February 13, 2023

BY CERTIFIED MAIL & EMAIL *via email: spencer.michelle.a@dol.gov*

U.S. Dept. of Labor/Occupational Safety & Health Administration (OSHA)
Attn: Lee Anne Jillings, Director
Directorate of Technical Support & Emergency Management
200 Constitution Ave, N.W., Room N-3653
Washington, DC 20210

PETITION to Change a Key Rule That Would Provide Greater Protection to Oil Spill Response Workers

Dear Director Jillings,

We, the undersigned, hereby petition the Occupational Safety and Health Administration (OSHA), pursuant to 5 USC § 553(e), to initiate the rulemaking process to amend its recordkeeping rule. We are a diverse group of concerned citizens, commercial fishing and labor organizations, labor-environmental alliances, environmental and human health advocates, scientific and medical professionals, community legal centers, and national and regional Tribal emergency management councils. Our shared concern, as presented in this petition, is to reduce or prevent long-term harm from oil spill exposures to our workers, families, and members. Many of us are the ones who respond to oil spills. Some of us are burdened with chronic illnesses from past oil spill exposures or have lost loved ones who were former oil spill response workers.

We are petitioning OSHA to require recording and recordkeeping of cold and flu symptoms during oil spill response actions under the NCP. Unless preventative action is taken to better protect *human health* during oil spills, as requested in this petition, the predictable cold/flu-like symptoms characteristic of oil spill exposures will continue to lead to predictable long-term illnesses, cancers, and premature deaths in oil spill responders and the exposed populace. Our petition follows.

Most sincerely,

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A. Executive Summary

Earth Island Institute, on behalf of The ALERT Project (ALERT), hereby petitions the Occupational Safety and Health Administration (OSHA), pursuant to 5 USC § 553(e), to initiate the rulemaking process to amend its recordkeeping rule.

OSHA's statutory mandate is to implement regulations that keep workers healthy and hold employers accountable for their failure to do so.[1] Under the Occupational Safety and Health Act (OSH Act), OSHA is responsible for issuing regulations that require "employers to maintain accurate records of, and to make periodic reports on, work-related deaths, injuries and illnesses." OSHA is also responsible for assuring that employers responding to oil spills under the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) adequately protect their response workers in accordance with OSHA regulations.[2] This petition focuses on oil-chemical exposures associated with spill response operations under the NCP and OSHA's current blanket exception for recording and reporting cold- and flu-like symptoms [29 CFR § 1904.5(b)(2)(viii)].

Oil spill exposures are complex, multi-phase mixtures of hundreds of hydrocarbons, often in vapor, mist/aerosol, dissolved, and particulate phases simultaneously, for which OSHA standards do not exist. OSHA standards also do not apply to non-traditional workplaces where response workers are exposed for months, working extended shifts, and often living on-site in the contaminated area. Oil spill exposures have led to quantifiable and severe health consequences for response workers (and residents living in or near the oil-impacted area). While health consequences such as cancer from genetic damage and chronic illnesses are slow-developing, cold- and flu-like symptoms, including coughing, wheezing, difficulty breathing, tightness of chest, headaches, dizziness, and nausea, among others, may be evident soon after initial exposure and may continue, and worsen, for years. Unless preventative action is taken to better protect *human health* during oil spills, the predictable cold/flu-like symptoms characteristic of oil spill exposures will lead to predictable long-term illnesses, cancers, and premature deaths in response workers and the exposed populace.

OSHA's cold/flu recordkeeping exception is overbroad. It fails to accurately record and report work-related illnesses associated with oil-chemical exposure during oil spill response under the NCP. Further, it is at odds with the NCP's stated priority of protecting human life and goal of mitigating harm to public health and welfare. It is also at odds with efforts of the NCP's National Response Team, of which OSHA is a member, to implement its recommended health monitoring and surveillance guidance for emergency responders, a guidance that recommends recording cold/flu-like symptoms and biomonitoring – continuous biomonitoring in uncertain exposures such as occur during oil spills.

A vast array of governmental entities relies upon OSHA injury and illness records to make decisions concerning occupational safety and health policies, programs, and

[1] 29 USC § 651 *et. seq.*
[2] 40 CFR § 300.175(b)(11).

standards. It is, therefore, of paramount importance that the records provide quality information that is accurate, complete, and relevant.

