AN ASSESSMENT OF THE CHALLENGES FACING ENVIRONMENTAL REGULATORS IN THE ERA OF ARTIFICIAL INTELLIGENCE

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These days, the terms "emerging tech" and "automotive industry" are being used a lot in the same sentence. As the technologies underlying today's cars and trucks have evolved to become evermore complex and sophisticated, so too have the legal and policy implications underlying these technologies. To date, the most widely debated and discussed topics have been focused on two major issue areas: autonomous vehicles (AVs) and connected cars. With respect to AVs, the debate centers on public safety and the degree to—and manner in which—government regulates AVs to ensure that they do not unduly compromise public safety. On the issue of connected cars, the focus is on privacy considerations and the question of how government ensures that companies properly safeguard (and use) the vast quantities of personal data collected from connected cars and their users. Both of these issues are extraordinarily important and already are generating robust discussion in the public space.

A less visible, but no less important, issue centers on how to adequately safeguard environmental concerns where one can utilize artificial intelligence (AI)—particularly machine learning and deep learning—to circumvent regulatory mandates. The Volkswagen (VW) emissions scandal represents the most recent example of an automobile manufacturer utilizing a "defeat device" to evade environmental regulators. VW's defeat device—a complex algorithm that detected when a vehicle was undergoing an emissions test—constitutes the most sophisticated form of AI yet deployed (or discovered) to skirt environmental law. With future developments in machine learning, it is conceivable that these technologies could again be used to bypass environmental regulation, including cheating on air emissions tests. Further, with the development of deep learning, it is equally possible that automobiles themselves will develop sophisticated systems to sidestep environmental regulation altogether. Should that become the case, the question becomes one of to whom liability should attach.

This article explores the challenges facing environmental regulators in an era of rapidly developing AI, with specific focus on systems designed to cheat air emissions tests. Part I provides a brief overview of the congressional mandate established in the Clean Air Act (CAA), with specific reference to regulations governing light-duty motor vehicles. Part II summarizes the salient facts underlying the VW emissions scandal. Part III discusses how AI technologies might frustrate—or facilitate—compliance with existing environmental regulatory regimes. Finally, part IV provides a short set of recommendations for how regulators, companies, and others can unleash the potential environmental benefits of AI while minimizing adverse outcomes.

I. Overview of CAA Statutory Mandate

Pursuant to CAA section 202, the Environmental Protection Agency (EPA) may "prescribe . . . standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, which . . . cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare." 42 U.S.C. § 7521(a)(1). Consistent with this mandate, EPA has promulgated emissions standards and testing procedures for light-duty motor vehicles. *See* 40 C.F.R. pt. 86, subpt. S.

EPA regulations require vehicle manufacturers to identify any auxiliary emission control device (AECD) installed in a vehicle. *See* 40 C.F.R. § 86.1843-01. EPA defines AECD as "any element of design which senses temperature, vehicle speed, engine [revolutions per minute], transmission gear, manifold vacuum, or any other parameter for the purpose of activating, modulating, delaying, or deactivating the operation of any part of the emission control system." 40 C.F.R. § 86.1803-01. For any AECD installed in a vehicle, the

manufacturer must provide "a justification for each AECD, the parameters they sense and control, a detailed justification of each AECD that results in a reduction in effectiveness of the emission control system, and [a] rationale for why it is not a defeat device." 40 C.F.R. § 86.1844-01(d)(11).

While the CAA does not impose a blanket prohibition on AECDs, section 203 of the act does prohibit the installation of "defeat devices," which are a specific type of AECD "that reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use." 40 C.F.R. § 86.1803-01. Defeat devices are expressly designed to "bypass, defeat, or render inoperative elements of the vehicles' emission control system that exist to comply with CAA emission standards." *See* Letter from U.S. Environmental Protection Agency to Volkswagen AG, Audi AG, Porsche AG, Volkswagen Group of America, Inc., and Porsche Cars North America, Inc., Re: Notice of Violation (Nov. 2, 2015) (hereinafter Nov. 2, 2015 NOV).

EPA also mandates that vehicle manufacturers undergo air emissions testing to demonstrate compliance with applicable air quality standards. For light-duty passenger vehicles, manufacturers must comply with Federal Test Procedure 75 (FTP-75), a standardized laboratory test whereby a car's engine is monitored for approximately 31 minutes under various testing scenarios to mimic city driving. During the FTP-75 process, a car "travels" for 11.04 miles at an average speed of 21.2 miles per hour (mph), with a maximum speed of 56.7 mph. In addition to FTP-75, manufacturers must also comply with supplemental FTPs to account for other driving scenarios likely encountered during highway driving.

