



ATTUNING TO THE CHEMOSPHERE: Domestic Formaldehyde, Bodily Reasoning, and the Chemical Sublime

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The air was rich with extrasensory material. Nearer to death, nearer to second sight.

—Don DeLillo, *White Noise*

During a six-month stay in a travel trailer in rural Oklahoma, a three-year-old developed small red dots on the backs of her ears, began bruising more easily, and walked through the world more clumsily, constantly toppling over. An older Indiana woman descended into a fog of “fuzzy thinking” and felt that her body was deteriorating at a slightly accelerated rate. A middle-aged man in Ohio sustained a “sick stuffy nose” and “throat problems” for a year and a half. Eye and respiratory-tract irritation, headaches, insomnia, and fatigue slowly crept into the body of a single father in rural Florida. His dreams, which became increasingly menacing over a matter of months, abated in intensity only when he slept next door at his grandparents’ house. The stool of a nurse in Texas gradually loosened in consistency. A police officer in Washington State almost entirely ceased eating as his sense of taste began to dull. His wife, experiencing the same sensorial skewing, doused her food with large quantities of salt and noted the “weird air” in their home.

The people above, and those who fill this article, began developing subtle and ongoing alterations to their physical constitution after spending time in a

home that would eventually be suspected of harboring elevated levels of airborne formaldehyde. Their apprehension of conventionally insensible domestic chemical exposures was informed by sustained attention to barely perceptible alterations of somatic function and atmosphere.

Recent attempts to theorize the body tacitly employ the terminology of airborne chemical exposures to explain the body's relation to the world. Indeed, scholars have described the ancillary processes of being a living body as becoming sensitive, embodying atmospheres, somatically judging environments, or becoming corporeally aware of nonhumans (Sloterdijk 2011; Latour 2004; Anderson 2009; Berlant 2011; Stewart 2011). In this article I argue that these affective processes of attending to the minute aberrations of the body and atmosphere are the primary means of discerning protracted and low-level encounters with domestic chemicals. Further, the tracking of small changes to body and atmosphere across time and space can accumulate into a process I call the "chemical sublime," which elevates minor enfeebling encounters into events that stir ethical consideration and potential intervention. The chemical sublime is both an experience and a practice that emerges out of late industrial material ecologies, one that inverts dominant conceptions of the sublime that hang heavy with Enlightenment-era baggage. In contrast to the long-prevailing formulation, the chemical sublime does not quell spectacular material threats with the transcendence of immaterial reason, thereby affirming human distinction and existing social orders. Rather, in the process I document, indistinct and distributed harms are sublimated into an embodied apprehension of human vulnerability to and entanglements with ordinary toxicity, provoking reflection, disquiet, and contestation.

At room temperature, the formaldehyde-based adhesives that hold together the plywood walls, particleboard subfloors, hardboard cabinetry, and carpet backings of the average American home slowly exhale chemical vapors into interior breathing space. Without a cracked window, an opened door, or other forms of air exchange, these silent and invisible microemissions accrue within the envelope of the home. Houseplants slowly filter out a fraction of the ambient chemical load as they absorb toxicants and assimilate benign formaldehyde metabolites into regular cellular function. A host of microorganisms that inhabit the soil surrounding plant roots avail themselves of formaldehyde vapors as a source of life-sustaining carbon (Kim et al. 2008).

The respiration of avian, feline, canine, and human inhabitants also removes formaldehyde from the air. Yet as formaldehyde vapors enter these bodies they are absorbed by the mucus membranes of the nasopharynx and lungs, bind to

DNA and proteins, disrupt cellular functions, and are quickly dismantled. In the process of metabolism formic acid is produced, yielding the possibility of acid-base imbalance and a range of systemic effects (ATSDR 2014). These slight biochemical impressions, which at first appear simply meaningless or puzzling, accumulate in the bodies of the exposed and reorient them to the molecular constituents of the air and the domestic infrastructure from which such chemicals emanate. It is through the articulation of these small corrosive happenings that residents reckon with how their homes are decomposing into them as they decompose in their homes.

The somatic work of the chemically concerned is enmeshed with an apprehension of their own bodies that is simultaneously sensuous and epistemological, referred to herein as “bodily knowledge” and situated within a process of “bodily reasoning” that tempers not just what one knows but what one becomes with or is estranged from. Sustained bodily reasoning gives rise to the chemical sublime, and together they offer a response to Kim Fortun’s (2012) call for ways to differently know and reimagine our ongoing late industrial present, which is marked by deteriorating sociotechnical systems and economic, climatic, and infrastructural instability.

The domestically exposed attune to their own effects and affects as a means of further discerning the barely perceptible constituents of their environment. This is not a practice confined to the “deviant agents” of those afflicted by multiple chemical sensitivity (Alaimo 2010, chapter 5; Murphy 2006, 173; Kroll-Smith and Floyd 1997, 10) or of those with diagnosed pathophysiologies like asthma. Rather, these molecular and relational appreciations arise from a somatic susceptibility and epistemic capacity common to human life—and often informed by nonhuman life.¹ By definition toxics bear “a potency that can directly implicate the vulnerability of a living body” (Chen 2012, 203), and it is by virtue of this very capacity to be chemically wounded, even minutely so, that bodies bear revelatory power.

This article unfolds across increasing durations of atmospheric formaldehyde exposure. The tip of the iceberg is my own encounter with exposures in the field. Much of this ethnography was conducted through the haze of indoor-air-quality-induced befuddlement. During the first hour spent in houses with suspected indoor air-quality issues, I would slowly develop an ache in the back of my eyes, which would with time spread throughout my skull. I repeatedly found myself struggling to resist a physical desire to expedite interviews as my mind felt increasingly woolly, my focus slipped, and my lines of inquiry lost their direction.

