No. 21-35751

UNITED STATES COURT OF APPEALS FOR THE NINTH CIRCUIT

NORTHWEST CENTER FOR ALTERNATIVES TO PESTICIDES, et al.,
Plaintiffs-Appellants,
v.
U.S. DEPARTMENT OF HOMELAND SECURITY, et al.,
Defendants-Appellees.

On appeal from the United States District Court for the District of Oregon
Civil Case No. 3:20-cv-01816-IM

BRIEF OF *AMICUS CURIAE* FORENSIC ARCHITECTURE IN SUPPORT OF PLAINTIFFS-APPELLANTS AND SEEKING REVERSAL OF THE DISTRICT COURT

Alison Borochoff-Porte*
POLLOCK COHEN LLP
60 Broad Street, 24th Floor
New York, NY 10004
(646) 827-6259
alison@pollockcohen.com

Mike Sargetakis
Counsel of Record
LAW OFFICE OF MIKE SARGETAKIS, LLC
735 SW First Ave, 2nd Floor
Portland, OR 97204
(971) 808-1495
mike@sargetakis.com

Counsel for amicus curiae Forensic Architecture

* Not admitted to practice in the Ninth Circuit Court of Appeals.

CORPORATE DISCLOSURE STATEMENT

Pursuant to Rule 26.1 of the Federal Rules of Appellate Procedure, *amicus curiae* Forensic Architecture, by and through its undersigned counsel, hereby certifies that it does not have any parent corporations and does not issue stock.

Forensic Architecture is a research agency hosted at and legally represented by Goldsmiths College (also known as Goldsmiths, University of London), a body incorporated by royal charter, and whose administrative offices are located at New Cross, London, SE14 6NW, United Kingdom.

*/s/*Mike Sargetakis
Mike Sargetakis

Counsel for amicus curiae
Forensic Architecture

TABLE OF CONTENTS

TABLE OF AUTHORITIES

Cases

Statutes

Other Authorities

Regulations

INTEREST OF *AMICUS CURIAE*[1]

Amicus curiae Forensic Architecture is an interdisciplinary research agency based at Goldsmiths, University of London, which investigates instances of violence committed by states, police forces, militaries, and corporations. The research team is comprised of architects, scientists, journalists, software developers, and filmmakers. Forensic Architecture's investigations employ technologies—such as digital and 3D modeling, architectural analysis, remote sensing, and machine learning—in order to illustrate and analyze instances of conflict and violence. These technologies have been applied to investigate and simulate occurrences of forced detention and displacement, killings, petrochemical expansion, the scale and concentration of chemical pollution, and—of most relevance to the case before this Court—the deployment of tear gas.

---

[1] Pursuant to Rule 29 of the Federal Rules of Appellate Procedure, counsel for *amicus curiae* certifies that all parties have consented to the filing of this brief, that no counsel for a party authored this brief in whole or in part, and that no person other than *amicus curiae*, its members, or its counsel made a monetary contribution to the preparation or submission of this brief. *Amicus's* university affiliation is for identification purposes only.

Forensic Architecture wishes to assist the Court with its unique expertise in modeling and simulation, in order to demonstrate that it is feasible for law enforcement and agencies to preemptively assess—i.e., in advance of deployment—how a chemical munition like tear gas can be distributed throughout the environment once released.

Amicus curiae has a scientific and empirical interest in ensuring that courts have accurate visual information and evidence regarding the occurrence of harms in society, and in providing investigatory assistance where necessary and helpful to a case. *Amicus* has and continues to work with legal organizations in the United States to model instances of violence and pollution. Forensic Architecture's investigations have been relied upon and presented in numerous national courts around the world, and before major tribunals and councils such as the United Nations General Assembly, the United Nations Human Rights Council, the United Nations Special Rapporteur on the Promotion and Protection of Human Rights and Fundamental Freedoms While Countering Terrorism, the Inter-American Court of Human Rights, the International Criminal Court, the European Court of Human Rights, the European Parliament's Committee on Civil Liberties, Justice and Home Affairs, and the

Colombian post-conflict Commission for the Clarification of Truth, Coexistence, and Non-repetition. *Amicus* has worked with and for major international non-governmental organizations, including Human Rights Watch, Amnesty International, Médecins Sans Frontières (Doctors Without Borders), and the International Committee of the Red Cross. *Amicus's* founder and principal investigator, Professor Eyal Weizman, is a tenured professor at Goldsmiths, University of London and a former Global Scholar at Princeton University. He sits on the Technology Advisory Board of the International Criminal Court, and is a life fellow of the British Academy.

Amicus curiae has a specific interest in this case because it believes, based on experience, research, and its understanding of presently available methodologies, that an environmental impact analysis *could* have been conducted in advance of the release of chemical munitions during the course of Operation Diligent Valor. *Amicus* submits that the use of toxic chemicals in response to civilians exercising their rights to protest is unjustifiable. It concurs with the assessment of local public health and science experts that the indiscriminate use of "crowd control" munitions against protesters marching for racial justice exacerbates

existing systemic inequalities, curtails freedoms of assembly and speech, and disproportionately impacts vulnerable communities.[2] *Amicus* also recognizes, as cited by Arya Mormon, et al., that "crowd control" munitions have been used at a higher rate at "Black Lives Matter protests than white supremacy or Proud Boy marches" in Oregon.[3]

[2] *See, e.g.*, A. Morman, et al., *Riot Control Agents: Systemic Reassessment of Adverse Effects on Health, Mental Stability, and Social Inequities* at 21 (2020), *available at* https://www.dontshootpdx.org/wp-content/uploads/2020/06/DSPFinal-RCAreport4SocialChange-AM.AR_.ZW_.DS-.pdf (citation omitted).

[3] *See id.* (citation omitted).

SUMMARY OF ARGUMENT

Tear gas is banned for use in warfare under the Geneva Conventions,[4] yet its usage has increased in certain jurisdictions, including the United States.[5] The phrase—tear gas—is an umbrella term for a group of chemical compounds that "make people unable to function by causing irritation to the eyes, mouth, throat, lungs, and skin."[6] One of the most commonly used compounds is chlorobenzylidene malononitrile, or "CS."[7]

This appeal involves an underlying claim that Defendants-Appellees Department of Homeland Security ("DHS") and former-Acting

---

[4] *See* Geneva Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, 26 U.S.T. 571 (June 17, 1925); *see also* Natasha Williams, et al., *The Problematic Legality of Tear Gas Under International Human Rights Law* at 9, International Human Rights Program, University of Toronto, Faculty of Law (Aug. 2020), *available at* https://ihrp.law.utoronto.ca/sites/default/files/media/Legality%20of%20Teargas%20-%20Aug25%20V2.pdf.

