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The East Palestine train derailment is the story that won't go away. Images of enraged residents shouting at company executives and government officials about the inadequacy of the response remind us all that across our vast industrial economy accidents of one sort or another are always waiting to happen while private firms and the agencies that are supposed to regulate them are too often asleep at the switch.

The train was carrying various hazardous substances, including vinyl chloride – a known human carcinogen. Vinyl chloride is widely used in the manufacture of polyvinyl chloride or PVC that is ubiquitous in our built environment (all those hard white plastic pipes you see). Given the massive growth in plastics production across the U.S., and especially in Ohio, there are literally millions of gallons of such chemicals moving across the region's rail system on any given day.

The most worrisome aspect of the East Palestine train derailment involved five derailed tanker cars that contained some 116,000 gallons of vinyl chloride. In the immediate aftermath of the derailment, Norfolk Southern and its hazardous

materials contractor decided to drain the five tanker cars into a ditch to avoid an explosion. They then performed what was referred to as a "controlled venting" or a "controlled release," even though it sounded more like an open-air burn of a large volume of toxic chemicals. While this may have been the right move in terms of emergency response, Norfolk Southern as well as state and federal regulators did a terrible job explaining the risks and benefits of the decision. You don't have to be a chemist to recognize that burning something like vinyl chloride is probably not a great idea and should be avoided if at all possible. Images of a dark toxic cloud rising over people's houses have rightly raised serious concerns about contamination and health effects. And when the government keeps telling people that everything is OK, that the toxic substances of concern have not exceeded safe levels, while these very same people are getting sick and watching fish kills happen in real time, they rightly lose trust. As one woman shouted at a meeting of residents shortly after the burn (a meeting that Norfolk Southern executives planned to attend but then bailed out of citing safety concerns): "Why are people getting sick if there's nothing in the air or water."

Exposed families have reported a range of troubling symptoms, including coughing, headaches, nausea, fatigue, and rashes. Doctors are apparently at a loss as to how to advise them because no one knows what these people were actually exposed to. Going forward these people are looking at a lifetime of questions about whether and how the toxic substances they have been exposed to will manifest as cancer or some other dreaded disease in the future. This kind of slow violence can produce collective trauma for communities that is compounded when the government seems unsteady in its efforts to protect public health.

The legal and political responses to the accident have been predictable. The state of Ohio has just filed suitagainst Norfolk Southern. A class action lawsuit is taking shape. A bipartisan group of Senators has introduced new legislation reforming railway safety. And hearings are being held, including a hearing before the Senate Environment and Public Works Committee on Thursday featuring Senators from Ohio and Pennsylvania, Norfolk Southern CEO Alan Shaw, state and federal environmental regulators, and first responders. During the hearing, another Norfolk Southern train derailed in Alabama, which Senator Whitehouse pointed out in his sharp questioning of Shaw. Fortunately, that train was empty and no one was hurt. But the irony of another derailment happening at the precise moment that the Norfolk Southern CEO was talking about how safety is his number one priority and how he is committed to making things right was hard to miss.

Two competing narratives have taken shape in the wake of the disaster and were very much on display during the Senate hearing: (1) big rapacious corporations taking advantage of deregulation to cut corners, fire workers, and enrich shareholders, which has endangered people and communities and (2) an inadequate and bungled response by EPA and state agencies, particularly regarding timely communication about the actual risks that are present and testing, which has further undermined the trust that people have in their government.

Vinyl Chloride, Dioxin, and The Airborne Toxic Event

The human health concerns here are potentially quite serious. This has been compounded by the state and EPA's bungled initial response. Residents are rightly furious, even in the face of repeated statements by regulators and company officials that East Palestine is safe.

Vinyl chloride itself, as noted, is a known human carcinogen and has been linked to liver cancer in workers around the world as well as brain cancer, lung cancer, lymphoma, and leukemia. As an industrial chemical, vinyl chloride was one of the 62,000 chemicals "in commerce" at the time that the Toxic Substances Control Act (TSCA) was enacted in 1976, which means that it was essentially grandfathered in under the statute and presumed to be safe unless and until EPA made a finding of "unreasonable risk." To date, vinyl chloride has never been subject to regulation under TSCA's program for existing chemicals, despite repeated calls from environmental groups and others to do so (including recent calls to classify vinyl chloride as a high priority chemical under the new TSCA framework that Congress adopted in 2016). EPA's efforts to regulate vinyl chloride as a hazardous air pollutant under section 112 of the Clean Air Act also went on for more than a decade and was ultimately a big part of the reason why Congress overhauled that section of the statute in the 1990 amendments.