Time and the flow of my thoughts became viscous.² My energy would bottom out, but my eventual sleep was wracked with restlessness.³

The spaces to which I was supposed to be most attuned were the spaces in which I felt most cognitively unhinged. Yet as much as ethnography is “a method of being at risk in the face of practices and discourses into which one inquires” (Haraway 1997, 190), it is also a method of understanding how sheltered the ethnographer is even within such exposures. A molecule of formaldehyde does not strike my lungs in the same way it does those who have endured months or years of exposure—for whom its effects are biochemically magnified and semiotically enflamed. While my exposures may have intimated the costs of apprehending chemical others, my impairments proved ephemeral and the stakes of my somatic cognizance comparatively negligible. To indulge in a “radical empirical” impulse (Jackson 1989), to gesture toward the evidentiary potential of my own body, would be to distract from all of the privileges of research that make my own exposure anomalous within the highly patterned landscape of domestic exposures across the United States. Almost all of my work took place in manufactured homes, a mainstay of low-to-moderate-income homeownership, which harbor four times the ambient formaldehyde of conventional site-built homes (COEHHA 2001).

My interlocutors who resided in factory-built housing could be variously classified as elderly, poor, disabled, tenuously employed, or Native. In these cases formaldehyde concentrations were both indicators and agents of social abandonment and precarity. As will become evident in the first ethnographic section, new homes, newly renovated homes, and tightly sealed so-called green homes also cultivate elevated formaldehyde levels, as the biopolitical circuits that expose some in the name of sheltering others are not without their leakages (Murphy 2006, 111).

I begin by situating this article in the space between theoretical work on affect and phenomenological studies of environmental exposures. In the following section I unfold the specific affects of a domestic chemical assessment scientist, an analysis that contributes to a growing literature on the body as part of the existential, pedagogical, and ethical grounds of cultures of science (Masco 2004; Myers 2008; Helmreich 2009). My purview then widens to discuss the larger sensorium of corporeal domestic air-quality perception and the instrumental use of sensitized bodies to identify the sources of domestic chemical exposure. Across authoritative and questioned bodies, companion species and humans, I ask: In what ways do diffuse sensory practices generate knowledge of, attention to, and

engagements with everyday materials? How can expanding the avenues and temporality of sensing yield an appreciation of what many of us are abbreviating from our own sense of the world?

ATTUNING TO THE CHEMOSPHERE

Formaldehyde is a nearly ubiquitous chemical in the domestic environment. It seeps from the very engineered woods that give much of contemporary domestic space its comfort, security, and affordability. The chemical holds the colors of upholstered furniture, adds strength to insulation, and enhances the texture of cosmetics in addition to its less deliberate environmental presence as a residue of incomplete combustion (from automobiles to cigarettes). The substance suffuses the economy to such an extent that an industry trade association asserts, “the production and use of formaldehyde accounts for five percent of the U.S. gross national product—about \$500 billion per year” (ACC 2013). Just as in the case of major financial institutions, the chemical’s bonds are so diverse and far-reaching that the potential toxicity of formaldehyde is too big to face head on. Not only the practical and procedural conventions of science yield difficulties in capturing the harms of chronic low-level exposure. Governmental regulators, stakeholders in chemical economies, and unwitting discursive allies—such as those advancing the pharmaceuticalization of environmental illness etiologies—also actively unknow its injury through a protean array of technical, methodological, and legal maneuvers (Shapiro 2014).

Formaldehyde is not only synthesized at industrial scales; trace amounts of the chemical, as a metabolic by-product, are produced on a cellular level by all organic life forms. Formaldehyde’s presence in late industrial domestic ecologies is neither reducible to a natural and endogenous element of carbon-based life, as industry would have it, nor is it an absolute toxin—a completely alien agent leached from modernity’s amenities and trespassing into virgin bodies. Thus bodily knowledge of ambient formaldehyde concentrations translates into recognition of a substance that is always already part of the chemical makeup of bodies, but whose specific concentrations indicate how desires for shelter, the solutions to housing demand posed by industrial capitalism,⁴ and toxic atmospheres are embroiled in a complex give-and-take.

As a starting point, my focus on the embodied apprehension of residential formaldehyde vapors documents the ways in which bodies become, in the words of the cultural philosopher Peter Sloterdijk (2009, 99), “differently-attuned, differently-enveloped, and differently-air conditioned” by way of mundane chemi-



Figure 1. Couple recovering from domestic chemical exposure. Oklahoma, March 2012. Photo by Akasha Rabut.

cals and the atmospheres they animate. Beyond chronicling how bodies are materially and affectively caught up in the breathing spaces of the built environment, I seek to ethnographically elucidate the “somatic modes of attention” that render minute exposures knowable (Csordas 1993). As Lauren Berlant (2011, 15) has noted, “bodies are continuously busy judging their environments and responding to the atmospheres in which they find themselves” (see also Latour 2004, 206). Bodies are sites for both actively absorbing the world and being put into motion by its constituent medley of humans and nonhumans.

The apprehension of domestic toxins is a matter of life and slow death, mediated by patho-logical bodily processes. Kathleen Stewart (2005, 1024) has written incisively on this dialectic of bodily harm and bodily knowledge: “The body consumes and is consumed. Like one big pressure point, it is the place

where outside forces come to roost.” The various processes of corporeal judging, numbing, sensitizing, absorbing, attending, consuming, and responding are part and parcel of the pervasive bodily practices that [Stewart \(2011\)](#) encapsulates in the phrase “atmospheric attunement” (see also [Anderson 2009](#); [Choy 2012](#)). Such attunements, in relation to the case at hand, facilitate becoming *with* and orienting *toward* the molecular constituents of domestic chemospheres ([Ahmed 2006](#); [Haraway 2007](#)), without a necessary knowledge of exactly what chemicals they are attuning to.

Like learning to become sensitive to environmental change, becoming unaffected too requires work. That my fieldwork was predominated by women’s accounts not only resulted from the feminization of body care, domestic care, health care-seeking, and self-monitoring for bodily dysfunctions ([Murphy 2006](#), 173; [Ore 2011](#), 281). It not only results from the likely increased exposure to domestic chemicals encountered in the course of many of these labors. The absence of men from my fieldwork stems from their active indifference to slight somatic abnormalities. A majority of the men I spoke with consigned bodily decay to the unavoidable process of aging as a means of rejecting the possibility that their bodies were permeable or vulnerable to chemical harm, thus also rejecting threats to masculine self-images ([Waldman 2012](#), 130–33). In this way the attunement to and denial of toxicity constitutes and is constituted by normative gender roles.