[5] *See* Craig Rothenberg, et al., *Tear gas: an epidemiological and mechanistic reassessment*, Annals of the New York Academy of Sciences 1378(1), 96-107 (2016), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5096012/.

[6] *Facts About Riot Control Agents*, Centers for Disease Control and Prevention, https://emergency.cdc.gov/agent/riotcontrol/factsheet.asp (last visited Jan. 30, 2022).

[7] *Id.*

Secretary Wolf ("Secretary Wolf") failed to conduct a proper environmental analysis of the impact of chemical munitions released during Operation Diligent Valor in downtown Portland, Oregon, in the summer of 2020. This brief explains that there is a methodology available that would have allowed agencies to feasibly assess, in advance of deployment, where the tear gas would distributed throughout the human environment. This brief also explains why conducting such an analysis is critical—the chemicals released by DHS during Operation Diligent Valor are hazardous to human health and the environment.

Amicus argues that such an analysis could and should have been undertaken to uphold the objectives of the National Environmental Policy Act ("NEPA"), "to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of [humankind]." 42 U.S.C.A. § 4321.

ARGUMENT

I. SCIENTIFIC METHODS CAN PRE-EMPTIVELY ASSESS THE FORESEEABLE ENVIRONMENTAL IMPACTS OF TEAR GAS AND CHEMICAL MUNITIONS

In 1969, "Congress passed NEPA to protect the environment by requiring that federal agencies carefully weigh environmental

considerations and consider potential alternatives to the proposed action before the government launches any major federal action." *Barnes v. U.S. Dep't of Transp.*, 655 F.3d 1124, 1131 (9th Cir. 2011) (citation and internal quotation marks omitted). NEPA's primary purpose is to ensure "that the agency, in reaching its decision, will have available, and will *carefully consider, detailed information* concerning significant environmental impacts." *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349 (1989) (emphasis added).

To effect its purpose, "NEPA imposes procedural requirements on federal agencies to analyze the environmental impact of their proposals and actions." *O'Reilly v. U.S. Army Corps of Engr's*, 477 F.3d 225, 228 (5th Cir. 2007). Agencies must analyze "reasonably foreseeable" impacts. 40 C.F.R. § 1508.1(g). A reasonably foreseeable impact is one which is "sufficiently likely to occur such that a person of ordinary prudence would take it into account in reaching a decision." *Id.* § 1508.1(aa).

As illustrated below, the deployment of tear gas can have significant measurable and foreseeable environmental and human impacts. Scientific methodologies can be applied to foresee such impacts. The existence of such methodologies, combined with the extreme

likelihood that tear gas would be deployed during Operation Diligent Valor, underscores the error of the district court's statement that "to send reinforcements to a temporary hotspot to carry out law enforcement functions has no foreseeable environmental impact that might suggest that a NEPA analysis is appropriate." *Nw. Ctr. for Alternatives to Pesticides v. U.S. Dep't of Homeland Sec.*, No. 3:20-CV-01816-IM, 2021 WL 3374968, at *7 (D. Or. Aug. 3, 2021). Airborne weapons such as tear gas are demonstrably and foreseeably dangerous; that police forces should rely on them for the purposes of "crowd control" is a testament to the intellectual bankruptcy of contemporary law enforcement practices, and a strong argument for the replacement of those practice, and those forces, with alternative models for maintaining the safety and rights of communities.

A. Fluid dynamics and Large Eddy Simulation methodologies

Tear gas is not actually a gas, but a liquid or powder that can "be released in the air as fine droplets or particles."[8] Studying its behavior,

[8] *Facts About Riot Control Agents*, Centers for Disease Control and Prevention, https://emergency.cdc.gov/agent/riotcontrol/factsheet.asp (last visited Jan. 30, 2022).

then, necessitates understanding liquids and fluids. The Department of Mechanical Engineering at Imperial College London—whom *amicus* has partnered with on six published and ongoing investigations—has been at the forefront of model development for what is commonly known as "fluid dynamics."[9] Increases in computing power since the 1980s have given rise to the field of "Computational Fluid Dynamics."[10] A specific technique within the field of Computational Fluid Dynamics, known as Large Eddy Simulation, can be used to model large-scale "turbulent mixing" and fluid problems, i.e., how air moves around a (natural or urban) environment in certain weather conditions, and more pertinently, how emitted gaseous or airborne chemicals behave, and move, within that air flow.[11]

---

[9] *See Thermofluids*, Imperial College London, https://www.imperial.ac.uk/mechanical-engineering/research/thermofluids/ (last visited Jan. 30, 2022).

[10] *See Topics: Computational Fluid Dynamics*, ScienceDirect, https://www.sciencedirect.com/topics/engineering/computational-fluid-dynamic (last visited Jan. 30, 2022).

[11] *See* U Piomelli, *Large eddy simulations in 2030 and beyond*, The Royal Society Publishing (Aug. 13, 2014), https://royalsocietypublishing.org/doi/10.1098/rsta.2013.0320.

Large Eddy Simulation can thus be used to trace the movements of particles and gaseous compounds through space and time.[12] *Amicus* submits that when Large Eddy Simulation is combined with traditional investigative techniques or other methodologies—such as digital modeling, image and video analysis, and archival research—one can confidently draw connections between an emission source, e.g., a tear gas canister, and the final resting location of the emitted chemicals. This combined modeling and investigative technique could be applied to, *inter alia*, industrial emissions, gunshot residue, and tear gas.

Amicus regularly uses Large Eddy Simulation and investigative techniques to reconstruct scenes of rights abuses and violence. *Amicus* refers to this hybrid methodology as "fluid dynamics simulation." To analyze how tear gas might be dispersed in an environment, *amicus* would construct a scaled 3D model of the area in question (e.g., a neighborhood in Portland, Oregon), using an architectural modeling software that would create an accurate depiction of "spatial features" like building heights, street widths, etc. This would help to understand how wind patterns might affect dispersion of the tear gas, because air behaves

[12] *Id.*

differently depending on where it is flowing—e.g., through a narrow urban street, or across a roundabout in a low-density neighborhood.[13]

An example of such a model of a neighborhood in Portland is presented here:

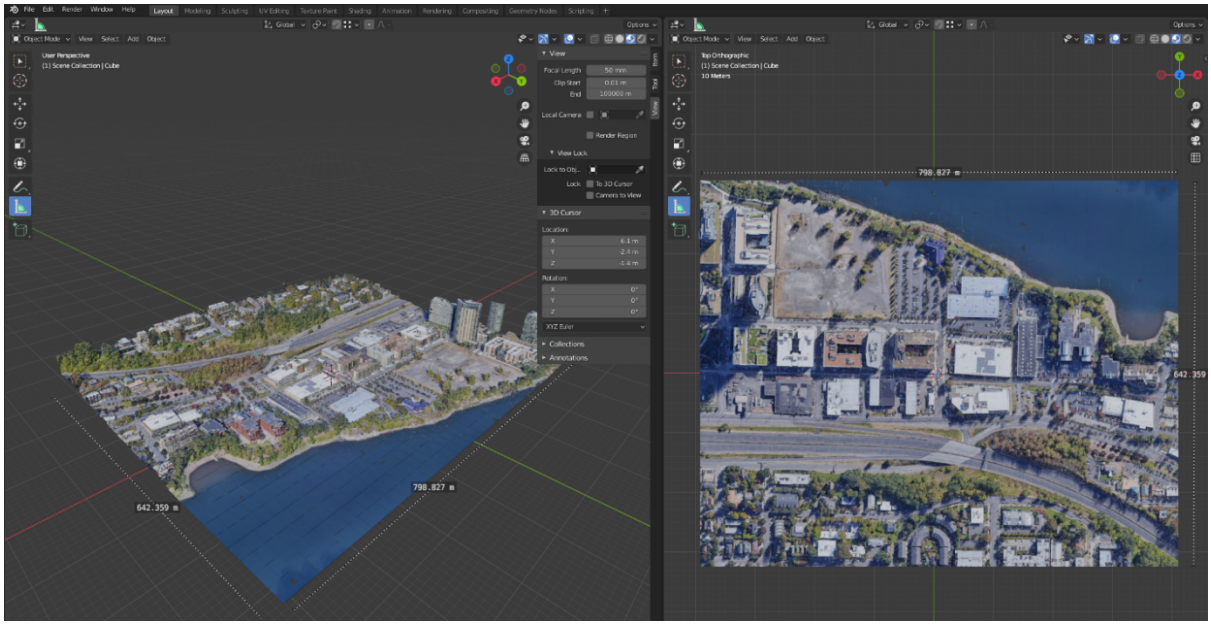

Fig. 1. Source: *amicus curiae* Forensic Architecture.

Because meteorology and weather conditions—including temperature, wind speed, and wind direction—affect the behavior of tear gas, it is important to base simulations on meteorological data.[14] Air

[13] *See* D. Zajic, et al., *Flow and Turbulence in an Urban Canyon*, J. of Applied Meteorology and Climatology, Vol. 50, Issue 1 (Jan. 1, 2011), https://journals.ametsoc.org/view/journals/apme/50/1/2010jamc2525.1.xml.

[14] *Amicus* accesses local weather data from meteoblue, which is a meteorological service created at the University of Basel, Switzerland,

(continued…)

density, which varies with altitude and temperature, must also considered, as must the location of a source (or sources) of emission, e.g., a tear gas canister, because the behavior of the emitted fluid will be affected by the position of emissions sources relative to one another in time and space.[15] Also relevant for health and environmental impact analysis is the rate and specific chemical composition of a given emission. Manufacturers often provide information on rate of emission from a given canister, and its chemical contents.[16]

At the heart of the Large Eddy Simulation technique that *amicus* uses to reconstruct or predict, among other things, tear gas dispersion, is

---

and which offers consistent weather simulation data in hourly resolution for different altitudes. *See* https://www.meteoblue.com.

[15] In its own investigations, *amicus* relies upon a variety of "open source" methodologies to locate emissions sources *post-facto*, such as collecting publicly available information via social media and publicly posted videos. Such methodologies need not be employed if attempting to analyze chemical dispersion pre-emptively. Rather, a variety of simulated "scenarios" and permutations could be analyzed for a range of locations and durations of emissions.

[16] *See, e.g.*, Safety Data Sheet (July 13, 2015), *available at* https://www.wyden.senate.gov/imo/media/doc/Defense%20Technology%201082%20-%20Riot%20Control%20Continuous%20Discharge%20Grenade%20CS%20-%20US.pdf (containing details for a CS-containing munition potentially used by Defendants-Appellees during Operation Diligent Valor, as obtained from DHS documents request from by United States Senator Ron Wyden of Oregon).

a topographic and architectural model of a given space. It works like this. A 3D digital environment, or "domain," is defined, which surrounds the model being created, and a 3D digital "volume" is created, which encompasses all the features of the model. If you were to subtract the *domain* from the *model*, you would be left with the *volume*, much like making an imprint on a clay mould.

The domain thus represents the fluid (air) environment surrounding a precisely modelled reconstruction of the relevant real-world architecture and topography. This fluid domain acts as the venue for a Large Eddy Simulation. In order to create a realistic simulation, certain conditions and parameters are placed into the model, including air velocity, direction and temperature, ambient humidity, and barometric pressure.[17] The simulation is given start and end "timepoints." Within the fluid domain, the movement of particles between the start and end timepoints, according to the starting conditions, can thus be

[17] The process also involves mathematical calculations of "turbulence," i.e., the movement of the air. The calculation of the turbulence is done by numerically solving the Navier-Stokes equation. *See, e.g.*, Lecture 4: The Navier-Stokes Equations: Turbulence (Sept. 23, 2015), *available at* https://projects.iq.harvard.edu/files/ac274_2015/files/lecture4.pdf (last visited Jan. 30, 2022).

simulated, according to a set of mathematical equations.[18] Completed simulations take meteorological conditions into account and in doing so, provide a reliable prediction of the movement of air in a given environment and weather conditions (the simulation software also allows for weather conditions to be varied over time).

These parameters—meteorological conditions and start and end timepoints—essentially create a four-dimensional (that is, space and time) "field" of turbulence. By simulating the dispersal of chemicals into that turbulence field, and taking into consideration the quantity, location, chemical composition of a specific emitted chemical, the movement of each molecule of that emission can be "tracked" or "followed" in the model across time. As a result of this process, the final resting place of an emission on the topographical and architectural environment can be determined. Thus, *amicus* submits that using its methodology, the spatiotemporal dispersion of any substance can confidently be assessed *post-facto,* but can also be confidently *predicted* in advance of deployment.

---

[18] *See* Jose M. Rodriguez & Raquel Taboada-Vazquez, *A new LES model derived from generalized Navier-Stokes equations with nonlinear viscosity*, Computers and Mathematics with Applications, Vol. 73, Issue 2 (2017), https://arxiv.org/pdf/1509.04489.pdf.

The methodology can accurately predict where high concentrations of a substance, such as tear gas chemicals, will likely be deposited.

In order to better understand, interpret, and present the results of the methodologies, the mathematical equations used are visualized via a 3D "cloud model."[19] The visualization depicts the extent and contours of clouds of chemical emission, and their anticipated movement over time.