Accordingly, petitioners request that OSHA amend the recordkeeping rule as follows:

1. Append the following sentence to 29 CFR § 1904.5(b)(2)(viii):

This exception shall not apply to on-site[3] workers, compensated or non-compensated, responding to an oil spill under the National Oil and Hazardous Substances Pollution Contingency Plan. Cold- and flu-like symptoms of these workers must be reported to OSHA according to the requirements of § 1910.120(q)(9)(iii).

2. Add the following provision to 29 CFR § 1910.120(q)(9):

(iii) Cold- and flu-like symptoms are recorded every calendar week for each operable unit[4] during an oil spill response under the National Oil and Hazardous Substances Pollution Contingency Plan, and must be reported to OSHA within 24 hours of that week for the duration of the incident response, by one of the following methods:

(1) By telephone or in person to the OSHA Area Office that is nearest to the site of the incident.
(2) By telephone to the OSHA toll-free central telephone number, 1-800-321-OSHA (1-800-321-6742).
(3) By electronic submission using the reporting application located on OSHA's public website at www.osha.gov.

[3] 40 CFR § 300.5. "On-site" is defined by the regulations governing the NCP.
[4] *Id.* "Operable unit" is defined by the regulations governing the NCP. Example: task force by job (nearshore, beach, offshore/source, decontamination, etc.), geographic location (state), time (specific calendar week).

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Acronyms

ALERT	A Locally Empowered Response Team
BELO	Back-End Litigation Order
BOD	Burden of Disease
BP	British Petroleum
BTEX	Benzene, toluene, ethylbenzene, xylene
CDC	Centers for Disease Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code for Federal Register
CHD	Chronic Heart Disease
DALY	Disability-Adjusted Life Year
DHHS	Dept. of Human Health Services
DWH	Deepwater Horizon
8-OHdG	8-hydroxy-2'-deoxyguanosine
EPA	Environmental Protection Agency
ERHMS	Emergency Responder Health Monitoring and Surveillance
FOSC	Federal On-Scene Coordinator
GAO	General Accounting Office
GAP	Government Accountability Office
GuLF	Gulf Long-Term Follow-up (study)
HAZWOPER	Hazardous Waste Operations and Emergency Response
KEGG	Kyoto Encyclopedia for Genes and Genomes
MDA	malondialdehyde
MI	myocardial infarction
NAS	National Academy of Sciences
NARA	National Archive and Records Administration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NIEHS	National Institute of Environmental Health Sciences
NIOSH	National Institute of Occupational Safety and Health
NOAA	National Oceanic and Atmospheric Administration
NRT	National Response Team
PAHs	Poly-cyclic Aromatic Hydrocarbons
PEL	Personal Exposure Limit
$PM_{2.5}$	Fine particulate matter
PPE	Personal Protective Equipment
PTSD	Post Traumatic Stress Disorder
SARA	Superfund Amendments and Reauthorization Act
SOA	Secondary Organic Aerosols
THC	Total Hydrocarbons
VOC	Volatile Organic Compounds
USC	United States Code
USCG	United States Coast Guard
YLD	Years Lived with Disabilities

B. Petitioner's Interests

EII is a nonprofit, membership organization incorporated under the laws of California and headquartered in Berkeley. Its mission is to support environmental action projects and build the next generation of environmental leaders in order to achieve solutions to environmental crises threatening the survival of life on Earth. EII acts as fiscal sponsor for The ALERT Project.

ALERT (A Locally Empowered Response Team) works collaboratively with at-risk communities to reduce toxic exposures from oil-chemical activities and to build a healthy energy future. The organization focuses on educating the public about toxic exposures, engaging people in local community oil spill response planning, and developing safe and effective oil spill response regulations, including those concerning response workers. Regulations relating to occupational illnesses associated with oil-chemical exposures, particularly in response to offshore oil leaks and spills, are of central concern. ALERT aims to strengthen oil spill preparation and response policies, protect the health of response workers and the public, and build the capacity of local communities and Tribes to have meaningful involvement in decision-making before and during oil disasters.