The question at hand is not who is becoming affected, but how. Phenomenological studies of pollution, environment, and well-being primarily direct their analytical attention to olfaction ([Auyero and Swistun 2009](#); [Brant 2008](#); [Fletcher 2005](#); [Jackson 2011](#); [Reno 2011](#)). These studies bring into crisp relief the intimate place-making and place-disrupting capacity of smells and highlight the way in which we often take displeasing scents as the primary indicators of environmental contamination. Yet the respiration of airborne chemicals does not end at the nose. The diffuse embodiment of inhaled, and especially chronically inhaled, chemicals as they seep deep into bodies and spur cascades of minor and often-latent disruptions remain largely uninvestigated ethnographically.⁵ Smells, whether off-putting or alluring, are most pronounced at the crossings of thresholds and then, over time, recede from perception as they become incorporated into new sensorial norms. As one’s scent sensitivity down-regulates in a process of olfactory adaptation, ongoing and low-level exposures become ordinary and perceptually undetectable ([Dalton and Wysocki 1996](#))—if such exposures even crested scent detection thresholds in the first instance.⁶

Although many episodic exposure events—from landfills to hydrocarbon-extraction activities—are announced by pungent odors, the limits of what [Joshua Reno \(2011\)](#) refers to as “olfactory epistemology” are often viscerally clear to the chronically exposed, as a middle-aged woman in Detroit facing persistent industrial emissions announced in an Air Pollution Community Forum in June 2013: “The state DEQ [Department of Environmental Quality] says ‘we depend on you and your smell to tell us when something is in the air,’ but the thing is, after a while that stuff wears you down and your senses stop working anymore. I know that in my body there’s some of that [pollution] in my system. It mess up your mind, it mess up your whole system.” Over time her olfactory perception of contamination dulled, while alterations in the quality of her thoughts and slight systemic aberrations continued to signal exposure. Following two years of ethnographic fieldwork on chronic domestic chemical exposures throughout a dozen U.S. states,⁷ I have come to the conclusion that such microscopic encounters are most readily sensed by less nameable and more diffuse sensory practices. Bodies are often embroiled in sensing the world well before cognition catches wind of protracted chemical encounters.

This argument runs counter to a pioneering analysis of women’s “exposure experiences” in which the authors assert that “in the case of household pollutants and chemical body burden, science has been the primary means through which embodied and indoor pollution have been ‘discovered’” ([Altman et al. 2008](#), 419). Beyond scents and science, I claim that the attuned body is the primary substrate of domestic formaldehyde exposure discovery. Bodies are sensors that indicate the presence of toxicants and, in some cases, specify their atmospheric concentration with uncanny precision. The empirical matter that fills this article is intended to challenge the confidence that we often place in our own ability to know when we have sensed something and when we have not.

Exposures slowly and invisibly emanating from the formaldehyde-based engineered woods that give form to domestic space require an attentiveness to how human bodies reveal imperceptible chemical exposures with their own subclinical wounding. In these affective spaces, “at the very limit of the phenomenal” ([Clough 2009](#), 51), the somatic precedes and then is entangled with the rational, a mingling of mind and body that bucks the standard psychosomatic dismissal of low-level chemical complaints in which mental factors cause or aggravate bodily issues. My account draws on a deep phenomenology of bodily formaldehyde detection that focuses on visceral and indeterminate sensorial facilities, rather than on mere smell. The latter may serve as an intimation of a wide variety of exposures, but

it is not the epistemic basis for chemical knowledge of everyday, ongoing, and low-level intoxication.

BODY METER

In February 2011, Linda Kincaid responded by email to a call for participants for my study of the experiences of domestic chemical exposure. An environmental activist had forwarded the call to what she refers to as her “formaldehyde list.” The list comprises a broad array of individuals interested in formaldehyde, many of whom have personally felt its effects—from former FEMA trailer residents,⁸ to consumers concerned about the broad range of products made with formaldehyde and, evidently, industrial hygienists. Linda has worked as an industrial hygienist—a scientific profession charged with the responsibility of assessing, controlling, and communicating environmental hazards—since 1991 and holds a master’s degree in public health from the University of California, Berkeley. The immediacy of her interest in domestic formaldehyde was derived not only from the elevated chemical levels registered by her monitoring equipment in the homes of her residential clients, but further by her own symptoms of exposure, which maintained a grip on her after returning from the field.

Before meeting in person in suburban Los Angeles to attend one of her formaldehyde home inspections and to learn to use a real-time formaldehyde meter, we spoke at length on the phone. Linda had only become interested in domestic formaldehyde exposure in the past few years. When she received her first phone call from a family that suspected their home was making them sick, she reacted with skepticism. “What are you talking about?” she thought to herself, but a quick literature review soon revealed that common domestic formaldehyde levels could give rise to the reported symptoms. Linda’s attention was piqued. As a pet project, she began to amass a small arsenal of portable real-time formaldehyde meters. Yet the vast majority of her work continued to be for the semiconductor and solar industries, and the irregular flow of clients with residential concerns could not sate Linda’s blooming curiosity about the magnitude of domestic chemical contamination.

After developers swiftly rejected her offers to test new subdivisions for free, she saw clandestine testing of open houses as her only option for gauging the prevalence of elevated residential formaldehyde. She set out to new unoccupied homes by herself on free weekends, with the intake hose of her Interscan 4160 formaldehyde meter timidly cresting the lip of her purse.⁹

It was really kind of a lark. Can I find elevated formaldehyde in homes? Is it going to be one in ten? . . . Within a few weeks I came to realize that there was a problem here. There is a *huge* problem here. I was getting the kinds of concentrations that they found in the FEMA trailers, and these are not trailers; these are high-end Silicon Valley homes.

And I started noticing that homes in one city in particular had seriously raised formaldehyde as compared to others. . . . Every house I went into had really pretty high formaldehyde, and I would have a headache and have trouble sleeping that night and toss and turn all night long. I'd be exhausted the next day, and when I did other communities it seemed that the formaldehyde wasn't as high and I didn't have those responses to the same degree or maybe not at all.