II. A Brief History of the VW Emissions Scandal

On September 18, 2015, EPA issued a CAA Notice of Violation to VW alleging that the company and its subsidiaries had utilized a defeat device in its model year 2009-2015 2.0 liter diesel cars that circumvented EPA air emissions standards so that vehicles emitted up to 40 times more pollution than permitted under regulation. *See* Letter from U.S. Environmental Protection Agency to Volkswagen AG, Audi AG, Porsche AG, Volkswagen Group of America, Inc., and Porsche Cars North America, Inc., Re: Notice of Violation (Sept. 18, 2015). Thereafter, on November 2, 2015, EPA issued a second CAA Notice of Violation alleging that VW produced and sold certain model year 2014–2016 3.0 liter diesel cars and SUVs that also utilized a defeat device to emit up to nine times more pollution than allowed by law. *See* Nov. 2, 2015 NOV.

On November 19, 2015, VW admitted that it had utilized the defeat device in all 3.0 liter diesel models in the United States since 2009. VW's defeat device in both its 2.0 liter and 3.0 liter vehicles constituted an algorithm that could determine when a vehicle was undergoing an emissions test. The algorithm, labeled as an "acoustic condition" in the underlying code, directed the car's onboard computer to check for as many as ten conditions associated with an emissions test. If the system detected the presence of any of these conditions, it would engage the emissions curbing system, which reduced the amount of nitrogen oxide emitted from the vehicle. Once the system determined that the emissions test was over, the vehicle would revert to normal operating conditions, which generated more pollution.

In January 2016, the U.S. Department of Justice brought criminal and civil charges against VW for alleged violations of the CAA. Over the course of the next two years, VW and the U.S. government negotiated a settlement whereby VW agreed to pay a $2.8 billion in criminal fines and $1.5 billion in civil penalties. In addition, the company agreed to plead guilty to three criminal felony counts, while six VW executives faced individual criminal charges.

III. The Use of Artificial Intelligence to Frustrate—and Facilitate—Compliance with Environmental Regulation

VW's defeat device constituted a cunning use of AI to skirt environmental regulation. While the VW defeat device may not conform to the image of AI as conceived in science fiction or by Hollywood—the killer robots of *The Terminator* series or the omnipotent virtual assistant in *Her*, for example— the VW algorithm nevertheless qualifies as AI because it "perform[ed] tasks under varying and unpredictable circumstances, without significant human oversight[.]" *See, e.g.*, Fundamentally Understanding the Usability and Realistic Evolution of Artificial Intelligence Act of 2017 (FUTURE AI Act), S. 2217, § 3(a)(1)(A).

While VW's algorithm is the most recent and notable example of AI used to skirt environmental regulation, the case is hardly the first of its kind, nor is it likely to be the last. Indeed, as machine learning/deep learning processes become increasingly sophisticated and commonplace, companies undoubtedly will seek to capitalize on AI to generate competitive advantage in the marketplace. And while there is nothing wrong with this desire to gain an upper hand on competitors, legal issues may arise in circumstances—similar to those facing VW—where a company finds that it cannot comply with environmental standards and instead must resort to subterfuge in order to create the appearance of compliance. AI will only make it easier for companies to engage in this chicanery and disguise noncompliance, particularly as synthetic systems grow more capable of identifying regulatory testing or enforcement scenarios by being able to "think like humans" or "act rationally . . . [to] achieve goals via perception, planning, reasoning, learning, communicating, decision-making, and acting." *See* FUTURE AI Act, § 3(a)(1)(B), (E).

Furthermore, there may come a time in the not too distant future where the underlying AI itself determines that environmental compliance is impossible and warrants action to disguise noncompliance and bypass environmental enforcement altogether. Under this scenario, a company would play no role in the deceit and may itself be unaware of the actions undertaken on its behalf by AI. Though this scenario sounds far-fetched, technologists are contemplating scenarios such as this, meaning that environmental regulators, companies, and others should be preparing for this contingency as well.

While AI poses a risk to society, including as a means of subverting environmental compliance, it is also important to note that AI stands to greatly benefit society. It is plausible—likely even—that AI will foster many positive and environmentally beneficial developments that allow companies to become even more competitive and environmentally friendly. Thus, it is possible to conceive of a scenario where AI allows a company to design, build, and/or operate a truly clean diesel automobile, for example. The key to unlocking the full potential and benefits of AI as an environmental tool, then, will be to craft policies and cultures that place high value on innovation and at the same time provide adequate safeguards for human health and safety.

IV. How to Unleash the Potential Environmental Benefits of AI While Minimizing Adverse Outcomes

So how can society foster conditions to facilitate the development of AI that generates environmental benefits? And how can we minimize potential adverse outcomes and avoid a repeat of the VW emissions scandal? Truthfully, there is no single solution; instead, governments, companies, academia, and the general public each must play a role—and work together—to craft workable solutions. What follows is a brief series of recommendations.

First, regulators—including EPA and individual state departments of environmental protection—should work with automotive companies, technology companies, academia, and the non-profit sector to develop greater technical

expertise so to understand and be able to identify circumstances where machine learning/deep learning is used, or could be used, to circumvent environmental regulation, including air quality standards. Ultimately, this will require greater investment by government entities so to attract employees with the necessary technical background (e.g., computer science graduates) to be able to understand how AI might be used in various environmental compliance (or non-compliance) scenarios.