ALERT has over 1,800 constituents across the United States, including Alaska, the Great Lakes, and the U.S. Gulf Coast, that receive ALERT's information and tools. These constituents include individuals who have been exposed to oil spills and dispersants through their work on, or in proximity to, oil spill responses. They are concerned that acute health impacts from those exposures, including symptoms such as respiratory problems, dizziness, headaches, chemical burns, and skin disorders, often persist as chronic illnesses that impact their daily activities and quality of life. OSHA's recordkeeping rule as currently formulated harms these constituents' interests because their illnesses are under-recorded and under-reported.

C. Regulatory Background

1. The OSH Act's Provisions on Recordkeeping and Reporting

OSHA's authority on recordkeeping and reporting is derived from two provisions of the OSH Act. First, OSHA – through the Secretary of Labor – is given broad authority under section 8 of the Act to require employers to keep and maintain records. Section 8(c)(2) requires the Secretary of Labor to "prescribe regulations requiring employers to maintain accurate records of, and to make periodic reports on, work-related deaths, injuries and illnesses other than minor injuries requiring only first aid treatment and which do not involve medical treatment, loss of consciousness, restriction of work or motion, or transfer to another job." Section 8(c)(1) also authorizes the Secretary of Labor to issue regulations "for developing information regarding the causes and prevention of occupational accidents and illnesses."

Second, Section 24(a) of the OSH Act requires the Secretary of Labor to "develop and maintain an effective program of collection, compilation, and analysis of occupational

safety and health statistics" and to "compile accurate statistics on work injuries and illnesses which shall include all disabling, serious, or significant injuries and illnesses, whether or not involving loss of time from work, other than minor injuries requiring only first aid treatment and which do not involve medical treatment, loss of consciousness, restriction of work or motion, or transfer to another job."

2. OSHA's Current Recording and Reporting Requirements

OSHA's current recording and reporting requirements are both contained in its recordkeeping rule. Under the recording requirements, an employee's work- related fatality, injury, or illness must be recorded by their employer if it is a new case and meets one or more of the recording criteria. Thus, when an employer decides whether a particular injury or illness experienced by their employee has to be recorded, the first step is determining if the injury or illness is work-related.

A fatality, injury, or illness is presumed to be work-related if an event or exposure in the work environment either caused or contributed to the resulting condition or significantly aggravated a pre-existing injury or illness. However, this presumption of work-relatedness can be rebutted by nine case-specific exceptions. The common cold and flu exception is one of these nine exceptions. Specifically, the common cold and flu exception states that an employer is not required to record injuries and illnesses if "[t]he illness is the common cold or flu (Note: contagious diseases such as tuberculosis, brucellosis, hepatitis A, or plague are considered work- related if the employee is infected at work)." [29 CFR § 1904.5(b)(2)(viii)]

While the recording requirements generally encompass all significant work- related injuries and illnesses, the two primary reporting requirements address a subset of those cases – fatalities and hospitalization incidents. The first requires an employer to report any case involving a work-related fatality to OSHA within eight hours. The second requires an employer to report an employee's in-patient hospitalization, amputation, or loss of an eye as the result of a work-related incident to OSHA within 24 hours.

Besides fatalities and hospitalization incidents, some employers are also required to annually submit the Summary of Work-Related Injuries (OSHA Form 300A) to OSHA, while other employers only must do so upon request.

3. OSHA's Authority under the NCP

The NCP governs the organizational structure and proceedings for oil spill responses taken pursuant to the Clean Water Act and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).[5] OSHA derives its authority over NCP responses as a member of the NCP National Response Team (NRT).[6] Specifically, response actions under the NCP must comply with the provisions for worker safety and health in the

[5] 33 USC § 1311(d), 42 USC § 9605; *see also* 40 CFR § 300.2.
[6] 40 CFR § 300.110.

OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations in 29 CFR 1910.120 and applicable provisions of the OSH Act (29 USC 651 et seq.), and state laws with plans approved under section 18 of the OSH Act. When a state without an OSHA-approved plan is the lead agency for response, the state must comply with standards in 40 CFR part 311, promulgated by EPA pursuant to section 126(f) of SARA (Superfund Amendments and Reauthorization Act).[7] The latter gives OSHA the authority under the NCP to "conduct safety and health inspections of hazardous waste sites to assure that employees are being protected and to determine if the site is in compliance with 40 CFR 300.175(b)(11): "(i) Safety and health standards and regulations promulgated by OSHA (or the states) in accordance with section 126 of SARA and all other applicable standards; and (ii) Regulations promulgated under the OSH Act and its general duty clause."