As Linda began to log higher levels with her formaldehyde meter, she also began to log increased levels within her body. Her symptoms signaled elevated chemical levels as clearly as the LCD readouts of her assessment technologies. In embodying the invisible gas, she utilized not one of the standard human sensory faculties but a calibrated, yet diffuse, awareness to aberration. She attuned to the irregular physical state of her neurochemistry.

Appraisals of her clients' homes would often turn back to her own body. When I asked about the curious symptom of intensified dreams that her clients reported,¹⁰ her first reaction was to describe her own corroborating experience: "And those were one of my symptoms too; it doesn't seem to happen to everybody. It absolutely is one of my symptoms. It is guaranteed. If I am in a house with 50–70 ppb [parts per billion] formaldehyde, I will have the utterly weird, bizarre, freaky terrifying nightmares and that is very consistent. It is not something that happens to me normally, so when it does happen it really stands out." Linda highlights her symptoms after merely an hour of exposure, bearing corporeal witness to long-term low-level chemical exposure disorders that have been historically disqualified as (female) psychogenic illness (Murphy 2006). Her repeated experiences in combination with her monitoring equipment lend credence to individual and isolated complaints on the scale of reproducible and scientifically observed phenomena. *It is guaranteed.*

Despite the short duration of Linda's exposures, she can surmise formaldehyde levels with extreme precision. In the above quotation, she asserts that she can sequence the onset of exposure symptoms down to a margin of error of about twenty parts per billion. In liquid terms, that is roughly equivalent to determining

the difference between fifty and seventy drops of formaldehyde diluted in a small railroad tanker or 250 chemical drums. In temporal terms, such accuracy is comparable to a margin of error of a minute when measuring durations over the course of a century.

At first blush, the exactitude of her body-meter-air attunement appears to border on the uncanny, if not the impossible. The ability to discern such infinitesimally small differences in atmospheric concentration does not derive from a supernatural capacity on Linda's part. Rather, such perceptivity results from a mundane monitoring of both repeated bodily irregularities and the levels of formaldehyde found by her meter. These practices are born out of standard scientific method, professional curiosity, everyday corporeal awareness, and openness to being affected. Linda's embodied awareness to biochemical aberration does not lie beyond the realm of toxicological plausibility.¹¹ As "the exact mechanism of action of formaldehyde toxicity is not clear" (ATSDR 2014, 5), the aspect of this process that remains inexplicable relates to the limits of toxicological knowledge, and not a mythic extrasensory perception.

Operating in tandem with her real-time formaldehyde meters, Linda's body viscerally logged the chemical exposures of the houses she visited. Over time, she calibrated an understanding of toxic effects to the outputs of her instrumentation, a process of indwelling both the indoor atmosphere and the meter. Scientific instrument and soma evaluated their immediate surroundings in accord. It is through this environmental and technical incorporation that Linda dilates her being-in-the-world (Merleau-Ponty 2012) and harnesses the relational-cum-epistemic utility of her body to understand the potentials of domestic chemical exposure, a process I have alluded to with the phrase "bodily reasoning."

THE CHEMICAL SUBLIME

Writing on an antithetical technoaesthetic encounter—the first detonations of nuclear weapons in the deserts of New Mexico—Joseph Masco (2004, 4) observed that "the weapon scientist's body [was] the most important register of the power of the bomb." The irradiation, shock wave, and ensuing firestorm of humankind's most lethal weaponry evoked reverence and bodily fear in onlooking male scientists as some were knocked to the ground, flash-blinded, or felt the blast bore into their being. For weapons scientists, the modest or ephemeral bodily traumas of the bomb's destructive might were, in a slightly masochistic fashion, the pleasures of a successful experiment. In the shadow of the world's first mushroom cloud, Masco posits, these bittersweet affects melted into a "nu-

clear sublime.” This highly specific version of the sublime propelled some scientists into nuclear disarmament campaigns, while others reveled in a feeling that approached divinity.

Sublime is not simply an adjective or noun denoting a characteristic or state of grandeur or awe. In chemistry, sublime is also a verb, invoked when substances transform from a solid directly to a gas, bypassing the intermediate liquid form. Formaldehyde used in the fabrication of pressed woods, for instance, slowly sublimates at temperatures above -2°F . In contrast to the spectacular, brutal, and lightning-fast sensorial pummeling that afflicted early nuclear weapons scientists, a multitude of diminutive formaldehyde plumes drifted into Linda’s lungs at the sedate speed of chemical off-gassing and regular human breathing.

The constituent effects of what could be summarized as the chemical sublime were often subtle and crept into Linda’s consciousness at a snail’s pace. The cognitive force of her discovery was not “directly proportional to the danger involved in the experiential event” as Masco (2004, 3) avers, reading Immanuel Kant (2000). Formaldehyde’s presence in domestic space was not signaled by overwhelming sensory stimuli, but rather indicated by a thickening veil of indistinction as perceptual faculties became occluded. The interference of air-quality-induced illness is received as a phenomenological transmission of its own right (Fortun 2003, 186). The sensorial noise of illness is the signal of domestic chemical exposure and the bodywork employed to apprehend the qualities of indoor air.

