



Suncor Energy.
Raw oil-sands bitumen, 2010.

More Liquid than Liquid: Solid-Phase Bitumen and Its Forms

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In apparently unrelated developments in 2017, two Canadian firms announced the invention of techniques for transforming bitumen into solid, self-contained units. For several years prior to this, a third Canadian inventor had also been working on a process for solidifying bitumen, an extremely viscous hydrocarbon abundant in the Athabasca region of western Canada, where it is both a celebrated source of resource wealth and a demonized source of unsustainable fossil-fuel emissions contributing to global warming. The oil sands mined in this region are about 5 percent water, 10 percent bitumen, and 85 percent other mineral matter and are firm enough to hold in your hand. Before bitumen can be commodified, it must be extracted from the ground, separated from the sands, and, typically, diluted for transportation to refineries via pipeline. Both state and industry in Canada have promoted the transportation of bitumen (from its land-locked points of origin to ports at tidewater) as a national economic imperative. Those engaged in the struggle over fossil fuel extraction and climate change have presented stopping this transportation as a global survival imperative.¹ Pipelines are a medium of this contention. Capitalists and state actors hoping to exploit bituminous sands for all they are worth want to expand the pipeline infrastructure that transports their commodity to market. Environmentalists and other activists strenuously work to prevent the construction of new and expanded pipeline infrastructure as a way to ensure that hydrocarbons that intensively emit greenhouse gases remain in the ground.

As the *Canadian Encyclopedia* notes, “One of the easiest ways to understand bitumen is to compare it to its cousin, conventional crude oil. Whereas conventional crude oil flows freely, bitumen does not. At room temperature it looks like cold molasses, and must be either heated or diluted before it flows.”² We agree. Understanding bitumen requires attention to the material conditions of its communication. In recent decades, the “materialities of communication” have enjoyed considerable scholarly attention, owing largely to the influence of German media studies.³ Much of this work downplays hermeneutic interpretation of symbolic exchange in favor of materialist analysis of



Suncor Energy. Raw bitumen being separated from sand at a Suncor extraction plant, Fort McMurray, Alberta, Canada, 2019. Suncor is the largest bitumen producer in the world.

the tangible properties of the devices and systems that mediate it.⁴ As Hans Gumbrecht observes, this points to the difference between “meaning effects and presence effects.”⁵ Subsequent work in North American media studies has extended this consideration beyond the physical properties and design of media devices themselves to include the material conditions and infrastructures that make them possible, such as energy.⁶ Some of this work nods in the direction of Canadian media theorist Marshall McLuhan and even to the late work of his mentor, the political economist Harold Innis.⁷ By contrast, our interest in the strange materiality of bitumen is more akin to Innis’s early work on the communicative function of infrastructures for the extraction and transportation of staple commodities.⁸ Our concern here is not really the materialities of communication but the communication of materials.

With respect to bitumen, the matter is not so much “what meaning cannot convey” as it is “what pipelines cannot convey.”⁹ Rendering bitumen in a form that allows it to “flow freely” is central to the *energo-politics* of this substance, and this is the context in which the stakes of making bitumen more, rather than less, solid become apparent.¹⁰ Bitumen’s natural state is liminal, being not quite liquid and not quite solid. To travel through a pipeline, the conventional method of transporting oil, this unconventional oil source must first undergo an energy-intensive transformation to be rendered liquid. However, growing contestation over the expansion and construction of pipeline infrastructure has led to an impasse, whereby rendering bitumen into liquid phase no longer ensures its flow. Thus, while our focus is not on media in the conventional sense, we are concerned with the processes and forms of mediation whereby human beings come to be in relation to (and through) materials such as bitumen.¹¹ In what follows, we briefly describe the emergence of this curious material and explore three possible categories for approaching it: sabotage, format, and containment.