The below image is an example of such a visualization, which delineates the presence of an emission at a certain location, at a single moment in time, between the start and end timepoints of a simulation:

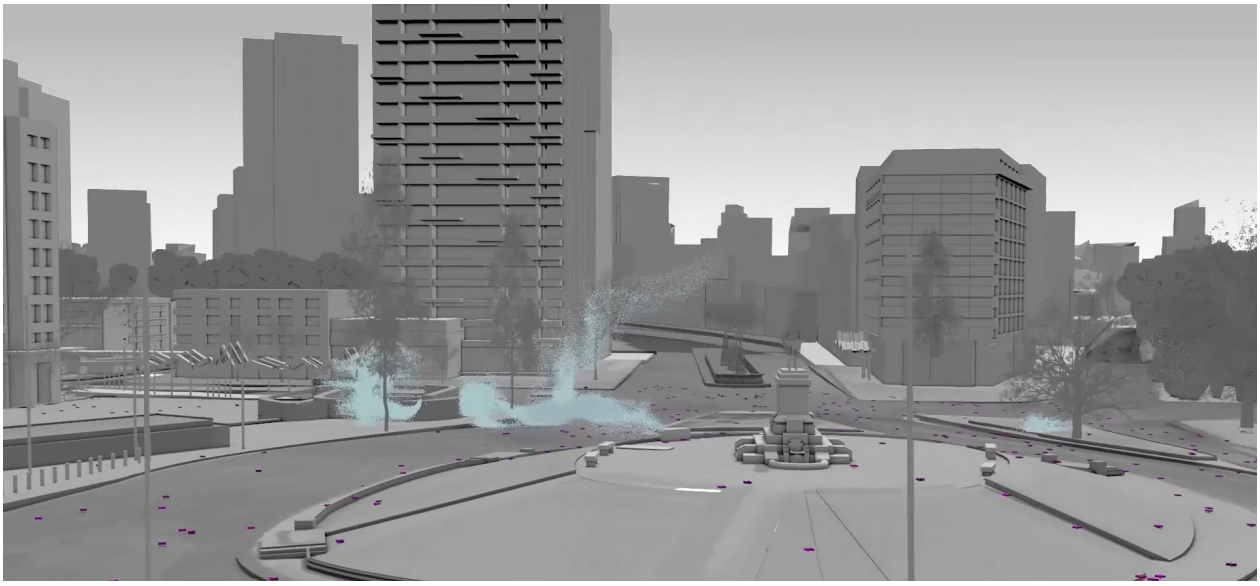

Fig. 2. Source: *amicus curiae* Forensic Architecture.

[19] The open-source software that *amicus* uses to generate the "cloud model" is called VisIt 3.2.1. *See* https://visit-dav.github.io/visit-website/index.html.

In summary, the combined methodologies outlined above can be used to predict, in advance of deployment, how concentrations of chemicals like tear gas would land in a given urban or natural environment.

The methodologies make it possible to answer this question: if quantity A of chemical B is deployed under weather conditions C, at location D, where would that chemical emission subsequently travel to? There is nothing to *amicus's* knowledge in fluid dynamics that would prevent such methodologies from being utilized predictively to assess a range of reasonably foreseeable scenarios of chemical deposition. Those scenarios could be reasonably factored into any "operation plan" drafted by Defendants-Appellees.[20]

[20] Such a plan was drafted by the Federal Protective Service, a constituent part of DHS, and is described in an Office of Inspector General report. *See DHS Had Authority to Deploy Federal Law Enforcement Officers to Protect Federal Facilities in Portland, Oregon, but Should Ensure Better Planning and Execution in Future Cross-Component Activities* at 15, Office of the Inspector General, DHS (Apr. 16, 2021), https://www.oig.dhs.gov/sites/default/files/assets/2021-04/OIG-21-31-Mar21.pdf.

B. Case study: tear gas deployment in Santiago, Chile

In 2020, Forensic Architecture published the results of its investigation into the deployment of hundreds of tear gas cannisters during protests in the Plaza de la Dignidad, Santiago, Chile.[21]

Using the fluid dynamics simulation methodologies described above, Forensic Architecture and Dr. Salvador Navarro-Martinez of the Department of Mechanical Engineering at Imperial College London, analyzed the scale and extent of tear gas deployed on December 20, 2019, in the Plaza de la Dignidad, and the implicated health risks. The event was documented on camera, and analysis of video footage indicated the deployment of 596 tear gas cannisters during a 3.5-hour period.[22]

Simulating fluid dynamics of the resulting CS gas clouds, *amicus* estimated the quantity of CS released at each identified emission point based upon the specifications for a projectile known to be used at the time

[21] *See Tear Gas in Plaze de la Dignidad*, Forensic Architecture (Dec. 12, 2020), https://forensic-architecture.org/investigation/tear-gas-in-plaza-de-la-dignidad.

[22] *Id.*

by Chilean police, which contained 23g of CS irritant smoke per cannister.[23]

For its investigation, *amicus* generated a precise digital 3D architectural model of the Plaza, utilized meteorological data like temperature and wind, identified known locations and assumed quantities of chemical depositions, and, using the methodologies outlined above, created and visualized a fluid dynamics simulation of that 3.5-hour period. The following image is a still-frame from the visualization of that simulation; a color scale is used to communicate concentrations of ground deposits of CS across the Plaza:

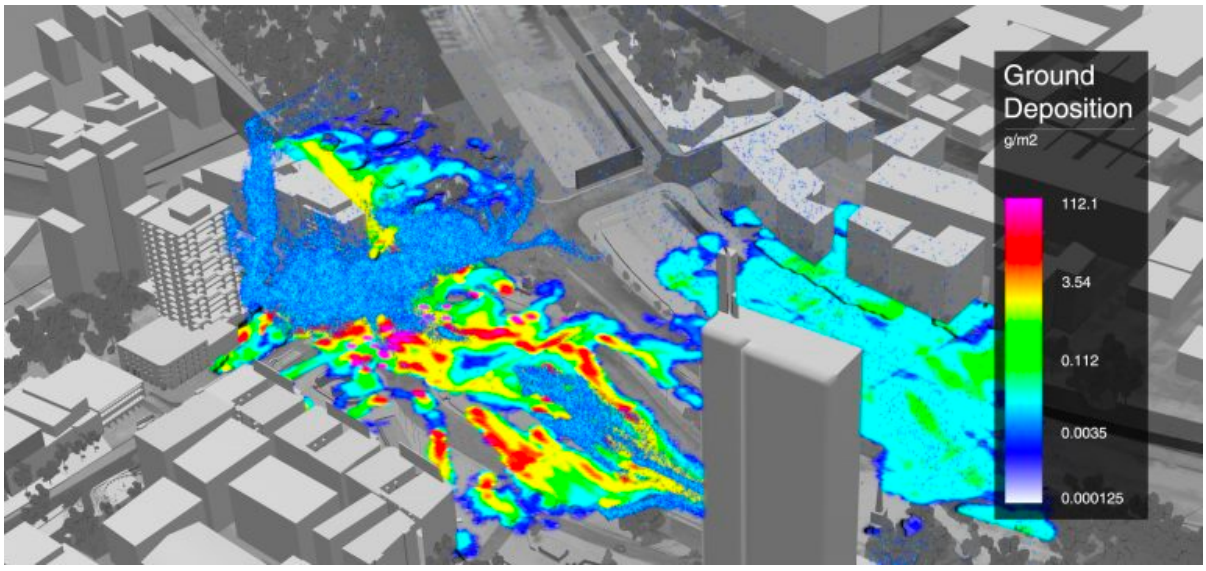

Fig. 3. Source: *amicus curiae* Forensic Architecture.