The magnitude of the issue of domestic chemical exposure revealed itself in piecemeal fashion—gleaned from the repeated toxic encounters of an attuned body, rather than patently imposed by a singular event like a mushroom cloud erupting into the stratosphere and tossing scientists to the ground. For Linda, the prevalence of elevated formaldehyde gradually accumulated into a technical and embodied awareness of residential chemical exposure that dwarfed her by its scale. *Within a few weeks I came to realize that there was a problem here. There is a huge problem here.* The form of the chemical sublime highlights the gendered assumptions undergirding Masco’s and Kant’s privileging of sublimity’s correlation with public, spectacular, and violent events over the profundity and density of widespread private, indistinct, chronic, and fragmented phenomena.¹²

The velocity of the epochal nuclear sublime is diametrically opposed to that of the mundane chemical sublime, yet they maintain a common substrate of experience—the bodies of scientist witnesses. Linda’s body was a vital register of both the chemicals that suffused domestic space and their specific concentration. The chemical process of sublimation, the elevation of state from solid to vapor,

is mirrored by Linda's somatic process of epistemic elevation, of corporeally validating her clients' symptoms and heightening her own bodily analytics. If bodily reasoning is the dynamic process through which knowledge of individual spaces of chronic exposure is somatically attained, the chemical sublime is the accrual of bodily reasoning to the point of articulating the patterned practices and infrastructures that distribute pockets of exposure across space. It is the traversing of a threshold of chemical awareness whereby the *irritations* of one's immediate environment become *agitations* to apprehend and attenuate the effects of vast toxic infrastructures. The chemical sublime thus exerts what Mel Chen (2012, 211) calls the "queer productivity of toxicity and toxins" that demands additional forms of labor.

Linda approached the City Council of San Jose, California, in the summer of 2009 as its members were on the verge of passing a building ordinance that required new homes to be certified as "green" by sealing them more tightly, a measure that would likely result in higher domestic formaldehyde levels.¹³ Linda proposed an addendum requiring green homes to be tested and meet indoor air-quality standards. She offered to render those services for free to demonstrate that she held no financial conflicts of interest. Her proposal was met by a smear campaign financed by the Formaldehyde Council, an industry-funded interest group, which commissioned scientific assaults on her findings. Linda's assertions about widespread domestic toxicity put her "at risk for future litigation,"¹⁴ as systems of commercial asset protection transformed her effort to mitigate systemic exposure risks into legal, scientific status, and financial risks on an individual level. Her data were then ignored and her motion scrapped.

The formaldehyde levels logged by Linda's instrumentation were well in excess of government-recommended thresholds, yet her findings failed to crest prevailing thresholds of significance. Why the visceral pull of the chemical sublime does not translate to a resounding ethical call—why Linda's assertions were so easily rebuffed—is not only the result of industry's mobilization of law, science, and capital. We must also look to how the sublime has brokered relations between exposure and the status quo since at least the dawn of the Enlightenment. While the full history extends well beyond the scope of this article, it will suffice to texture the chemical sublime by digging deeper into how it diverges from the Kantian root of Masco's nuclear sublime.

In Kant's (2000) conception, the immensity or might of the sublime first overwhelms our imaginative capacity or indicates the fragility of the human body, yielding a sense of helplessness and distress. This diminutive feeling is then coun-

tered and ultimately overcome by reassuring one's self of the power of the mind, by the belief that reason sets humanity apart and above the physical world. The internal tumult and sensuous displeasure is elevated into the delight and superiority of reason. Quintessential of the Enlightenment project, Kant's sublime outlines a process by which intellectual mastery dominates the threats of the material world and indicates humanity's continued progression. As the critical theorist Gene Ray (2004, 10) asserts, "the ideological function of the aesthetic category of the sublime within Kant's critical system is anxiously bound up with . . . deep metaphysical optimism." The optimism of the sublime serves to affirm existing power orders—to justify the optimist credo of "whatever is, is right"—even in the face of mass calamity, such as the great Lisbon earthquake of 1755 that fascinated Kant and haunts his analytic of the sublime.

The chemical sublime is sharply distinct from Kant's formulation of the sublime in at least four ways: the form (space, time, and intensity) of exposure, the relation between the supersensible (mind) and the sensible (matter), orientational movement (from without to within or vice versa), and political reckoning. Unlike in the case of Kant, who relished the sublime while collecting reports on the great Lisbon earthquake from his East Prussian home, the objects of the chemical sublime cannot be held at a distance. As the practice of bodily reasoning makes clear, the material transformations of the body are inseparable from intellectual processes of molecular deduction. An extended absorption of toxicants is not a situation that can be transcended by way of a feeling of rational control. The sublimation of toxic bodily reasoning does not form part of a mental mastery over perceived threats—intellectually closing off their danger. Rather, it constitutes a sensuous reasoning that indicates how open our bodies are and amplifies—rather than extinguishes—the tensions, agitations, and dissident potentiality of large-scale hazards. It is the coalescing of underrecognized disturbances rather than a compensation for those that overtly disturb—the beginning of a confrontation, not its resolution.

As unfathomably common industrial chemicals warp, distort, and decay human and nonhuman bodies alike, they corrode the optimism and anthropocentrism of the Enlightenment. Instead of "transforming the worst into the best" (Lyotard 1988, 41) as a foil of human triumph, the chemical sublime is a condensation of vaporous displeasures and a way of being deeply moved by the latent toxicity of industrial human progress.

Although Linda's attempt to effect change has ended in a way that is well recited within the contemporary history of toxic contamination (Boudia and Jas

2014), the way it began makes for a less recited story. It is a story that bears on how the chemical sublime can attend to the decentralized crises of the contemporary moment and that gives rise to the potentiality of living otherwise.

BODIES OF EVIDENCE

The chemically aware body is not only borne out of profession and curiosity as in Linda Kincaid's case. More often than not, bodily knowledge of chemical others derives from the necessity of cohabiting with toxins, as was the case with Harriett McFeely and her husband, Dick, who live in a modular home on the outskirts of a small town in Nebraska. In the spring of 2011, I traveled to stay and speak with the McFeelys, who claim to have endured more than two decades of domestic formaldehyde exposure.

Before Harriett got access to free formaldehyde tests from the Sierra Club, and before formaldehyde had been introduced to her as a possible perpetrator, she was near the end of her rope. In twenty years of inhabitation, she had slowly developed constant diarrhea, a runny nose, fatigue, severe eye irritation, double (occasionally triple) vision, the need to read with one eye shut, headaches, a sense of taste that skewed toward metallic or simply "strange," and numerous other symptoms.¹⁵ With resurgent exasperation she recounted her dogs getting sick and dying one after the other, while her and her husband's health steadily deteriorated. Her doctor received her complaints with skepticism and an implied diagnosis of hypochondria: "They couldn't find out what's wrong in my body, so they thought I was crazy. That's the only answer."