Second, government, academia, and the private sector should reaffirm their commitments to public-private partnerships and work to find multidisciplinary solutions to (1) foster and encourage the development of AI systems that yield tangible environmental benefits; and (2) craft detection and enforcement mechanisms to ensure that AI is not being used to evade environmental regulation. To achieve these complementary goals, federal and state governments should be prepared to devote real money to programs aimed at finding solutions. Certainly, governments should exercise scrutiny in how they spend taxpayer money, but they should not reflexively "zero-out" or otherwise shutter programs—such as the EPA ROVER program—that work on developing verification techniques with real-world applicability. *See, e.g.*, Peter Whoriskey, *EPA Closed the Lab That Might Have Caught VW Emissions Problem Years Ago*, Wash. Post Oct. 7, 2015. For example, had EPA continued to fund the ROVER program, it may have had at its disposal a mechanism to test emissions outside of FTP-75 that AI could not easily anticipate and overcome. *See id.*

Third, governments, companies and the general public should continue to support nonprofit organizations and universities that are working to validate environmental compliance and identify how AI might be utilized in nefarious ways. For example, the International Council on Clean Transportation, a nonprofit that facilitates engagement between environmental regulators and universities to provide independent science, funded the West Virginia University study that ultimately detected the errors in VW emissions reporting. Likewise, Kirill Levchenko, a computer scientist at the University of California San Diego (UCSD), worked with colleagues at UCSD and Germany's Ruhr University-Bochum to identify the emissions curbing code in VW's algorithm. One cannot overstate the importance of these types of academic studies in serving as an independent check on industry and government, particularly as AI grows increasingly more ubiquitous.

Fourth, regulators should consider developing more sophisticated regulatory mechanisms—including robust auditing mechanisms and stiffer criminal and civil penalties—to encourage environmental compliance and deter cheating. Crafting appropriate regulatory mechanisms—i.e., mechanisms that can adequately respond to the rapid rate of technological change—may require congressional action that vests with enforcement agencies greater authority to promulgate interpretive guidance that creates rights and obligations on regulated entities. That said, governments at all levels should work closely with those in the private sector to ensure that regulation does not overly burden or impede innovation—admittedly, this is a very delicate balance. Further, as machine learning progresses to a stage where systems are rewriting their own code to avoid environmental regulation and detection—so that even the companies themselves are unaware of what the machine is doing—it may be necessary to rethink liability and enforcement regimes to avoid the inequity of punishing companies that are not co-conspirators to a crime, but rather are the patrons of sophisticated machines that generate environmentally adverse unintended consequences.

Finally, automotive and technology companies should continue to work to foster corporate cultures that prioritize ethical and legal applications of AI and reject and take swift action against those who seek to stymie those efforts. Companies should develop robust compliance offices and internal auditing/review procedures that give compliance officers a direct line to senior leadership, something that VW, to its credit, has done in

the two-and-a-half years since the emissions scandal first became public. Further, companies should be willing to admit that they cannot know the full range of consequences arising from the development of AI—even narrow AI—and they should strive to be as transparent as possible about what they do and do not know.

Ultimately, there is a lot to be excited about with respect to the rapid development and ubiquitous deployment of AI—particularly with respect to its applications to mobility and environmental compliance. That said, complex legal, policy, and ethical challenges remain and will continue to arise. Addressing these challenges will require full participation and cooperation from every element of society.

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SURPRISING TRENDS IN BENZENE RISK

Dr. Kathryn Kelly, DrPH Med

Our air toxics series starts with benzene, which was listed in the 2005 National Air Toxics Assessment (U.S. EPA, 2011) as one of 10 air toxics that contribute more than 90 percent of the estimated incremental cancer risk associated with breathing outdoor air pollution. The key points:

- Outdoor exposure to benzene and concentrations of benzene in blood have decreased dramatically over the past two decades.
- Unregulated indoor exposure to benzene exceeds regulated outdoor exposure.
- Incidence of leukemia—the greatest health concern associated with exposure to benzene—has not decreased.

Why Is Benzene a Concern?

We all know benzene. It's the sweetish smell we notice filling our gas tanks. It's on the Environmental Protection Agency's (EPA) Top 10 list because of concern over its association with leukemia in workers exposed to high concentrations over time. And by "high," we mean ongoing exposures to concentrations that are tens of thousands of times higher than we individually experience at the gas stations for an average of 70 minutes a year. Thankfully, these high occupational levels have not been experienced in the United States for decades.

Let's take a closer look at the variables affecting health risk due to benzene exposure:

- What are the trends in emissions of benzene over time?
- What are the trends in resulting air concentrations?
- What are the trends in levels of benzene in our bodies resulting from those concentrations?