and mobilizes relations (Gille; Hird "Waste," "Knowing Waste"; Hird et al.). The unfathomably diverse and multitudinous bacteria that

metabolize landfills, and the half-lives of iodine, strontium-90, plutonium, and other nuclear materials suggest just the kind of (re)configurings, entanglements, and relationalities that Barad's theory details.

[5] Secondly, agential realism's focus on phenomena rather than things requires careful attention to the myriad "material-discursive practices" through which these phenomena are constituted, rearranged, abandoned, and reconstituted (Barad, "Posthumanist Performativity" 818). So waste is not a pre-given thing that awaits analysis and critique (as well as sorting, reclaiming, and disposing). Waste only becomes a phenomenon through various agential cuts, or "cutting together-apart" ("On Touching" 14). The research team of which I am part—consisting of a social scientist, an engineer, and a humanities scholar—is concerned with identifying these myriad cuttings together-apart. These cuts require various apparatuses and practices such as mass production and consumption, anaerobic digestion, global transportation and communication, statistical modeling, organismal differentiation, cheap mechanized labor, heavy water, cultural analysis, nonrenewable fossil fuels, and so on. Put another way, I am interested in the various material-discursive "apparatuses" that "(re)configure" (Barad, "Posthumanist Performativity" 816) and literally make and re-make the world's waste.

[6] What particularly intrigues me about these ongoing (re)configurings is their *indeterminacy*: "how strange," writes Barad, "that indeterminacy, in its infinite openness, is the *condition for the possibility* of all structures in their dynamically reconfiguring in/stabilities" (Barad, "Measure of Nothingness" 16). Astrid Schrader describes traces articulated when the indeterminate is rendered determinate (i.e. made into a phenomenon) through measuring. These traces "require *work that involves material determinations*" (Schrader 43, my emphasis). The work various material-discursive apparatuses engage in is to determine phenomena. It takes work to know something, or as Fleck notes, "to recognize a certain relation, many another relation must be misunderstood, denied, or overlooked" (30). This is a limitless process; so long as there are phenomena (including the ghostly virtual matter described in quantum field theory), there must be indeterminacy rendered determinate:

Matter is never a settled matter. It is always already radically open. Closure can't be secured when the conditions of im/possibilities and lived indeterminacies are integral, not supplementary, to what matter is. (Barad, "Measure of Nothingness" 16)

[7] Moreover, humans are not determining the world at a distance: all phenomena, human or otherwise, are of the world, as Barad argues ("Posthumanist Performativity"). Environmental studies professors, engineers, artists, waste management industries, members of the public, waste management regulators: all contribute to making waste knowable and determinate, to making waste a phenomenon. Humans are, however, not the only ones measuring and determining phenomena. Agential realism argues that world-making is not effected through human measuring/knowning alone; myriad unfathomable inhuman phenomena—quarks, photons, and those not/there virtualities within the quantum field and so on—all measure. These inhuman measurements render the world determinate as much, if not more, than human measurements. "The world," Barad reminds us, "theorizes as well as experiments with itself" ("On Touching" 2). Turning human exceptionalism on its head, Barad argues that "[i]f we thought the serious challenge, the really hard work, was taking account of *constitutive exclusions*, perhaps this awakening to the infinity of *constitutive inclusions*, the in/determinacy that manifests as virtuality calls us to a new

sensibility" ("On Touching" 13; see also "Erasers and Erasures"; Rouse).

Indeterminacy's Constitutive Inclusions

[8] Within engineering and science, determining waste is a highly complex process, and the constitutive inclusions are extensive. Certainly, landfills, nuclear repositories, incinerators, and other management techniques have become more technically sophisticated as engineers and scientists develop better liners, gradient specifications, barriers, and so on (which doesn't mean these techniques are always or most often adopted). This 'so on' is wide-ranging: for instance, modern landfills are lined with a complex layering of rocks, clay, sand, and geo-textile membranes and/or liners, and are physically structured in waste cell layers, which are placed on top of each other to form a number of waste columns (Yildiz and Rowe). Estimating landfill settlement depends upon, amongst other things, the "type of waste, moisture content, compaction density, porosity, compressibility, biodegradation rate (level of nutrients available for biological activities, presence of enzymes, sludge addition, pH, temperature), and mode of landfill operation" (Elabroudy et al.).