Harriett first began suspecting the house as the source of her family's collective illnesses in 2002 when she left home for five days and her vision cleared and other symptoms subsided. Again in 2007 she left the house for three days and her ailments abated. She then ruled out domestic radon exposure, carbon dioxide, sewer gas, black mold, and water contamination.¹⁶ Her last-ditch attempt to ascertain the etiology of her family's illnesses was to invite a friend of a friend, named Nancy Shoemaker, who suffered from multiple chemical sensitivities. Harriett hoped that Nancy would use her chemical susceptibility to pick up where her own bodily knowledge left off by divining the specific source of their health issues within the home.

Nancy, who spoke with delicate and slightly nervous poise, had developed chemical sensitivity at an early age, while attending beauty school in Nebraska. Nearly every morning when sterilizing the styling utensils, Nancy would lose consciousness and collapse. She had to drop out and readjust her dream of be-

coming a beautician. Nancy did not think much of her fainting spells until years later when she moved to Florida, where she and her husband took up residency in a trailer. After moving into the trailer, her sensitivities dramatically escalated, but not only at home. A whiff of cologne on the street or shaking hands with someone wearing a transparent Band-Aid could be enough to wilt Nancy to the ground. Her body became jarringly attuned to the vast chemical infusion of the world around her.

As a result of these continual chemical encounters, she learned to move through the world with caution. When barefoot at home she would cross sections of linoleum with circumspection, unsure of the daily caprice of her sensitivities. Her corporeal vulnerability to chemical vapors or direct contact is not spread uniformly throughout her body. As a high-frequency exposure site, an extra-sensitive area in the center of Nancy's palm became more acutely affected with time. Nancy took advantage of the embodied insights of her palm and tacitly honed its reactivity. She now uses her palm to assess the hazard of the various materials and spaces that she encounters in daily life. As she spoke, her gaze turned down to her hands, and she ran her right index finger in circles around the area on her left hand. "If I put something on that sensitive spot or touch something with that sensitive spot, I can tell if I can handle it at that time or not."

To manage anxiety about her emergent reactivity, Nancy developed a deeper literacy of the chemical world by way of a deeper literacy of her own body. "I know about formaldehyde and I'd never done anything like [what I did] with Harriett," she explained, "but I knew how formaldehyde affected me." She averred an amassing of somatic knowledge about formaldehyde via years of enduring its effects and affects—through dozens of fainting spells, bouts of wooziness, enervating weakness, and daily somatic tests of the material things that populate her world.

It was with the sensitive spot in her hand that Nancy began to assess the chemical constitution of Harriett's home, as an alternative to expensive and inaccessible scientific instrumentation. Sitting in her small and immaculate assisted-living apartment, Nancy recounted the process: "And so I went into the different rooms and I tested the carpet and doors. . . . I went into the kitchen, and I just grabbed hold to open the cabinet or something. I don't think I touched it very long" At that point in the story, Nancy lost consciousness. Harriett observed Nancy clutch her stomach and let out a groan. The color dropped from Nancy's face as she dropped to the floor and began to seize. Harriett's Boston Terrier,

Bowser, ran into the room to investigate the commotion and curled into a fit of seizing as he approached Nancy. The two lay there next to each other on the carpet, gripped by spasms, for a few moments before Harriett and her husband dragged Nancy outside. Bowser continued to convulse in the kitchen. The dog came to within an hour but remained disoriented, running into the furniture, walls, and doors.

Nancy gradually regained her composure over the course of half an hour. After she felt well enough, she went on her way, confident that she had found at least one source of the McFeelys' suffering. As unnerving as the experience was, Harriett also felt relieved that Nancy had validated her suspicion that chemicals were quietly emanating from her home. With an affirmative nod Harriett emphasized the instrumentality and accuracy of Nancy's body: "In my opinion, that lady is like a human Geiger counter." Of course Harriett, and all exposed and affected bodies, also bears this capacity to make manifest the chemical world, albeit in less eventful ways. Some bodies exclaim while others speak in hushed tones. In domestic chemical exposures, bodies are both the means of apprehension and the site of damage. Bodies uncover invisible toxins with their wounding. Humans and their nonhuman companions serve as their own canaries in the unwitting coal mines of residential America. A month after Nancy's visit, Harriett's fifth dog in twenty years had to be put to sleep after he became wracked with near-constant seizures. As of June 2015, the McFeelys have lost two more dogs to similar ailments.

Like Linda, Harriett felt the pull of the chemical sublime. She felt the attrition in her own body and monitored the bodily ailments of her dogs and her husband. In line with what the sociologist [Phil Brown \(1997\)](#) has called "popular epidemiology," or the lay appropriation of expert means of environmental health assessment (see also [Murphy 2006](#), 62), Harriett sought to comprehend the systemic nature of such exposures. Harriett wrote letters to the editors of newspapers in five or six nearby towns. Her short notes, published in 2008, read: "Modular home owners, have you had any health problems? Have your indoor pets had any mysterious illnesses? Please write or call me." Phone calls began rolling in, one after another. Harriett began to systematically survey respondents. She asked those who called her how long they had been living in their home and what their symptoms were. She surveyed thirty individuals from thirteen different households throughout Nebraska. Respondents supplied thirty-two different symptoms that they perceived to be correlated to the occupation of their modular home, ranging from unusual thirst to cancer. Harriett further inquired about