Solid-Phase Bitumen

The most prominent method for transforming bitumen into solid, self-contained units is being developed by the Canadian National Railway Company (CN) and is patented as CanaPux. This method involves shaping bitumen into semisolid pucks by mixing and coating it with a hydrocarbonaceous polymer shell. The shell seals the bitumen, creating pucks that are water resistant, buoyant, and have a nonstick surface. Upon delivery at refineries, the pucks must be shredded and heated to separate the polymer from the bitumen, thus introducing the need for additional processing, recycling, and transportation infrastructures. Seven months after the CanaPux patent was filed, Ian Gates, a professor of petrochemical engineering at the University of Calgary, announced another method of solidifying bitumen. While working on ways to *upgrade* bitumen—to render it lighter and *less* viscous—he unintentionally discovered a way to *degrade* it into solid pellets. Gates’s bitumen pellets are referred to as “self-sealing” because they do not require additives to form their seal. Instead, the pelletizing process invented by Gates uses heat to separate lighter petrochemicals from the bitumen and pressure to seal the more viscous remainder in a membrane of polymerized bitumen that encases the pellet. Gates describes these self-sealing pellets, marketed under the name Solideum BITTS, as being “like a black Advil pill.”¹² The pellets are promoted as more efficient than CanaPux (because they do not require polymer additives), are readily produced in the field, and use less energy in transport (because they do not require additional heat to hold their form).¹³ A third version of solid-phase bitumen, marketed as BitCrude, has been developed by Alberta entrepreneur Cal Broder. BitCrude is produced by heating diluted bitumen, removing the separated diluent, and pouring the remaining liquefied bitumen into specialized containers where it cools and solidifies in brick form.¹⁴ The resulting product has been described as “semi-solid blobs” of “butter-like crude.”¹⁵

By transforming bitumen from a viscous liquid into a solid, these methods render it akin to granular or bulk commodities such as grain and coal. In solid, self-contained form, bitumen pucks, pellets, or bricks can be handled, transported, and stored using techniques and infrastructures similar to those used in transporting these other commodities. Rendered into granular form, self-contained bitumen can be poured into secondary containers—trucks, railcars, freighters—for relatively safe, long-distance terrestrial and marine transportation to continental or offshore refining facilities. Solideum BITTS, for example, are promoted as “tough little heat-sealed bitumen balls that are easily transported by standard railcar or truck and then processed as usual at end market.”¹⁶ Each of the newly invented techniques for

processing bitumen promises to reduce the environmental risks associated with transporting liquid bitumen—that is, leakage, spill, and ignition. As a sealed solid, a bitumen puck, pellet, or brick will not leak, spread, or saturate in the manner of oil in liquid phase. If accidentally dumped into a body of water, the pucks, pellets, or bricks will float for easy retrieval by skimming, their toxicity safely contained by their membranes. Finally, while still flammable, their polymer coating makes them less liable to accidental ignition and combustion than liquid hydrocarbons. According to CN, its bitumen pucks are “environmentally inert and in the event of an incident, CanaPux pellets would simply need to be picked up.”¹⁷ Similarly, BitCrude is presented as drastically reducing the potential for soil or water contamination in the event of accidental release: the “semi-solid pieces of crude oil can be retrieved with absolutely no environmental damage.”¹⁸

In these ways, solid-phase bitumen represents a technical solution to the various environmental hazards involved in the transportation of liquid oil and could thus obviate transportation regulations—such as the recently imposed tanker moratorium along British Columbia’s north coast—imposed to address such hazards.¹⁹ However, along with being a technology that solves an environmental problem, solid-phase bitumen is also a technology that solves a political problem—and, in so doing, perpetuates an environmental hazard arguably greater than that posed by spills, leaks, and fires. Crucially, solid-phase bitumen promises to enable the transportation of bitumen without pipelines. CN, a railway company that plays a central role in the logistics of commodity transportation in Canada, speculates that CanaPux will “unlock” new supply chains, and the company explicitly proposes transportation of bitumen by rail as the solution to pipeline bottlenecks.²⁰ Petroleum producers and supportive governments in Canada have long argued that economic exploitation of the Athabasca oil sands has been hampered by limited pipeline capacity and by the difficulty of building new pipelines in the face of political opposition from environmentalists, Indigenous peoples, and other groups.²¹ Indeed, this conflict has become a structural feature of contemporary Canadian politics.²² Solid-phase bitumen—a (self-)container that could unleash the economic potential of bitumen extraction from the political forces that have otherwise been containing it—appears to present a solution. CN’s interest in developing this material reminds us that, even if solid-phase bitumen contains *itself* primarily, it still requires *secondary* containment for transport. In 2018, CN (Canada’s largest railway) set a record for crude-by-rail shipments, largely owing to the



Above: Innovate Calgary. Solideum BITTS bitumen pellet, 2017.