D. Factual Background

1. OSHA Illness Recordkeeping & the Prevalence of Cold/Flu-Like Symptoms During Oil Spills

The OSHA exception for recording and reporting common cold and flu symptoms[8] has particular relevance to oil spill workers. Although the exception only applies to actual disease cases, the existence of this exception may dissuade employers from recording other illnesses with similar symptoms. Notably, work-related oil-chemical inhalation often produces short-term symptoms that are difficult or impossible to distinguish initially from symptoms of the common cold or flu, as the following example illustrates.

Before the OSHA common cold and flu exception went into effect in January 2001, upper respiratory illnesses were recorded and reported during oil spills. During the 1989 *Exxon Valdez* oil spill, Exxon recorded and reported a total of 6,654 clinic visits for upper respiratory illnesses among a total of some 11,000 workers (exposed and non-exposed) during the five months of response, as revealed in documents obtained in a subsequent, successful, toxic tort lawsuit brought by a sick worker.[9] Yet a biological cause of the "Valdez Crud" was never identified. Twelve years later, the *Exxon Valdez* oil spill once again made international news when reporters discovered lingering respiratory harm was still prevalent among former workers.[10] A subsequent health survey found a greater prevalence of long-term respiratory harm (symptoms of chronic airway disease and chronic bronchitis), neurological impairment, and multiple chemical sensitivity among former

[7] 40 CFR § 300.150 *et. seq.*

[8] OSHA exemption 29 USC § 1904.5(b)(2)(viii): Occupational Injury and Illness Recording and Reporting Requirements, Final rule. 66 Fed. Reg. 5,916 Jan. 19, 2001. 66 FR 5,916

[9] Exxon, statistical summary of industrial hygiene monitoring for EVOS, Med-Tox 1989. In: *Stubblefield v. Exxon*. 1994. 3AN–91–6261 CV (HBS), Alaska Superior Court, Third Judicial District at Anchorage. Exxon's medical records were SEALED by court order No. 931015 on 10/15/1993 for 30 years (until October 2023). Some records that were obtained before the court order are available in Ott R, 2004, *Sound Truth and Corporate Myths* (Dragonfly Sisters Press: Cordova, Alaska), Appendix A, Table A.2, p. 451, free online https://rikiott.com/oil-spill-information/exxon-valdez/

[10] Murphy K, "Exxon oil spill's cleanup crews share years of illnesses," *The Los Angeles Time*s, 11/5/2001.

Exxon Valdez oil spill workers with self-reported high oil exposure.[11] Common colds typically last 1–2 weeks, not 14 years.

A record of work-related cold/flu-like symptoms during oil spill response provides accountability – a feedback loop on the NCP goal to minimize harm to human health and safety during emergency response. It is also critical quality information for decision-makers to prevent or reduce long-term harm to oil spill response workers, many of whom are often community residents, e.g., 82.3% of the BP DWH GuLF (Gulf Long-term Follow-Up epidemiology) Study participants lived in Gulf Coast states.[12] If Exxon's work-related medical records for cold/flu-like symptoms had remained public (instead of being sealed by court order for 30 years), the National Institute of Occupational Safety and Health (NIOSH) Health Hazard Evaluation for the *Exxon Valdez* oil spill might have recommended long-term health monitoring,[13] and OSHA might not have exempted colds and flu from its work-related recordkeeping regulations. Further, the long-term harm that followed the 2010 BP DWH oil disaster might have been prevented or reduced.[14] The latter initially expressed as cold/flu-like symptoms and are discussed in the case study in section D.2.

While cold/flu-like symptoms are a hazard in any workplace where oil-chemical exposure is possible, oil spills uniquely expose response workers (and residents) to a very high risk of oil-chemical inhalation and associated illnesses for several reasons. First, oil spill exposures are complex mixtures of hundreds of hydrocarbons, many of which are individual human health hazards that have toxic or irritant effects if inhaled.[15] Further, these complex mixtures exist in multi-phases as oil vapors, mist, aerosols, and fine particulates. Health harm is further increased when chemical dispersants are used to break apart surface slicks.[16] OSHA standards simply do not exist for such complex mixtures of oil and oil-dispersant combined.[17]

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[11] O'Neill A, 2003. Self-reported exposures and health status among workers from the *Exxon Valdez* oil spill cleanup. Master's thesis, Yale Univ., Dept. of Epidemiology and Public Health. 203 pp. Available free online under Exxon Valdez artifacts: https://rikiott.com/oil-spill-information/exxon-valdez/

[12] Kwok RK, et al., 2017. The GuLF STUDY: A prospective study of persons involved in the BP DHOS response and clean-up. *Environ Health Perspect* 125(4):570-578. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5382003/ Of the 32,608 participants in the GuLF Study, 82.3% lived in a Gulf state.