Because vinyl chloride evaporates quickly when exposed to air and breaks down after a few days, the main health concerns regarding East Palestine have focused on what happens when you burn a large volume of vinyl chloride in the vicinity of a residential neighborhood. In that respect, the two main substances of concern following the burn that were reported in the press were phosgene (a toxic gas used as chemical weapon in World War I) and hydrogen chloride. More recently, attention has shifted to dioxins—a class of chemical compounds, the most toxic of which is 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (commonly referred to as TCDD). According to the National Research Council, TCDD, or what is often just called dioxin, "is among

the most toxic anthropogenic substances ever identified" and has been implicated in various high-profile industrial disasters, such as Times Beach Missouri as well as the tragedy of Agent Orange. Some have referred to dioxin as the Darth Vader of chemicals because of the many cancer and non-cancer health effects that it is linked to. Dioxin is also extremely persistent in the environment and it bioaccumulates. According to the EPA, it is "commonly found" at hazardous waste sites across the country.

EPA started investigating dioxin risks in the mid 1980s and initiated a formal re-assessment of dioxin in 1991. In 2012, more than twenty years later, EPA released its final draft non-cancer risk assessment. At the time, EPA stated that the cancer risk reassessment would be finalized "as expeditiously as possible." To date (thirty-two years after it initiated its formal reassessment of dioxin!), EPA has still not released its final cancer risk assessment and has given no indication of when it expects to do so. The story behind the delay is complicated and demonstrates fundamental problems with EPA's approach to risk assessment (a topic that will have to wait for a future post), but much of it boils down to the agency's inability to bring risk assessments to an end, an outcome that is all too often in the interests of the regulated community. In the dioxin case, much of the delay has been caused by disputes over the shape of the dose-response curve at very low levels of exposure, the specific biological mechanisms involved, and whether dioxin is an initiator or a promoter of cancer. These uncertainties may never be resolved. Meanwhile, the risk assessment process soldiers on, unable to delivery useful and timely results for regulators.

What is virtually certain is that dioxins were produced when the vinyl chloride was burned in the wake of the East Palestine derailment. But no one can say how much or what may have happened to these dioxins in the wake of the burn because there was no testing done for dioxins for four weeks after the accident. Finally, on Friday March 3rd, EPA ordered Norfolk Southern to test for dioxins, even though the community had asked for this from the beginning. In explaining the lack of testing, EPA Region 5 administrator Debra Shor told Senator Capito at last Thursday's Senate hearing that because EPA found very low levels of phosgene and hydrogen chloride in their initial testing, there was a very low probability that dioxins would be present. But that is hardly a reason not to test for the chemicals that people are most concerned about. If immediate testing for dioxins had been performed and demonstrated that this was not something to worry about, that would have been a huge relief for the community. The fact that it took a month to order the testing

demonstrates a massive misunderstanding of the whole point of monitoring and testing as part of any comprehensive response to such an event. Simply put, monitoring and testing are not just technical exercises, but are highly charged parts of any response to any release of toxics that are absolutely essential for people to feel safe.

Extensive air, water, and soil sampling do now seem to be in place. Data are being made available in close to real time. All agencies have committed to a long-term monitoring program for the region. Initial reports on dioxin sampling of some of the dirt removed from the site for transport to hazardous facilities in other states have not reported concentrations at levels of concern. Results from broader dioxin sampling of the surrounding area have not yet been released.

Regardless of what those tests show, however, residents will likely continue to wonder if anything was missed in the month-long delay. They will continue to question whether the headaches, coughs, rashes, and other symptoms they have experienced are only temporary or harbingers of more chronic illnesses in the future.

Jumping the tracks: deregulation, normal accidents, and toxic ignorance

From a regulatory perspective, what happened in East Palestine can be seen as a convergence of two trends over the last forty plus years: (1) railroad deregulation and (2) the inadequacy of our existing laws regulating toxic substances, including emergency response.

On the first, these is no question that railroad deregulation has encouraged Norfolk Southern and other large rail companies to focus on cutting costs and increasing profits at the expense of much-needed investments in infrastructure and safety. To take one example, in recent years, the railroad industry has adopted so-called Precision Scheduled Railroading (PSR)—a scheme promoted by activist Wall Street investors to increase efficiency and on-time deliveries while reducing costs and juicing profits. In reality, this has meant longer trains, fewer engineers and other key staff, and more pressure to deliver. In addition, the Trump administration's decision to relax the rules for breaking systems on trains that carry hazardous materials – a roll back of an Obama regulation that the Biden administration has so far failed to reinstate – also made an accident like East Palestine that much harder to avoid. On top of all of this, there are fewer railroad inspectors on the beat to make sure that the railroads are following the rules that remain.

Like many of its peers, Norfolk Southern has taken full advantage of deregulation while enjoying the fruits of special privileges and bailouts from the government (see, e.g., the Biden administration's decision in late 2022 to intervene in the railroad labor dispute, which Ohio Senator J.D. Vance characterized at the Senate hearing last Thursday as tantamount to a government bailout). Indeed, over the last six years, Norfolk Southern has reduced its workforce by some 38% as it implemented the PSR program. Meanwhile, profits have soared. The company made more than $3 billion in profits last year. And over the last five years, according to the New York Times, it has returned some $18 billion to shareholders through dividends and stock buybacks—double the amount it has invested in its infrastructure and operations.