Opposite: Cal Broder. Bitcrude bitumen brick, 2018.



continued inadequacy of pipeline capacity, and announced a record \$3.5 billion capital expenditure on railway construction for 2019.²³ Soon thereafter, the Government of Alberta announced a three-year, \$3.7 billion commitment to lease “state-of-the-art” rail cars to move 120,000 barrels per day—currently price-distressed and stranded due to pipeline backlogs—to coastal ports.²⁴ The government has indicated that transporting liquid bitumen by rail is not a viable long-term solution to the problem of stranded barrels, partly because of environmental risks associated with this mode of transport. The advent of self-contained, solid-phase, “environmentally inert” bitumen could alter this calculus, especially if the infrastructure for its secondary containment and transport is already in place. That said, solid-phase bitumen is an emergent entity that should be handled with care, especially prior to its entanglement in the relations that will establish its presence. For now, we can only speculate on the terms that might best orient us as we attempt to figure out what solid-phase bitumen is, what it is for, and what it does.

Sabotage

In his groundbreaking account of sabotage in the history of fossil fuel extraction and so-called carbon democracies, Timothy Mitchell shows how sabotage has been central to the entwined histories of carbon energy and the democratic welfare state.²⁵ Organized workers in the late nineteenth and early twentieth centuries leveraged their power to sabotage the movement of coal in order to extract political and economic concessions from capital. Capital responded by sabotaging this source of workers’ power, turning to an energy commodity—oil—whose material properties allowed for circumvention of the manual labor required for its transportation, diminishing the political potential of disruption. Mitchell’s account teaches us that the politics of sabotage concerning energy commodities relies heavily on the material properties of those commodities and the corresponding configuration of infrastructures for transporting them.²⁶ As a solid, coal was moved

by human labor, either manual or mechanized, and the trucks and railcars by which it was transported were vulnerable to sabotage by strike, fouling, or blockade. Oil, in its fluidity, required relatively little human labor to flow via pipelines and tanker ships configured to minimize the potential for disruption, thereby serving as technologies of capitalist sabotage of workers' power.

In North America, the efficacy of oil and gas pipelines as infrastructures immune to sabotage has waned considerably. This is not because operating pipelines have been subjected to sabotage by workers but because proposals to expand pipeline networks give environmental, Indigenous, and community activists the opportunity to disrupt continued expansion of the fossil-fuel economy by obstructing construction of the infrastructure needed to bring unconventional hydrocarbons to market.²⁷ These obstructions take forms that include public advocacy, regulatory intervention, legal challenges, and direct action. Once inside a pipeline, flowing oil is difficult and dangerous to sabotage. But it cannot flow *without* a pipeline, and so approval and construction of new pipelines have emerged as sites of considerable sabotage potential.

Solid-phase bitumen is similarly a political technology of sabotage—in this case, an attempt by capital to sabotage the success of social movements in contesting pipeline development as a means of disrupting the fossil-fuel economy.²⁸ According to Mitchell, “oil pipelines were invented as a means of reducing the ability of humans to interrupt the flow of energy.”²⁹ The same would seem to be true of solid-phase bitumen. What is interesting in this case is the way in which the current sabotage by industry relies precisely on inverting the material basis of the original efficacy of pipelines as media of capitalist sabotage; namely, oil's fluidity. Coal was vulnerable to workers' sabotage because it was solid and its infrastructures presented multiple points and modes of disruption. Oil circumvented this because it was fluid, and pipeline infrastructure enabled uninterrupted point-to-point transmission. This fluidity becomes a liability under conditions where political actors are able to halt or delay construction of the pipeline infrastructures through which oil must flow. The sabotage solution represented by self-sealing bitumen is to render it into a solid that has no need for pipelines, an environmentally stable material that does not need to flow to become a commodity, thus becoming more liquid than liquid. Solid coal was replaced by fluid oil in an act of sabotage, and now fluid oil becomes solid so that it might “flow freely.” As Ian Gates notes concerning Solideum BITTS, “Our thought is that if you are transporting it to the west coast, you would use coal cars, and then you would use a coal terminal and you could put them in any ship that can hold coal. . . . For us, it just pours out like coal.



Canadian National Railway Company. CN railyard as shown in CanaPux promotional video, 2018.

It's a granular material."³⁰ Though far from Gates's intention, it is tempting to consider whether, even as it circumvents disruptions in the transportation of diluted bitumen by underground pipeline, solid-phase bitumen transported over land by rail might reactivate sites and modes of sabotage that once belonged to the logistics of coal transport. Another possibility is that shippers will develop other logistical techniques for reducing the friction that solid-phase bitumen conveyed by rail might otherwise be exposed to in supply chains.³¹ As Gates adds, "You could put them into shipping containers, if you wanted."³²

Format

To describe pipelines as media is a straightforward task: pipelines contain, store, convey, conduct, transmit, connect, distribute, and span. In these respects, they are like rivers, canals, railroads, and highways, and also like telegraphy, telephony, portable print media, and wired and wireless digital networks.³³ However, the case of solid-phase bitumen suggests another, more precise, concept borrowed from contemporary media studies: format.