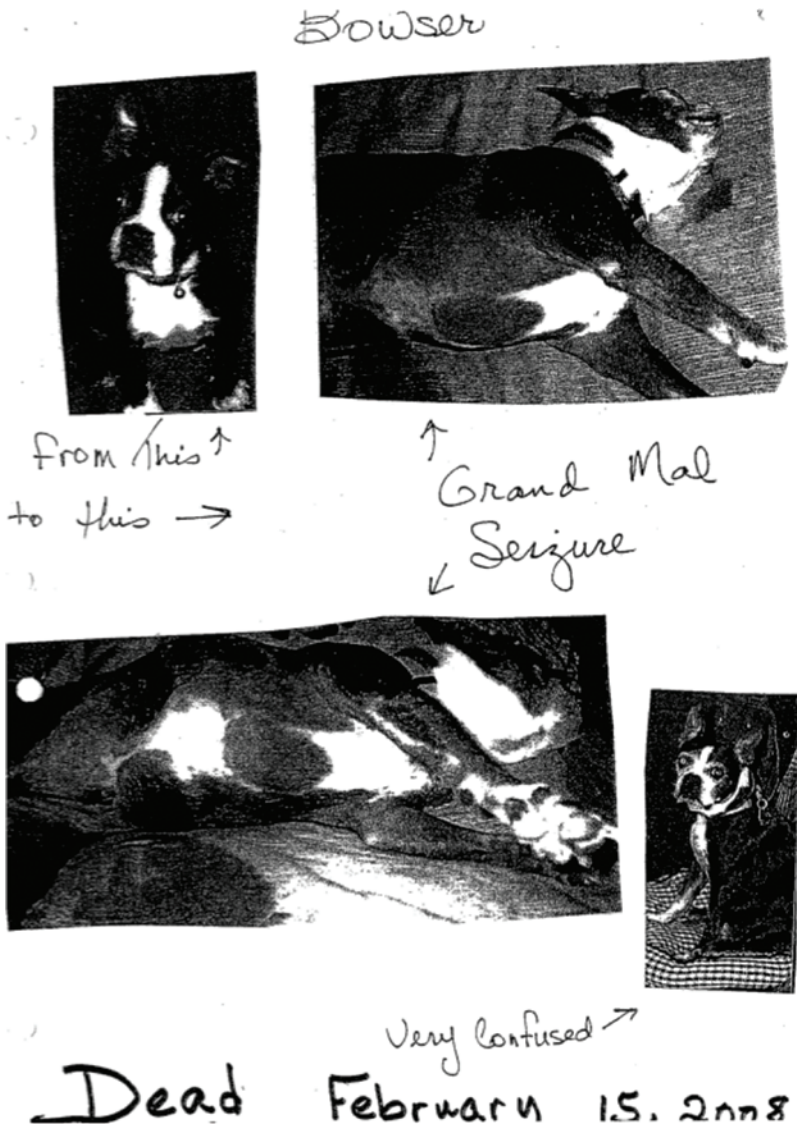


Figure 2. A photocopied entry of the records kept by Harriett McFeely, showing photos of Bowser the dog and notes. Bowser's body and disposition index the presence of otherwise-invisible chemicals.

indoor pet health and recorded the symptomatology of fifteen animals in seven households. She was able to garner funds for formaldehyde test kits from the Sierra Club and tested respondents' homes. Seven of the thirteen homes tested had levels of formaldehyde in excess of the World Health Organization's maximum recommended exposure for half an hour—81 parts per billion. Harriett



Figure 3. The dog owned by the McFeelys at the time of the author's visit to the site of Nancy's seizure. Hastings, Nebraska, April 2011. Photo by Nicholas Shapiro.

mails copies of her data, adorned with a row of skulls and crossbones along the spreadsheet's bottom border, to anyone who may be able to help.

Harriett made her husband promise that a thorough autopsy would be performed on her if she were to "drop dead" before him. Shifting her stone-faced gaze over to me, she asserted with certainty that the decomposition of their dogs' bodies served as a herald of her and her husband's future. "I would bet you a hundred thousand dollars that if they did an autopsy on us today, I would bet money that it is exactly like the dogs." Harriett implies that their domestic exposures have reduced her and her husband to the walking dead, that a post-mortem examination could rightfully be performed on them at any time. A grim suggestion, perhaps, but one that is representative of many of the persevering residents of potentially chemically contaminated homes. As evinced by Harriett's perceived imminent autopsy, sustained chemical exposures beckon death, but they also render death ambiguous. She takes the logic of bodily reasoning to its conclusion: if wounding intimates the source of harm, then death will surely disclose its ultimate truth.

Coming to corporeally comprehend one's environment does not always have consequences as severe as in Harriett's case. Residents of potentially contaminated homes I met across the United States gradually became aware of minor departures

from their normal sense of taste, sense of balance, clarity of thought, memory, durability of skin, or frequency of contracting colds. Occasionally, inhabitants did not claim even the slightest deviation from their typical physical state. They only recognized atmospheric irritation as an altogether-indistinct feeling. As one North Dakota man noted, “Something about the air in here doesn’t seem quite right.” Or as a woman living on a reservation in the Northwest observed, “in the middle of the day it gets weird air and I open the doors.” While slightly suboptimal health or simply off-putting auras were predominant among my research participants, many suffered from more debilitating illnesses. In these spaces where enduring and knowing are coterminous, the feeling of living death seeped into the margins of life for those with even minimal symptoms.

TOWARD A LATE INDUSTRIAL SUBLIME

The average American home maintains indoor formaldehyde levels capable of inducing irritation (Hun et al. 2010). Chronically absorbing this chemical is not a process relegated to the lower classes or precarious, even if such populations do bear dramatically higher burdens. To somatically apprehend formaldehyde exposure means to begin apprehending the costs of late industrial infrastructures, economies, and standards of living. It sets in motion an appreciation that the molecular cohabitants who physically hold our world together also encourage our unraveling. Becoming a “pupil of the air” (Sloterdijk 2009, 84) is to attune to the aerosolized material culture and more-than-human semiotics (Kohn 2007) within which one is immersed. Focusing on slight sensations and dysfunctions reorients discussions of chemical phenomenology from its current emphasis on episodic olfactory events to an apprehension of the irritating chemical background noise of everyday life.

Ambient formaldehyde makes itself known to mammalian life through minor effects and affects that the exposed can accumulate, over repeated incidents, into an embodied awareness of the scale of chemical saturation, beyond the individual pocket of air we call home. I theorize this string of intimate sensations as amounting to a chemical sublime, which can “aggregate life diagonal to hegemonic ways of life” (Povinelli 2011, 30) and give rise to attempts at living otherwise. The chemical sublime does not merely refigure a form of the sublime in philosophical discourse but poses an alternative schema of eventfulness or call to action, one that expands dominant ideas of catastrophe and the disturbing. The chemical sublime is perhaps just one instantiation of an emergent late industrial sublime that reckons with the temporally and spatially dispersed residues of contemporary

political orders, including climate change (Morton 2013), biodiversity loss (Yusoff 2013), extractive labor practices, and social abandonment (Povinelli 2011), among others.