[23] *See* MP-4M3-CS—Multi-Smoke Projectile (CS)—37/38mm, NonLethal Technologies (Nov. 2018), https://www.nonlethaltechnologies.com/pdf/DS/MP-4M3-CS.pdf.

The simulation assisted in measuring the concentration of CS in the air, on the ground, and in the water of a nearby river at various timepoints during that 3.5-hour period. Using fluid dynamics simulation, *amicus* was able to determine that between 8:30 and 8:40 PM on December 20, 2019, the concentration of CS in a single cubic meter of air at a sample point around the Plaza reached approximately forty times the limit recommended by the Chilean police's own operational guidelines,[24] as illustrated in the following graphic depicting the concentration of CS at a sample point in the Plaza:

[24] The document in which these guidelines are described is not in the public domain, but was disclosed to *amicus*. A page from the relevant manual may be seen in the video available at *Tear Gas in Plaze de la Dignidad*, Forensic Architecture (Dec. 12, 2020), https://forensic-architecture.org/investigation/tear-gas-in-plaza-de-la-dignidad.

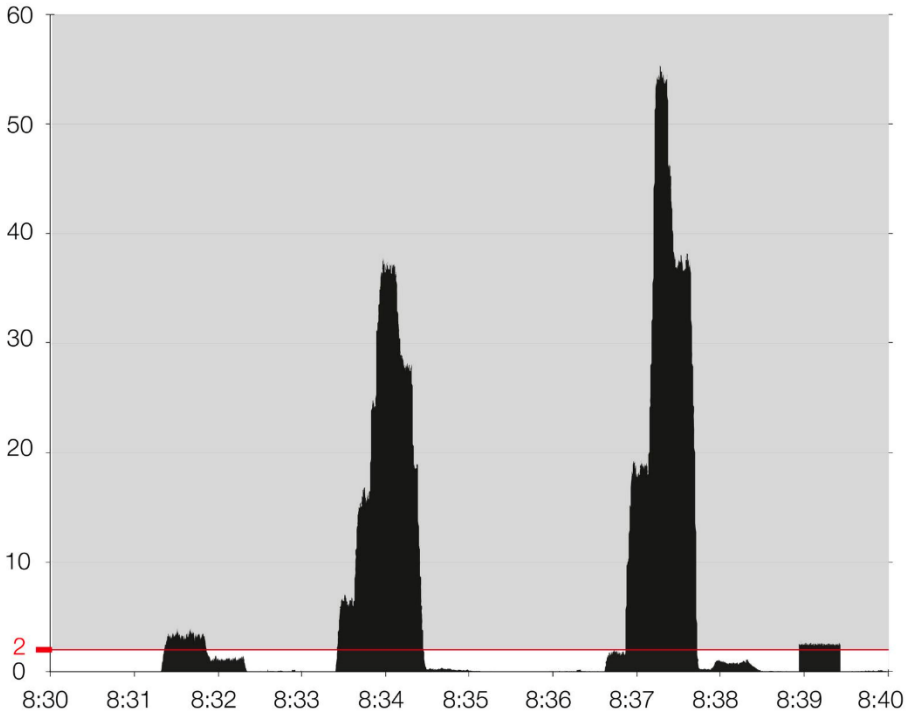

Fig. 4. Source: *amicus curiae* Forensic Architecture. The *x*-axis is the time, ranging from 8:30-8:40 PM on the evening of December 19, 2020. The *y*-axis is concentration of CS in mg/m^3.

C. Applying fluid dynamics to Operation Diligent Valor

Amicus submits that there is no reason why a similar analysis could not have been conducted *preemptively* in Portland, Oregon, as part of the operations plan drafted in relation to the planned activities by DHS agents beginning in July 2020.[25]

[25] *See DHS Had Authority to Deploy Federal Law Enforcement Officers to Protect Federal Facilities in Portland, Oregon, but Should Ensure Better Planning and Execution in Future Cross-Component Activities* at 15, Office of the Inspector General, DHS (Apr. 16, 2021), https://www.oig.dhs.gov/sites/default/files/assets/2021-04/OIG-21-31-Mar21.pdf.

Such an analysis would require four ingredients: (1) meteorological data; (2) a 3D topographical and architectural model; (3) emissions specifications; and (4) information about the quantity and location of potential emissions. Widely available high-resolution satellite imagery of the continental United States makes digital modeling of Portland highly feasible.[26] Regarding the quantity and location of potential emissions of chemical agents such as tear gas, DHS documents made public by United States Senator Ron Wyden of Oregon indicate that DHS possesses detailed specifics on the munitions available to and used by its agents.[27]

---

[26] Such satellite imagery could be acquired via commercial means, for example, from Maxar Technologies, or Planet Labs.

[27] *See List of Documents Obtained from DHS*, *available at* https://www.wyden.senate.gov/imo/media/doc/DHS%20Letters%20and%20Documents%20on%20Summer%202020%20Use%20of%20Force.pdf (including links to communications from Senator Wyden, and safety data sheets for munitions related to Operation Diligent Valor); *see also Press Release: Wyden Secures Review of DHS Law Enforcement Policies, Answers to Questions About Trump Administration Use of Force; Finance Committee Will Begin Consideration of Magnus Nomination for U.S. CBP Commissioner*, Ron Wyden, United States Senator for Oregon (Sept. 29, 2021), https://www.wyden.senate.gov/news/press-releases/wyden-secures-review-of-dhs-law-enforcement-policies-answers-to-questions-about-trump-administration-use-of-force-finance-committee-will-begin-consideration-of-magnus-nomination-for-us-cbp-commissioner.

According to a list of the equipment used by DHS during Operation Diligent Valor, a range of liquids, smokes, and powders containing numerous different chemical agents were deployed.[28] The sheer diversity of chemical agents underscores the importance of a preemptive analysis, because any attempt at *post-facto* modeling would be more complicated (though not impossible).