The definitive work on formats is Jonathan Sterne's exhaustive study of the MP3 format for sharing digital audio files.³⁴ A format is a codified, typically standardized, arrangement of the material properties of a thing. Formats become especially meaningful in relation to things that are meant to be distributed, shared, and used across contexts. Formats are generally understood to be technical, which means they are socially produced and contingent, not naturally given and necessary. On some level, formats are intentional, though the lines between the intentions of *formation* and its social outcomes are broken and multiple. Sometimes formats are adapted to the infrastructure or medium through which the thing passes or is accessed for use; sometimes media and infrastructure are adapted to format. What matters is that they are effective only together. And formats become present in the context of a broad range of social, political, economic, and cultural conditions, interests, and relationships—contexts into which formats themselves also intervene. This interplay of the material, technical, and social aspects of formats changes over time, taking new shapes and retaining the residues of old ones. This makes formats political, in several ways: formats arise at least partly from decisions

that could have been otherwise; they bear the marks of the politics of their formation; and they make a difference in social relations and possibilities.

Just as the MP3 format is “a technique for storage and movement of audio,” bitumen pucks, pellets, or bricks are formats, codified arrangements of matter, techniques for the storage and movement of oil.³⁵ Sterne writes, “Encoded in every MP3 are whole worlds of possible and impossible sound and whole histories of sonic practices.”³⁶ This suggests the following modification: encoded in every unit of self-sealing bitumen are whole worlds of possible and impossible energy and whole histories of energetic practices. To treat solid-phase bitumen as a format is to discern those histories and possibilities through detailed examination of the material, technical, social, economic, and political relationships it encodes, the habits sedimented in and by it, the infrastructures with which it interacts, the protocols that result from that interaction, and the ways those protocols operate politically. It is to acknowledge that “the stories we tell about formats matter” and to attend to “the big questions that live inside a diminutive format.”³⁷

The most conspicuous feature of bitumen pucks, pellets, and bricks as potential formats for oil is their solidity, which reverses the story typically told about oil’s liquidity. Liquidity refers both to the fluid material properties of a liquid and to an asset’s availability for conversion to cash in a market. In Mitchell’s account, oil’s liquidity in the first sense ensured its liquidity in the second sense, by enabling it to flow through pipelines, past the obstructions to which coal, as a solid, was vulnerable. In the case of bitumen, rendering it into a format compatible with the established protocols of pipeline infrastructure requires that it be *made liquid* by the technical addition of diluent, a thinning agent that allows viscous bitumen to flow through pipelines. However, if pipelines cannot be built, oil’s liquidity in the first sense—its fluidity—undermines its liquidity in the second sense (hence the frequent description of Canada’s bitumen as stranded, distressed, or landlocked). Ironically, in this context, it is oil’s fluidity that prevents it from *flowing*. To become liquid in the sense of a fungible asset, bitumen has to be made solid (and buoyant and impermeable), which is what the techniques of self-sealing are meant to achieve. Bitumen’s liminal “natural” state—not quite fluid, not quite solid—opens it to formatting in each of these ways, as dynamic material and political contexts demand.

Beyond solidity, the ultimate format of self-sealing bitumen—pucks, pellets, or bricks; chemically or thermally sealed—is presently undetermined. And while the outcome is impossible to predict, it will be decisive to the future of this resource and the relations surrounding



Canadian National Railway Company. CanaPux in production at InnoTech Alberta lab, as shown in promotional video, 2018.

it. The MP3 file format relies on encoding at one end of the infrastructure by which it is distributed, and decoding at the other, according to standardized protocols without which the files would be useless and without value. Once these protocols were established, entire systems of ancillary technologies, infrastructures, expertise, practice, and use grew to support and capitalize on the particular manner in which the formatted files could be encoded and decoded. Advantageous positioning in this system is a source of wealth and power. As Sterne's account of the MP3 shows, the establishment of the format and accompanying protocols was not the result of an objective calculation of technical efficiency but the contingent outcome of a social and political struggle between the actors who were invested in it.