[9] Besides these complexities, engineers and scientists must determine a landfill's integrity expecting that it will contain certain objects—diapers, metals, plastics, Styrofoam, wood, liquids, refrigerators, pet shit and litter (as well as the dead pets themselves), batteries, food, chairs, fabrics, and so on—and the rather less expected, such as products of common industrial processes like coal fly ash, of which over fifty percent ends up landfilled (Chertow). More than 308 million tons of plastics are consumed worldwide each year, most of which still end up landfilled (PlasticsEurope). In addition, over ninety-seven percent of food waste is landfilled in the United States (Levis et al.). Landfills also mix waste designated hazardous with that defined as non-hazardous, including over seven million known chemicals, 80,000 of which are in commercial circulation (and with a further 1,000 new chemicals entering into commercial use each year) (Wynne 48). Add to this the approximately 14,000 food additives and contaminants added to landfills when we waste food. The engineering and science of waste disposal, in other words, must contend with a vast heterogeneous mix of known, unknown, and unknowable phenomena.

[10] Moreover, landfills assemble billions of heterogeneous bacteria whose "variations may be cyclical, directional, stochastic, or chaotic" (Collins, Micheli, and Hartt). Aerobic bacteria metabolize a landfill's early life, which produces material that is highly acidic and toxic to surface water. Anaerobic bacteria do the bulk of the metabolizing work deeper in the landfill's strata, producing leachate. Leachate is a heterogeneous mix of heavy metals, endocrine disrupting chemicals, phthalates, herbicides, pesticides, and various gases including methane, carbon dioxide, carbon monoxide, hydrogen, oxygen, nitrogen, and hydrogen sulfide. Factors affecting leachate production rate and composition include the:

characteristics of the waste (initial composition, particle size, density and so on), the interaction between the percolating landfill moisture and the waste, the hydrology and climate of the site, the landfill design and the operational variables, microbial processes taking place during the stabilization of the waste, and the stage of the landfill stabilization. Most of these factors change during the operational period of the landfill as the landfill is developed causing significant changes in leachate quality and quantity. (Yildiz and Rowe 78)

[11] Leachate travels vertically and horizontally within landfills, and continues to travel when it leaks beyond landfill cells, and sometimes through geological strata. That is, leachate may percolate into soil and groundwater (the engineers' job is to prevent this to the largest degree possible), where it moves into and through plants, trees, animals, fungi, insects, and the atmosphere. Via leachate, bacteria create well-known, little-known, and new biological forms. Elsewhere I have described bacteria's complex and ubiquitous relationality (see Hird, *Origins of Sociable Life*) within and between bacterial 'kinds' (bacteria are not, biologically speaking 'species'), as well as with all other forms of life (and indeed, nonlife). Leachate defines a particular 'cutting together-apart' that produces known as well as unknowable biological forms (as the latter transform quickly into new forms).

[12] Engineers and scientists are fully cognizant that they are building conceptual and statistical models of the movement of moisture, bacterial metabolism, soil integrity, and so on, and then testing these models empirically in controlled experiments. To take just one example, conceptual models constructed to test landfill quality assume each layer is a completely mixed reactor with uniformly distributed waste, moisture, gases, and bacteria—but this is not actually the case, with cells containing decomposed material of varying degrees (Yildiz and Rowe). Engineers and scientists, in other words, know they are creating conceptual models that are not reality itself in order to derive determinate matters of fact. Describing the principle of *renormalisation* in physics, Barad writes, "If it turns out to be possible to get finite results by subtracting infinities via a process that cuts out the domain of unknown physics, then the theory is said to be renormalisable. The cut-off method of renormalisation is a mathematical way of bracketing out what you don't know" (Barad, "On Touching" 11). This is what the engineering and science of waste management does: it makes certain facts about landfills, bioreactors, and the like known through a process of bracketing out or minusing, indeterminacy; not just what is as-yet unknown, but what is unknowable (including what engineers and scientists don't know to include). This is necessary to the acquisition of knowledge. And as Barad argues ("Measure of Nothingness"), it explicitly builds ignorance into theory. Whilst new bacterial forms developed within the leachate medium may not constitute 'unknown infinities,' their trajectories are not only largely unknown, but unknowable.