Yet with formaldehyde production and consumption infrastructure largely locked in, and without the capacity for networking the atomized populations charged by the chemical sublime, decamping from spaces conditioned by uncountable formaldehyde microemissions is, at a societal level, not an option. Such pleas are either actively disqualified, as is the case with Linda, or they passively languish without authoritative clout, as with Harriett. Beyond instrumentalizing viscera, such attunements to encounters between airs and bodies constitute the openings through which to grapple with the composition of our world and with the untold caustic ecologies that remain largely insensible to the human.

ABSTRACT

Chronic domestic chemical exposures unfold over protracted timelines and with low velocity. In this article I argue that such microscopic encounters between bodies and toxicants are most readily sensed by less nameable and more diffuse sensory practices. The apprehension of conventionally insensible toxic exposures is informed by sustained attention to barely perceptible alterations of somatic function and atmosphere. Slight biochemical impressions, which at first appear simply meaningless or puzzling, accumulate in the bodies of the exposed and reorient them to the molecular constituents of the air and the domestic infrastructure from which such chemicals emanate. Through the articulation of these small corrosive happenings, residents of contaminated homes can accumulate minute changes to body and atmosphere across time and space in a process I call the “chemical sublime,” which elevates minor enfeebling encounters into events that stir ethical consideration and potential intervention. The chemical sublime is a late industrial experience that inverts an Enlightenment-era, yet still dominant, conception of the sublime. Across authoritative and questioned bodies, companion species and humans, this essay asks: in what ways do diffuse sensory practices generate knowledge of, attention to, and engagements with the chemical world? [phenomenology; anthropology of science; affect; chemical exposure; bodily reasoning]

NOTES

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1. Within toxic domestic ecologies, the absence of mice and cockroaches or the frenetic behavior of companion birds, cats, and dogs are often read as sentinel indicators of toxicity (see *Limn*, no. 3, <http://limn.it/issue/03>).
2. Bouts of hypognition are all too often anthropologically overlooked as they "tend to resist or defy explicit forms of representation due to their lack of culturally infused conceptual elaboration" (Throop 2005, 506).
3. I never felt these sensations when I sat chatting with informants outside in folding chairs, on walks, in cars, in office buildings, or in fast food restaurants. Photographers and journalists that I brought to meet my informants also developed similar symptoms. In collaboration with Brandon Costelloe-Kuehn, Kim Fortun, and analytical chemists at Prism Analytical Technologies, I tested the atmospheric formaldehyde of twenty-four of these homes and found elevated formaldehyde levels in the vast majority. I cannot rule out the possibility of other agents in the indoor air of these trailers, such as other volatile organic chemicals or mold toxins.
4. The case at hand is not an anomaly. As is likely well known, industrial capitalism often seeks industrial chemical solutions for its problems, from engineered wood to pesticides to pharmaceuticals.
5. More-than-olfactory air pollution sensing practices do surface in discussions of scent, such as Caterina Scaramelli's (2013, 157) mention of the involuntary convulsions felt by a voluntary water quality sampler in Massachusetts during the collection of a particularly potent sewage off-flow. In addition to discussing the operational usages of scent, Joy Parr (2010) details the less canonical but still-named senses of proprioception, kinaesthetics, and proxemics at play in avoiding (rather than detecting) radiation in a Canadian nuclear power facility.
6. In addition to olfactory imperceptibility due to consistent exposures, the prominent scent scientist Pamela Dalton warned me in an interview that smells do not serve as resolute indicators of either chemical concentrations or toxicities.
7. Between 2010 and 2012 my interest in domestic air quality was circulated online, via offline social networks, and in the news media. More than one hundred people wanting to discuss residential chemical exposures contacted me. I conducted in-person interviews and participant observation in twelve states and phone interviews in eleven additional states.
8. Federal Emergency Management Agency trailers were deployed en masse in late 2005 and early 2006 in response to the residential destruction of hurricanes Katrina and Rita. These emergency housing units were found to harbor elevated levels of formaldehyde in their interior atmosphere (CDC 2008) and are extreme examples of much more widespread domestic air-quality issues. These trailers were my entry point into this course of research.
9. She also used UMEx formaldehyde badges to validate her real-time results, as the copresence of other chemicals can increase or decrease the readout of the real-time meter.
10. The sleep disorders Linda has recorded are not restricted to nightmares. She notes that several of her married clients now sleep in separate beds due to insomnia or flailing around at night; both are issues reported to me by one in three of my informants.
11. For instance, the onset of the effects she claims formaldehyde has on her body (50 ppb)

- is six parts per billion above the Office of Environmental Health Hazard Assessment's (COEHHA 2008) acute Reference Exposure Level for formaldehyde sensory irritation (44 ppb).
12. On gender and nuclear weapons, see Masco 2004, 21, note 26. Joseph Masco's focus in this article is not solely on the above-ground testing that constituted the grandest manifestation of the nuclear sublime but also subsequent, "more limited" forms of the sublime under the underground testing regime, and then virtual testing of the current stockpile stewardship regime.
 13. So-called green homes do pose a potential trade-off between energy efficiency and health. Such homes are sealed more tightly but often use the same construction materials as traditional homes, and as a result are likely to bear high ambient chemical concentrations (Kincaid and Offermann 2010).
 14. This phrase appeared in a letter from Betsy Natz, the executive director of the Formaldehyde Council, to Linda Kincaid, dated August 11, 2009.
 15. Her husband, Dick, suffered from eye irritation, a loss of his sense of smell and taste, and numerous other symptoms shared with Harriett.
 16. Her radon levels were negligible. A state employee checked for sewer gas and black mold. They have their own well with no nitrates or E. coli, which is also checked by the state annually as they do in-home food preparation for Harriett's wedding catering business.

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