The same will be true of solid-phase bitumen. Whether pucks, pellets, bricks, or something else, it will have to be encoded and decoded, according to standardized protocols that will be key to its value. Bitumen pellets will need machines to produce them, locations and mechanisms to accumulate and distribute them, containers to store and transport them, infrastructures to carry those containers, and devices to convert them to usable material. These will be sources of wealth and power. All of this will depend on their format, and the protocols attached to it, which will be the result of a contest between actors struggling for advantageous position. Cal Broder, the inventor of BitCrude, says,

We have developed a process that allows us to alternate it between its solid state of butter and its liquid state of butter. And we get to control when it becomes a liquid, and that's very crucial in the transportation because we can transport it as a solid and transfer it between processes as a liquid.³⁸

The control to which Broder refers is contingent on establishing "butter" as the standard format for solid-phase bitumen. Whether this will happen remains to be seen. That one of the companies seeking to establish the format of self-sealing bitumen is a railway company (not a pipeline company) is not without significance. Control over formats and protocols—the ability to require that a thing be configured in a particular way as a condition of its distribution and therefore its value—is one of the ways that "carriage" (or distribution or infrastruc-

ture) companies have historically sought to enforce their interests over “content” providers. This, in turn, is why formats, standards, protocols, and infrastructure are often (though not always) regulated in the public interest: they are a potential source of cascading power. The railway company that will transport solid-phase bitumen in rail cars has a vested interest in pucks, not butter.

Moreover, the history of oil as a commodity is one in which the format of its medium of containment, storage, and transportation—namely, the barrel—became a unit of measure inextricably related to the circulation of information about oil in the form of price. As Brian Jacobson shows, while barrels began their career as a format for containment, storage, and transportation, they came into their own and have persisted as a standardized unit of price, or information, whose relationship to the material capacity of actual barrels is strictly conventional.³⁹ In 1905, steel drums with a 55-gallon capacity became the standard for transport, but the earlier, now obsolete barrels’ 42-gallon capacity remained (and remains) the standard unit of pricing. Barrels are now seldom used to contain and convey oil, because other, more efficient and stable, media have taken their place, but the barrel as a format for *information* about oil remains the global standard. Jacobson writes of this transition, “The barrels people used to hold oil were no longer the barrels they used to talk about it. A barrel became a quantity of oil futures sold, or crude spilled, or latent energy stored.”⁴⁰ To be quantified for speculation and priced for exchange, liquid commodities need to be rendered into standardized units in which the media of their containment are implicated in complex ways.⁴¹ One question we might ask about solid-phase bitumen is whether and how it might be implicated in the politics of pricing bituminous oil. Will self-contained bitumen become a new unit of measure to which price can be attached? Will solid-phase bitumen be converted into barrels (as a measure, if not a container) and, if so, at what rate? Will they be weighed or counted? How will the specifics of the physical format of the pucks, pellets, or bricks relate to this rate of conversion, and what politics and infrastructures of standardization will be engaged to determine this, with what implications for how we think about and act in relation to oil?

Containment

The key to the technical solution provided by the technology of solid-phase bitumen is its solidity. Solidity lends bitumen the characteristics of granular and bulk commodities, qualities that are crucial to the politics of contesting oil’s flow. Rendering and maintaining the solidity of bitumen is an active process whereby a hardened shell *holds* viscous bitumen inside. Taking seriously this action of *holding*, we

suggest that bitumen pucks, pellets, and bricks can be analyzed as containers. On the premise that containers are essential media of energetics—that potential implies prior containment—it is advisable to think through *what* and *how* solid-phase bitumen contains.

In his essay “The Thing,” Martin Heidegger fixes on the figure of the jug. The status of the jug as a thing, he explains, resides in its being a vessel that contains. The jug’s holding function is performed not by its impermeable bottom or sides but by the emptiness or void the jug creates. This void *holds*, he explains, “first by taking what is poured in” and then “by keeping and retaining what is taken in.”⁴² The twofold holding action of taking and keeping is completed by a third action when what is contained gushes out, which Heidegger refers to as the “outpouring.” In her feminist account of containers, Zoe Sofia draws on Heidegger to connect the idea of outpouring to the notion of supply, suggesting we might interpret the jug as a “technology of re-sourcing: it can be filled from a source, then itself becomes a source of what it has kept and preserved.”⁴³ Containers are resource technologies on which extractive economies rely.