[13] Engineers and scientists are well aware of indeterminacy in, for example, their attention to issues such as 'contaminants of emerging concern,' which include chemicals such as bisphenol-A (BPA) that have been used in many plastic products and are believed to mimic human estrogen at low concentrations (LaPensee et al.; Takai et al.), polybrominated diphenyl ether (BPDE) which is an additive flame retardant in plastics, foams, and fabrics that may cause liver, thyroid, and neurodevelopmental toxicity (US EPA), as well as new materials such as nanoparticles which were not part of the waste stream at the time many landfill regulations (e.g. US Subtitle D) were developed (Islam and Rowe; Rowe; LaPensee et al.; Takai et al.). Issues such as contaminants of emerging concern are not only 'known knowns' (the things we know we know), 'known unknowns' (the things we know we don't know), or 'unknown unknowns' (the things we don't know we don't know) (Rumsfeld): the words 'contaminants,' 'emerging,' and 'concern' are themselves agential cuts.

[14] Just as engineers and scientists endeavor to determine landfill containment, so too do societies

create the phenomenon of waste through connected forms of material-discursive agential cuts such as practices of household waste sorting, curb side pick-up, recycling, legislation, surveillance, public education, health discourse, nation-building rhetoric, and so on. My research is centrally concerned with tracing these intra-active cuts that produce waste as diverse phenomena. This tracing brings me to government archives, landfill test sites, community group meetings, biochemistry laboratories, waste management corporation websites and offices, garbage dumps, political rallies, engineering text books, dumpsters, recycling centers, street curbs, and composting sites.

Responsibility's Imprescriptibility

[15] If a concern with the Anthropocene is that it characterizes humans' de-stratification of billion-year-old fossil fuel and other material layerings from the earth's strata, then landfills and nuclear waste repositories articulate a concern in the opposite direction, with a kind of earthly re-stratification or re-layering (Clark and Hird). A landfill's contaminating lifespan is estimated at hundreds to thousands of years, and nuclear contamination endures for upwards of 100,000 years, or 3,000 generations, making the consequences of this re-stratification indeterminable.

[16] Referring to an event's unexpected or unanticipated supplement or remainder, Joseph Masco suggests, fallout has "become a new planetary strata" ("Planetary Optics" 14). Landfills, nuclear power plants, and repositories may be understood as "massive generating practices" that "link human actors, technological capabilities, atmospheres, and ecologies in new configurations of contamination" subject to remainder ("Planetary Optics" 2). Waste fallout is politically coded as a 'side-effect' or 'residual risks' (Beck, *Ecological Politics*), which exacts an important agential cut in determining these forms of energy generation and waste management practices as safe—Ulrich Beck puts it more categorically as "organized irresponsibility" (*Ecological Politics* 61). As such, landfill disasters (leachate leakage, landfill fires, explosions, and sliding) and nuclear accidents are typically discussed in terms of discrete and localized events that affect a specific region, with identifiable actors that allows for evaluation of harm, wrongdoing, responsibility, and appropriate remediation; the containment, in other words, of risk (see Beck). But landfill and nuclear fallout exceed these local demarcations. Referring to the proliferation of industry-produced endocrine disruptors, Nancy Langston draws our attention to the confluence of soma and techne: "our bodies are how we're most natural, but now they're also how we're most industrialized" (130-31). Makhijani and Schwartz furnish a list of people whose health is identified as being at risk from U.S. nuclear production:

(1) Workers in uranium mines and mills and in nuclear weapons design, production and testing facilities; (2) armed-forces personnel who participated in atmospheric weapons testing; (3) people living near nuclear weapons sites; (4) human experiment subjects; (5) armed forces personnel and other workers who were exposed during the deployment, transportation and other handling and maintenance of weapons within the Department of Defense; (6) residents of Hiroshima and Nagasaki in August 1945; and (7) *the world inhabitants for centuries to come*. (396, my emphasis)

[17] *The world inhabitants for centuries to come*. In other words, all of us. "Exposure is now a general condition—a question of degree rather than kind," writes Masco ("Mutant Ecologies" 531; see also

Grajeda). This is not, of course, to equate my exposure to nuclear fallout to that of people living near Los Alamos, or the relative health effects of my living in an urban Canadian city with that of the peoples of Love Canal or Kibera.^[21] As Masco succinctly puts it, global landfilling and "[n]uclear security [have] required complex new forms of internal cannibalism" as humans and local ecologies are differentially sacrificed ("Mutant Ecologies" 530). Waste is a global phenomenon whose prescriptability is limited:

we've been feverishly terraforming planet earth for generations. This means we are living in the unintended aftermath of cumulative industrial projects—remaking bodies and the atmosphere on a planetary scale. (Masco, "Planetary Optics" 19)

[18] Recalling Barad's provocation that the world experiments with itself, we have little idea what the multitudes of bacteria that metabolize landfills will make of its ingredients, of themselves as they proliferate and differentiate into new forms, or of the geosphere and biosphere (Clark and Hird). Likewise, our lack of knowledge of the effects of nuclear fallout and low-level radiation exceeds current spatial and temporal fallout demarcations. For example, consider the Russian thistle that absorbs strontium-90 and cesium and metabolizes it from nuclear contaminated areas, its head eventually severing from its stem, thus becoming a source of windblown distributed radiation (Stang). Phytoremediation attempts to deal with landfill leachate through a process whereby certain tree species are planted on closed landfills, the tree roots ingest leachate, and expire a more environmentally palatable (for whom and what?) form of contamination into the atmosphere. This process is considered successful if the trees are not asphyxiated and survive up to *two years* after siting (Kim and Owens). These so-called 'eco-solutions' are predicated on the differential sacrifice of inhuman beings as well as humans.

[19] Ultimately, Barad's agential realism is a theory about ethics: it seeks to address the difficult ground of social obligation through phenomenal (re)articulations, which, to use Isabelle Stengers's words "allow us to inherit our history otherwise" (Bordeleau 17). The indeterminacy of waste draws our attention to the *imprescriptibility* of ethical responsibility to future generations and environmental sustainability (Arendt; Benford; van Wyck). In law, prescription infers a statute of limitations for the identification and assignation of guilt: after a certain time, crimes must be forgiven. Imprescriptability refracts a global futurity of indeterminate entanglements, of cuttings together-apart, and of collective (in)human vulnerability and responsibility:

ethics is not simply about responsible actions in relation to human experiences of the world; rather, it is a question of material entanglements and how each intra-action matters in the reconfiguring of these entanglements, that is, it is a matter of the ethical call that is embodied in the very worlding of the world. (Barad, *Meeting* 160)

[20] Agential realism, then, draws attention to the complex de-stratifications and re-stratifications, the limitless potential intra-actions corralled into composing waste as human, inhuman, disposable, reusable, risky, determinate, containable, profitable, inert, anthropogenic, and ethical. To paraphrase Barad, it matters how waste comes to matter.

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Notes

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 2. Love Canal is a neighborhood in Niagara Falls, New York that became the site of a public health emergency in the 1970s when approximately 22,000 tons of toxic waste leaked from a dumpsite over which a school and housing had been built. Kibera is a neighborhood in Nairobi, and the largest urban slum in Africa.
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