When put in that context, this looks like an accident waiting to happen. And the evidence is clear that this is a problem that goes well beyond a single company. Since 2015, there have been more than one hundred railroad accidents involving transport of hazardous substances – about 1 per month—far less than the thousand plus derailments experienced every year, but a shockingly large number when one thinks recognizes how dangerous some of these hazardous materials are. While no one can say that deregulation and the focus on profits caused this particular accident, it is clear that it made such an accident that much more likely.

Second, the East Palestine derailment and its aftermath also illustrate the serious problems that have plagued the federal regulatory approach to toxic substances for decades. Vinyl chloride, as noted, was grandfathered in under TSCA and thus has never been subject to serious regulatory attention under that statute. In terms of the cleanup, EPA also seems to have deferred too much to Norfolk Southern and it's contractors, particularly on testing, which has further undermined trust. The Guardian reported over the weekend on a joint investigation with ProPublica finding that much of the indoor testing that has been performed in the wake of the disaster has been done by Norfolk Southern's long-time contractor, the Center for Toxicology and Environmental Health (CTEH). Questions have been raised about the adequacy of the testing and what conclusions one can draw. According to the report, CTEH has been testing for VOCs only. And yet, both CTEH and Norfolk Southern continue to say on the basis of these tests that residents' homes are "safe." Of course, all they can really say is that the tests they performed did not find any contaminants at levels that are thought to cause harm. Their tests don't tell us anything about the presence of other contaminants. Nor do they recognize that exposures below the levels they detected could be causing harm, especially to sensitive groups. One

thing we have learned over the last half century of environmental law is that nearly all supposedly safe exposure limits for hazardous substances have been reduced as new evidence has documented that harm occurs at lower exposures than previously believed.

The truth is that the regulators don't really know – and can not know – what is safe and what is not in this context. And if they don't test widely and set up a system for long term monitoring, they (and we) will never know and never have the opportunity to learn. This is an abdication of the basic commitment to protect public health that is supposed to be at the core of our environmental laws.

Learning from East Palestine

Stepping back from the East Palestine disaster, there is no question that railway safety and regulation need to be back on the agenda in Congress, but it is difficult to see how far the current bipartisan effort can get in today's polarized environment. At the same time, the Biden administration needs to revisit the Trump roll backs on rail safety and do whatever it can via regulation. As for EPA, if it can't muster a strong response to these sorts of toxic accidents, how can we possibly expect it to do its job when it comes to the longer term challenge of protecting public health from the myriad forms of pollution and toxic substances that are all too common parts of everyday life for many millions of Americans. In a country that has already lost a great deal of trust in government and after four years of relentless efforts by the Trump administration to gut EPA and other agencies, a more coherent and effective response by the government might have reminded people (even and especially in a red state like Ohio) that the government has a vital role to play in protecting public health and safety.

None of which is to say that this is somehow EPA's fault. Make no mistake that the responsibility for this accident lies squarely with Norfolk Southern and the deregulation of railroads that began in the early 1980s. All of which illustrates yet again how important these network industries are to everyday life and how problematic it is to adopt a system of "light-handed regulation" that relies on competition and markets to deliver essential services. Network industries that involve moving massive volumes of hazardous substances through communities like East Palestine need to be regulated for what they are: critical infrastructure.

As for the cleanup, Norfolk Southern will pay for it – that much is clear. CERCLA provides ample authority for EPA to force the company to clean up the site.

Removal and remediation will take time and there will inevitably be problems along the way. EPA, for example, has already been criticized for moving too slowly in directing the removal of contaminated soil from the site. And neither EPA nor Norfolk Southern CEO Alan Shaw was able to say where the contaminated materials were going and how quickly they would all be removed. But this will get sorted.

With respect to the longer term, CEO Alan Shaw has stated repeatedly that the company will stay as long as it takes to "make it right" for the people of East Palestine. But he was evasive at the Senate hearing last Thursday about whether that meant paying for long-term health monitoring and health care for families and providing compensation for losses in property value. One can only suspect that he must have been coached by company lawyers to stay on script (Norfolk Southern is committed to "making it right" was a constant refrain) rather than commit to paying for anything beyond what is required. Years of litigation will likely determine how that plays out.

When the dust finally settles, when the cleanup is finished, when the politicians have moved on to the next crisis, what then will happen to the community of East Palestine—to the people whose homes and lives have been turned upside down? Like so many others living in industrial sacrifice zones around the country and around the world, they deserve not to be forgotten. But more than that, they deserve to know that the government and the companies involved have actually learned from this disaster and are working to adopt the necessary reforms to make sure it does not happen again.