Analyzing solid-phase bitumen as a form of containment brings our attention to pelletizing as a process of mediation.⁴⁴ As Sofia argues, containment is a complex form of mediation in which the twofold action of taking and holding already implies the third action of outpouring. This is characteristic of solid-phase bitumen. The shell takes the viscous bitumen and holds it over time and in space. By taking and holding the viscous oil in a shell, solid-phase bitumen changes the way the commodity can be handled, managed, stored, and transported. In containing oil’s liquidity, solid-phase bitumen allows it to move and rest in ways that it otherwise could not: transported by rail, truck, or maritime vessel and stored in warehouses, free-standing piles, or silos. However, that is not the end of the mediating process of containment. The twofold action of taking and retaining is completed in outpouring, which occurs once the bitumen is delivered to points of processing and refining, where the bitumen is reconstituted as a liquid commodity. This is what solid-phase bitumen *as a container* is for. As a container, the essence of solid-phase bitumen is not fulfilled in its taking and safe holding of toxicity but in the supply of bitumen as resource; that is, in the outpouring of bitumen’s toxicity at a time and place determined by capital. Multiple press images show the pucks, pellets, and bricks being handled, emphasizing precisely the moment of holding. However, as a medium of containment, solid-phase bitumen is a technology for unleashing the hazards of oil, not withholding them.

To reiterate: Containers are intended to hold, but holding is destined for the outpouring. However, the nature of the outpouring might

vary from one format to the next. The conceit of containment isolated from extraction and expenditure is precisely the grounds for CN's extraordinary claim in its promotional materi-



als that CanaPux are “environmentally inert,” as well as BitCrude’s claim that accidental releases cause “absolutely no environmental damage.”⁴⁵ Promoters of these formats seek to focus environmental and political concern on the moment of transportation because it is there that the apparent physical containment of bitumen’s toxicity can do the political work of containing opposition to oil sands development more broadly. However if, following Heidegger and Sofia, we see that containment necessarily mediates between extraction and expenditure then, as containers, CanaPux and BitCrude (formats primarily aimed at markets for bitumen as a fuel source) are far from environmentally inert. In both cases, their contents are destined for combustion. This might not be the case for Solideum BITTS. Here, the case for the environmental benefit of solid-phase bitumen rests not only on safety and efficiency in transport but on a projected expenditure that does not (directly) involve combustion: paving. As Ian Gates told us, “We think it is a better feed stock for asphalt. At the end of the day, our product being a feedstock for asphalt, you’re fixing the carbon. There is no combustion of this product afterwards. We don’t burn it.”⁴⁶ Gates estimates that the global market for asphalt is growing by around 4 percent annually, largely owing to massive infrastructure investment in the Global South. “We keep laying more and more asphalt on roads and creating more and more roads on this planet,” Gates reasons, adding, “These are controlled oil spills, really.”⁴⁷

The conceit of containment attached to solid-phase bitumen, in any of its potential formats, arises from claims about its impermeability. As an impermeable medium for viscous oil, the shell purports not only to contain the liquid bitumen but, in doing so, to contain the environmental, political, and economic risks of spills, leakage, and other forms of unwanted disruption attached to pipelines, tankers, and barrels, and even to combustion itself. In order to explore the promise of self-containment in all of its material relationality, we can draw on insights from work in feminist new materialism. These insights direct our attention to the manner in which materials can be treated as agentially real—as doing things, as being part of, rather than apart from, complex and consequential assemblages of human and nonhuman entities in which the part played by human beings cannot be prejudicially determined to be the only or decisive one.⁴⁸ From this

Above: Michelle Siu. Early CanaPux prototype, shaped cylindrically and evocative of hockey puck, 2017.

Opposite: Canadian National Railway Company. Later rectangular-shaped CanaPux, more efficient for packing and storage, 2018.



perspective, claims about impermeability and self-containment are inherently unstable.

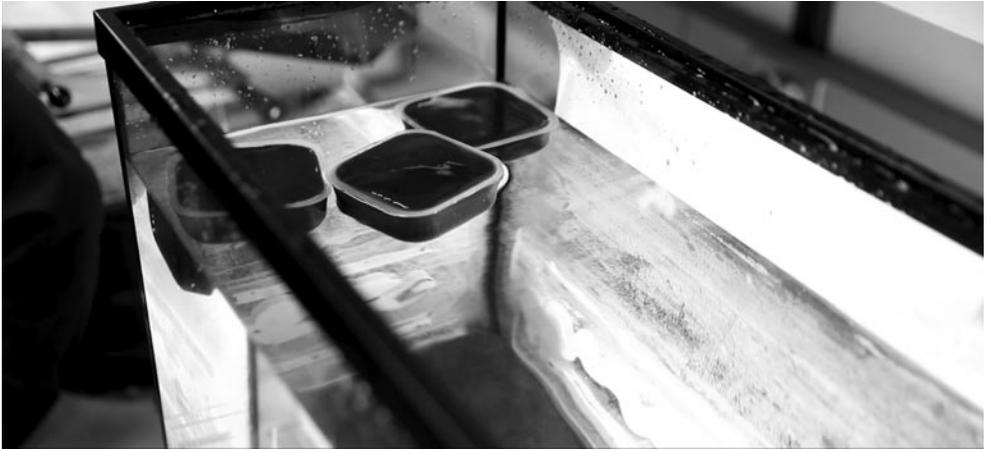
Stacy Alaimo, for instance, characterizes impermeability as a fantasy associated with the sovereign, autonomous, individual,