Comparable predictive modeling is feasible, and is regularly conducted for other institutional entities—such as state departments of environmental quality.[29] DHS could have engaged in predictive modeling

---

[28] *See List of Documents Obtained from DHS*, *available at* https://www.wyden.senate.gov/imo/media/doc/DHS%20Letters%20and%20Documents%20on%20Summer%202020%20Use%20of%20Force.pdf (including links to safety data sheets for munitions related to Operation Diligent Valor).

[29] By way of illustration, federal and state air regulations often require permit applicants to demonstrate that the emissions from a proposed complex will not cause, or contribute to an exceedance of, for example, National Ambient Air Quality Standards or any increment. *See, e.g.*, Or. Admin. R. § 340-216-0010 *et seq*. (setting forth Oregon Department of Environmental Quality regulations for air contaminant discharge permit applications); 42 U.S.C. § 7475(a)(3); *see also Subway-Surface Air Flow Exchange (S-SAFE) Study*, Brookhaven Nat'l Laboratory, U.S. Dep't of Energy, https://www.bnl.gov/s-safe/ (announcing the country's largest urban air flow study to date to better understand the risks posed by airborne contaminants, including chemical, biological and radiological (CBR) weapons in the event they are dispersed in the atmosphere and in [New York] City's subway system).

of tear gas in the urban environment. *Amicus*, for example, previously used data from the Louisiana Department of Environmental Quality's Emission Reporting Inventory Center to produce a Large Eddy Simulation of pollutants emitted from thirty-three industrial facilities in an area of Louisiana infamously known as "Death Alley," and "Cancer Alley."[30, 31] From this data, Forensic Architecture used its fluid dynamics methodology to create a simulation[32] of the spread of six pollutants, from which the below image is drawn:

---

[30] *See Environmental Racism in Death Alley, Louisiana*, Forensic Architecture (June 28, 2021), https://forensic-architecture.org/investigation/environmental-racism-in-death-alley-louisiana/; *Cancer Alley*, Wikipedia, https://en.wikipedia.org/wiki/Cancer_Alley.

[31] *See Permitted/Actual Emissions by Radius Report*, Louisiana Department of Environmental Quality, Emissions Reporting and Inventory Center, https://business.deq.louisiana.gov/Eric/EricReports/RadiusReportSelector?.

[32] Underscoring the feasibility with which DHS could have undertaken an analysis, the simulations that *amicus* runs are essentially just the computation of a mathematical equation, from a range of given inputs (as outlined elsewhere in this brief). Any computer with the appropriate software can do this processing; the greater the available processing power, the faster simulations can be created.

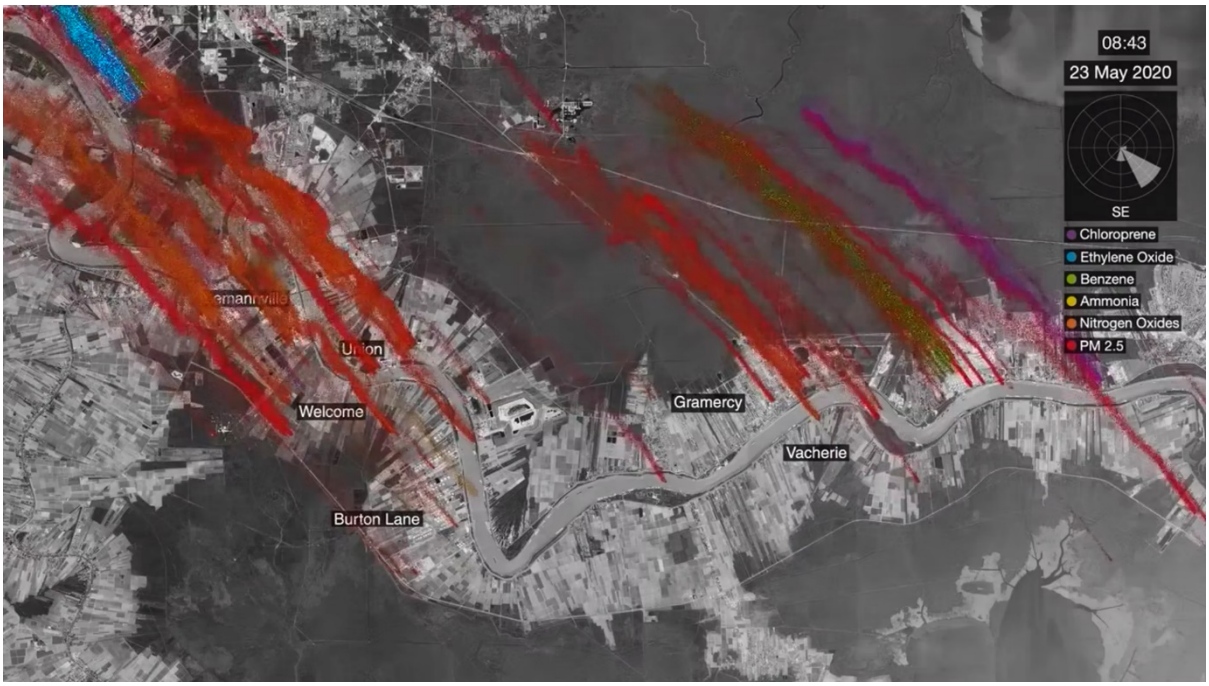

Fig. 5. Source: *amicus curiae* Forensic Architecture.

* * *

As demonstrated above, any impacts of tear gas deployment during the course of Operation Diligent Valor were measurable, and could have been reasonably foreseen. Using scientifically-sound methodology, DHS could easily analyze the impacts of its proposed actions involving the release of chemical munitions on civilians. The fact that Operation Diligent Valor facilitated the deployment of tear gas, in an environment where the Mayor of Portland announced a ban on the municipal police

force's use of tear gas, suggests a flagrant disregard for the foreseeable impacts of its use.[33]

II. TEAR GAS CAN SIGNIFICANTLY AFFECT THE QUALITY OF THE HUMAN ENVIRONMENT

Under NEPA, federal agencies must assess the environmental impacts of, and consider alternatives to, proposed actions that "significantly affect[] the quality of the human environment." 42 U.S.C. § 4332(2)(C). NEPA's "twin aims" require federal agencies "to consider every significant aspect of the environmental impact of a proposed action," and to ensure that agencies "will inform the public that it has indeed considered environmental concerns in its decision[-]making process." *Kern v. U.S. Bureau of Land Mgmt.*, 284 F.3d 1062, 1066 (9th Cir. 2002) (quotation marks and citation omitted).