masculine subject of capitalism.⁴⁹ In the context of the warming climate and intensifying environmental toxicity of the Anthropocene, Alaimo and others criticize the ethos of impermeability as increasingly untenable.⁵⁰ Instead, she advocates for a posthumanist, feminist, and queer environmental ethics that operates on the understanding that all bodies—both human and nonhuman—are intrinsically permeable; that is, subject to material permeation of and by their environment, a condition that calls for an ethics and politics centered on relations characterized by *exposure*.⁵¹

As with many substances rendered toxic through involuntary subjection to human use, the ethos of containment undergirding the dream of self-sealing bitumen runs in the opposite direction.⁵² In her treatment of the repellent, “hydrophobic qualities” of petrochemicals, and their implication in dreams of “perfect containment,” Janine Macleod observes that, “in the context of mounting ecological and social instabilities, the widespread proliferation of impermeable synthetic materials cannot be divorced from a powerful impulse to keep the shared world out.”⁵³ This impulse certainly applies to self-sealing and solid-phase bitumen, which purport to contain the environmental and political risks associated with the transportation of viscous bitumen.

In CN’s CanaPux promotional video, bitumen pucks are shown floating in clear water. The pucks’ hydrophobic and self-contained character is key to what a representative of Toyo Engineering, the firm hired to build CN’s pilot project, calls their “environmental reduction.”⁵⁴ The fusing and coating of bitumen with polymer illustrates what Heather Davis refers to as the “desire to coat the world in plastic.”⁵⁵ As a substance, plastic exemplifies this dream of impermeability, she explains; it is designed, at its molecular level, to be self-contained. While Alaimo articulates an ethics of exposure or permeability, Davis emphasizes the ways we are already intimately entangled with plastics and polymers and urges us to relate to these substances as being, much like ourselves, the progeny of petrocapi-talism.

Inspired by this and by Kim Tallbear’s work on pipestone as kin in Dakota territory, Metis anthropologist and fish philosopher Zoe Todd explores the complex status of “oil as kin” in recent work focused on the territories where the Athabasca bitumen fields are located. For Todd,



this reflection was prompted by a 2016 spill of 200,000 liters of diluted bitumen into the *kisiskâciwani-sîpiy* (North Saskatchewan River). As she observes, “Beyond the spill’s technical and infrastructural impact, the oil and diluents killed many more-than-human beings within the river.”⁵⁶ Todd’s is a beautiful meditation on the various forms of relationship between bitumen as fossil fuel, the elements of its geography, and the ecologies it shares with a diversity of human and nonhuman creatures:

The fossil fuels which animate the political economy of my home province are a paradoxical kind of kin—the bones of dinosaurs and the traces of flora and fauna from millions of years ago which surface in rocks and loamy earth in Alberta act as teachers for us, reminding us of the life that once teemed here when the place that we know as Alberta was home to myriad species who made life, made worlds, within lands and waters I now know as *pehonan*. But, the insatiable desire to liberate these long-gone beings from their resting place, to turn the massive stores of carbon and hydrogen left from eons of life in this place, weaponises these fossil-kin, these long-dead beings, and transforms them into threats to our very existence as humans in prairie metropolises like my home town.⁵⁷

The weaponization of fossil fuels, their “liberation” from rest, requires containment. Todd suggests that dewatering our relations to oil may require raising a different set of questions. “What does it mean,” she asks, “to approach carbon and fossil beings, including those spilled into the *kisiskâciwani-sîpiy*, as agential more-than-human beings in their own right?”⁵⁸ She suggests it means approaching bitumen as kin and, in doing so, understanding that the dominant relationship of weaponized toxicity is but one among many imaginable alternatives, a field of “messy and paradoxical” possibilities she describes as “oil/gas pluralities.”⁵⁹

She observes that “it is not the oil itself that is harmful” but the extraction, transportation, refining, and consumption of these “oily progeny” by the extractive petrocapitalism of the settler-colonial state that make them “a weapon against fish, humans, water and more-than-human-worlds.”⁶⁰ Searching for a path out of this assemblage to

Above: Canadian National Railway Company. CanaPux floating in a tank of water, as shown in promotional video, 2018.

Opposite: Marlin Olynyk. Protestors demonstrate against expansion of the Trans Mountain Pipeline, Burnaby, British Columbia, Canada, 2016. Owned at the time by Kinder Morgan Energy Partners, the pipeline has since been purchased by the Canada Development Investment Corporation, which is owned by the Crown and accountable to Parliament; Prime Minister Justin Trudeau has announced plans to proceed with the expansion.



“other worlds” in which our relations with bitumen might be otherwise, Todd issues a plea not to forget “to tend with care to the oil, the gas and all of the beings of this place . . . to tend to relationships, to ceremony (in all the plurality of ways this may be enacted), to the continuous co-constitution of life-worlds between humans and others.”⁶¹ Drawing on Blackfoot scholar Leroy Little Bear, Todd reminds us that we live within already “narrow conditions of existence” that are growing ever more narrow in the context of the “so-called Anthropocene.”⁶² Her piece ends with the hope that settlers, like ourselves, will come to appreciate that “tending to [the] reciprocal relationality we hold with fish and other more-than-human beings” is essential to sustaining these increasingly precarious conditions.⁶³

Approaching solid-phase bitumen as sabotage, as format, and as container requires that we take seriously the contingent materiality of bitumen, as well as the complex human and nonhuman reciprocal relations that constitute what it is, what it becomes, and what it does in any given context. To figure that out, we will have to attend to solid-phase bitumen in all its complex materiality, which will include reckoning with the agency and relations of the many human and non-human entities whose actions must combine for them to become what they will become, to do what they will do, and to mean what they will mean. This might require letting go of the conceit of containment and the plastic fantasy of impermeability on which it relies.

Notes

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4. For a paradigmatic example, see Friedrich A. Kittler, *Gramophone, Film, Typewriter*, trans. Geoffrey Winthrop-Young and Michael Wutz (Stanford, CA: Stanford University Press, 1999).
5. Hans Ulrich Gumbrecht, *Production of Presence: What Meaning Cannot Convey* (Stanford, CA: Stanford University Press, 2004). 19.
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44. On mediation, see Kember and Zylinska, *Life after New Media*; and Richard Grusin, "Radical Mediation," *Critical Inquiry* 42, no. 1 (2015): 124–48.

45. "CanaPux," CN Innovation; and "Environmental Responsibility," BitCrude.

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49. Stacy Alaimo, *Exposed: Environmental Politics and Pleasures in Posthuman Times* (Minneapolis: University of Minnesota Press, 2016), 4.

50. See Joanna Zylinska, *Minimal Ethics for the Anthropocene* (Ann Arbor, MI: Open Humanities Press, 2014); and Barad.

51. Alaimo, 94.

52. See *Containment*, directed by Peter Galison and Robb Moss (Redacted Pictures, 2015), 82 mins.

53. Janine Macleod, "Holding Water in Times of Hydrophobia," in *Petrocultures*, 275.

54. "CanaPux," CN Innovation.

55. "Heather Davis: The Queer Futurity of Plastic," video, 34 min., recorded 28 February 2016 at De Brakke Grond, Amsterdam, posted to Vimeo by Sonic Acts, 2016, <https://vimeo.com/158044006>.

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57. Todd, "Fish, Kin and Hope," 104.

58. Todd, "Fish, Kin and Hope," 106.

59. Todd, "Fish, Kin and Hope," 107.

60. Todd, "Fish, Kin and Hope," 107.

61. Todd, "Fish, Kin and Hope," 107. This comports readily with something Sterne writes about formats: "the mediality of the medium lies not simply in the hardware, but in its articulation with particular practices, ways of doing things, institutions, and even in some cases belief systems." Sterne, 10.

62. Todd, "Fish, Kin and Hope," 107.

63. This call to tend to relationality in matters of resource extraction is echoed in the work of Emilie Cameron. She explains how, when Inuit gather to discuss proposed mine developments on their lands in Nunavut (in northern Canada), they do so by telling stories about "how life is made and sustained through the relations and practices we foster, and those we undermine." Likewise, they ask questions of mineral development such as how particular mining projects will "support and sustain life, and if so, what kind of life, for whom, and on whose terms?" Emilie Cameron, *Far Off Metal River* (Vancouver: UBC Press, 2015), 109–10.