The district court erroneously stated that "there was no reason for DHS officials to believe that their decision to send reinforcement personnel to a hotspot to respond to violent criminal activity would have a significant environmental impact." *Nw. Ctr. for Alternatives to*

[33] *See Portland mayor bans cops from using tear gas during protests*, AP News (Sept. 10, 2021), https://apnews.com/article/portland-ted-wheeler-archive-oregon-racial-injustice-55c8df19ff327f1d11815a687859ad2f.

Pesticides, 2021 WL 3374968, at *7. The impacts of tear gas deployment, from a human health and environmental perspective, can be enormous. And "the massive increase in tear gas deployments worldwide," alongside "the often-observed absence or disregard of evidence-based deployment rules and operating procedures, is of great concern."[34]

First, as to human health, "[e]xposure to tear gas agents produces a wide spectrum of health effects, including acute and chronic effects."[35] The United States Centers for Disease Control and Prevention states that the general category of "riot control agents" may induce symptoms including "blurred vision," "burning," "choking sensation," "vomiting," while "[l]ong-lasting exposure or exposure to a large dose" can lead to "blindness," "glaucoma," "respiratory failure," or "immediate death due to severe chemical burns to the throat and lungs."[36]

---

[34] *See* Craig Rothenberg, et al., *Tear gas: an epidemiological and mechanistic reassessment*, Annals of the New York Academy of Sciences 1378(1), 96-107 (2016), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5096012/.

[35] *Id.*; *see also* Anderson CO Tsang, et al., *Health risks of exposure to CS gas (tear gas): an update for healthcare practitioners in Hong Kong*, Hong Kong Med. J., 26(2), 151–53 (Apr. 2020), https://www.hkmj.org/abstracts/v26n2/151.htm.

[36] *Facts About Riot Control Agents*, Centers for Disease Control and Prevention,

(continued…)

A summary of thirty-one studies spanning eleven countries, surveying injuries from tear gas and pepper spray occurring between 1990 and 2015, documented "significant injuries as well as permanent disabilities" arising from the use of such chemicals by law enforcement, including "a range of injury severity for neurological, oropharyngeal, cardiac, pulmonary, and musculoskeletal systems."[37] In Portland, Oregon specifically, of 2257 people who self-identified as having been subjected to tear gas, 1995 people (88.4 percent) reported eye issues including "eye burning" and "blurred vision," 1238 (54.9 percent) reported skin issues, including "burning sensation" and "burns.[38] A woman has

---

https://emergency.cdc.gov/agent/riotcontrol/factsheet.asp (last visited Jan. 30, 2022).

[37] Rohini J. Haar, *Health impacts of chemical irritants used for crowd control: a systematic review of the injuries and deaths caused by tear gas and pepper spray*, BMC Public Health, 17: 831 (2017), https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-017-4814-6.

[38] Britta N. Torgrimson-Ojerio, *Health issues and healthcare utilization among adults who reported exposure to tear gas during 2020 Portland (OR) protests: a cross-sectional survey*, BMC Public Health, 21: 803 (2021), https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-021-10859-w.

sued Portland, claiming that the use of tear gas "caused reproductive and menstrual problems."[39]

In identifying that tear gas can lead to severe health consequences, the American Lung Association highlights that "[l]ong-term health effects from tear gas are more likely if exposed for a prolonged period or to a high dose while in an enclosed area. In these instances, it can lead to respiratory failure and death.[40]

In a June 2020 report, Portland-based public and mental health experts Morman, et al., highlighted that tear gas's health impacts are understudied.[41] As identified by the American Thoracic Society,

---

[39] Ashley Koch, *Woman sues city of Portland over tear gas effects*, KGW8 News (Dec. 8, 2021), https://www.kgw.com/article/news/local/the-story/portland-tear-gas-lawsuit/283-3e04fea3-304c-4654-8e51-60b263b9f0ed.

[40] *Tear Gas*, Am. Lung Ass'n, https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/toxic-air-pollutants/tear-gas; *see also Facts About Riot Control Agents*, Centers for Disease Control and Prevention, https://emergency.cdc.gov/agent/riotcontrol/factsheet.asp (last visited Jan. 30, 2022) ("The extent of poisoning caused by riot control agents depends on the amount of riot control agent to which a person was exposed, the location of exposure (indoors versus outdoors), how the person was exposed, and the length of time of the exposure.").

[41] *See, e.g.*, A. Morman, et al., *Riot Control Agents: Systemic Reassessment of Adverse Effects on Health, Mental Stability* at 12, 18, *and Social Inequities* (2020), *available at* https://www.dontshootpdx.org/wp-content/uploads/2020/06/DSPFinal-RCAreport4SocialChange-AM.AR_.ZW_.DS-.pdf (citation omitted).

> Much of what we currently know about the health effects of exposure to tear gas and other chemical agents is based on military research conducted in the 50s, 60s, and 70s using young healthy male research participants. These studies do not address the potential health effects for vulnerable populations who are exposed, including children, older adults, and people with underlying health conditions.[42]

These practical realities—the potential devastating harms and the generally understudied nature of tear gas—highlight the importance of preemptively assessing impacts.[43] Fluid simulations can assist in

---

[42] *Press Release: Tear Gas Use During COVID-19 Pandemic Irresponsible; Moratorium Needed, Says American Thoracic Society*, Am. Thoracic Society (June 11, 2020), https://www.thoracic.org/about/newsroom/press-releases/journal/2020/tear-gas-use-during-covid-19-pandemic-irresponsible-moratorium-needed,-says-american-thoracic-society.php; *see also Tear Gas*, Oregon Health Authority, https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/HEALTHYNEIGHBORHOODS/TOXICSUBSTANCES/Pages/Tear-Gas.aspx (identifying a New York Academy of Sciences article as stating "that there is lack of data available on the range of health effects from tear gas exposure").

[43] Moreover, at the time of Operation Diligent Valor, specifically in the context of the global COVID-19 pandemic, the human health risks were heightened. *See, e.g.*, *Don't Shoot Portland v. City of Portland*, 465 F. Supp. 3d 1150, 1156 (D. Or. 2020) ("[T]he use of tear gas under these circumstances may put protestors' health at risk, contributing to the increased, widespread infection of this lethal virus. Without a court order limiting the circumstances in which PPB may use tear gas,

(continued…)

preventing the deployment of chemicals in residential neighborhoods, in the vicinity of schools, hospitals and care homes, commercial centers, parks and public spaces, and in urban areas where there is geographic risk (e.g., narrow streets) of high, prolonged exposure.

Second, as to the environment, the chemicals Defendants-Appellees DHS and Secretary Wolf planned to (and ultimately did) deploy, have environmental impacts that are both far-reaching, and problematically under-studied. "Due to the dearth of scientific research and the misinterpretation of some of the available studies," one research team recently "conclude[d] that a serious reevaluation of chemical [demonstration control agent] safety and more comprehensive exposure follow-up studies are necessary."[44] In 2020, Senators from Oregon wrote

---

Plaintiffs are likely to suffer irreparable physical and constitutional injuries.").

The American Thoracic society called for a moratorium on tear gas's deployment by law enforcement against protesters. *Press Release: Tear Gas Use During COVID-19 Pandemic Irresponsible; Moratorium Needed, Says American Thoracic Society*, Am. Thoracic Society (June 11, 2020), https://www.thoracic.org/about/newsroom/press-releases/journal/2020/tear-gas-use-during-covid-19-pandemic-irresponsible-moratorium-needed,-says-american-thoracic-society.php.

[44] Jennifer L. Brown, et al., *Reevaluating tear gas toxicity and safety*, Inhalation Toxicology, Vol. 33, Issue 6-8 (Sept. 12, 2021), https://www.tandfonline.com/doi/abs/10.1080/08958378.2021.1963887?scroll=top&needAccess=true&journalCode=iiht20.

the Environmental Protection Agency, imploring it to investigate the environmental "impacts of sustained tear gas use."[45]

Following tear gas deployment, Portland's Bureau of Environmental Services found elevated levels of certain contaminants in stormwater and sediment.[46] Morman, et al. highlighted three chemical agents that are used for crowd control: o-chlorobenzylidene malononitrile (CS), 2-chloroacetophenone (CN), and oleoresin capsicum (OC). According to their report, one active ingredient in CS—2-chlorobenzaldehyde—has been cited as being "toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment."[47] Another active ingredient, malononitrile, which "may be fatal if inhaled,

---

[45] Senator Ron Wyden, et. al., *Letter to Andrew Wheeler, Environmental Protection Agency* (Aug. 13, 2020), https://www.wyden.senate.gov/imo/media/doc/EPA%20tear%20gas%20letter.pdf.

[46] *Press Release: Environmental Services Releases Results of CS Gas Residue Sampling in City Stormwater Pipes; $20,000 Penalty to Feds*, Portland Bureau of Environmental Services (Sept. 10, 2020), https://www.portland.gov/bes/news/2020/9/10/environmental-services-releases-results-cs-gas-residue-sampling-city-stormwater.

[47] A. Morman, et al., *Riot Control Agents: Systemic Reassessment of Adverse Effects on Health, Mental Stability* at 10, *and Social Inequities* (2020), *available at* https://www.dontshootpdx.org/wp-content/uploads/2020/06/DSPFinal-RCAreport4SocialChange-AM.AR_.ZW_.DS-.pdf (citation omitted).

swallowed, or absorbed through the skin or mucous membranes," carries a probable oral lethal dose for humans of "5-50 mg/kg, or between seven drops and one teaspoonful, for a 70 kg (150 lb.) person."[48] CN, according to the authors, is "three- to ten-fold more toxic than CS in rats, rabbits, guinea pigs, and mice."[49]

In September 2020, another Portland-based scientific researcher released a report identifying the use of hexachloroethane (HC) during Operation Diligent Valor—a substance that is "very toxic to aquatic life with long-lasting effects" and is "suspected of causing cancer," according to a "Safety Data Sheet" published by Defence Technologies.[50]

Understudying these impacts could have deleterious consequences for numerous nearby ecosystems, including one of Portland's major

---

[48] *Id.* (citations omitted)

[49] *Id.* at 11.

[50] Safety Data Sheet (Dec. 1, 2015), *available at* http://sds.chemtel.net/webclients/safariland/finished_goods/Defense%20Technology%201083%20-%20Military-Style%20Maximum%20Smoke%20HC%20Grenade.pdf; *see also* Juniper L. Simonis, *Quantifying use of lethal ZnCl2 on Black Lives Matter demonstrators by United States Homeland Security* at 5 (Sept. 30, 2020), https://zenodo.org/record/4434918#.YfdfBfXMJTY ("HC smoke has further significant effects on the environment, including defoliation and long-term reduction in tree growth, and stunted development, scale deterioration, skeletal weakness, and bioaccumulation in fish." (citations omitted)).

waterways, the Willamette River, which provides spawning, rearing, and essential habitat for numerous threatened and endangered anadromous and resident species, including steelhead, pacific lamprey, Chinook salmon, and many others already facing numerous risk factors related to water quality problems. *See, e.g.*, *Endangered and Threatened Species; Initiation of 5-Year Reviews for 28 Listed Species of Pacific Salmon and Steelhead*, 84 Fed. Reg. 53117 (Oct. 4, 2019) (notifying the initiation of a 5-year review of twenty-eight species listed under Endangered Species Act, including several in the Columbia and Willamette River basins).

* * *

Fluid dynamics simulation can complement relevant literature to predict the environmental or human health impacts of chemical munition deployment. It would be dangerous to let the district court's statement that "the challenged actions here [were] routine, temporary, tentative, and responsive to the actions of others" stand. *Nw. Ctr. for Alternatives to Pesticides*, 2021 WL 3374968, at *7. The release of a chemical banned in warfare into civilian, urban, or residential environments should never be viewed as "routine." A preemptive, scientific analysis of the

deployment of tear gas was not only possible in Portland, but warranted, in order to ensure protection of the human and natural environment.

CONCLUSION

The district court's judgment should be reversed.

Dated: January 31, 2022

Respectfully submitted,

/s/ Mike Sargetakis
Mike Sargetakis
Counsel of Record
LAW OFFICE OF MIKE SARGETAKIS LLC
735 SW First Ave, 2nd Floor
Portland, OR 97204
(971) 808-1495
mike@sargetakis.com

Alison Borochoff-Porte*
POLLOCK COHEN LLP
60 Broad Street, 24th Floor
New York, NY 10004
(646) 827-6259
alison@pollockcohen.com

Counsel for amicus curiae Forensic Architecture

* Not admitted to practice in the Ninth Circuit Court of Appeals.

CERTIFICATE OF COMPLIANCE

1. This Brief complies with the type-volume limit of Federal Rule of Appellate Procedure 29(a)(5) and Ninth Circuit Rule 32-1 because it contains 5655 words, excluding words exempted by Federal Rule of Appellate Procedure 32(f).

2. This Brief complies with the typeface and type-style requirements of Federal Rule of Appellate Procedure 32(a)(5)-(6) because it was prepared in a proportionally-spaced typeface using Microsoft Word in Century Schoolbook, 14-point font.

/s/ Mike Sargetakis
Mike Sargetakis

Counsel for amicus curiae
Forensic Architecture