[13] NIOSH, 1991. Health Hazard Evaluation Report. Prepared by Gorman RW, Berardinelli SP, Bender TR. U.S. DHHS, May. HETA 89-200-2111 and 89-273-2111, *Exxon/Valdez* Alaska Oil Spill.

[14] King B, Gibbons J, 2011. *Health Hazard Evaluation of the Deepwater Horizon Response Workers,* Health Hazard Evaluation Report, HETA 2010-0115 and 2010-0129-3138. A high prevalence of upper respiratory symptoms was noted in surveys of in-situ burn workers (6) offshore source workers, offshore workers in general, nearshore workers, and some beach workers (9–12).
Brown M, Schwartz N, "Oil spill workers complain of flu-like symptoms," *The Associated Press*, 6/3/2010.

[15] U.S. NIOSH 2010. Evaluating the Health Impacts of the Gulf of Mexico Oil spill testimony before the Committee on Health, Education, Labor, and Pensions: John Howard, MD, NIOSH Director. June 15, 2010. Washington, D.C.: Department of Health and Human Services.

[16] Afshar-Mohajer N, et al., 2019. The human health risk estimation of inhaled oil spill emissions with and without adding dispersant, *Sci Total Environ* 654:924-932. doi: 10.1016/j.scitotenv.2018.11.110

[17] Pratt GC, et al., 2020. Modeled air pollution from the in situ burning and flaring of oil and gas released following the Deepwater Horizon disaster. *Ann Work Exp & Health* 66(Suppl 1):i172–i187. doi: 10.1093/annweh//wxaao84. "There are no occupational standards" for $PM_{2.5}$ air concentrations (11).

Second, even if OSHA standards did exist for complex mixtures, as they do for some *similar phase* mixtures like volatile organic compounds (VOCs) or fine particulate matter ($PM_{2.5}$), OSHA itself has noted on its website that many of its standards are now outdated and not protective: "OSHA recognizes that many of its permissible exposure limits (PELs) are outdated and inadequate for ensuring protection of worker health. Most of OSHA's PELs were issued shortly after adoption of the OSH Act in 1970, and have not been updated since that time… Industrial experience, new developments in technology, and scientific data clearly indicate that in many instances these adopted limits are not sufficiently protective of worker health… OSHA *recommends that employers consider using the alternative occupational exposure limits* [e.g, the NIOSH Recommended Exposure Limits and the California OSHA PELs] *because the Agency believes that exposures above some of these alternative occupational exposure limits may be hazardous to workers, even when the exposure levels are in compliance with the relevant PELs*" (emphasis added).[18] As a result, decisions about worker health are actually being left up to the employer, instead of being mandated by OSHA.

Third, OSHA standards also do not apply in non-traditional workplaces. In traditional workplaces, workers may be exposed to mostly discrete oil or chemical pollutants only during an 8-h workday and a 40-h work week. In contrast, oil spill response workers often work extended shifts for weeks or even months, and they usually remain on-site where they may experience *continuously variable levels* of complex, multi-phase oil-chemical mixtures. And fourth, many response workers are not regular employees, but rather large numbers of temporary contract workers (the majority are often area residents),[19] volunteers, or prisoners participating in work-release programs.[20] Providing adequate training and protective equipment for these workers is more difficult to achieve and enforce than for conventional employees,[21] compounding the extent of exposures.

This concern for oil spill workers is further heightened by the aggressive offshore expansion of oil and gas development and the frequency at which oil spills and response operations occur in the United States. In 2018, the National Oceanic and Atmospheric Administration (NOAA) reported a total of 137 oil spills at a rate of roughly 11 spills per month.[22] As a category, oil spills vary widely in magnitude from small spills of less than 100

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[18] OSHA Permissible Exposure Limits – Annotated Tables. https://www.osha.gov/annotated-pels
Lerner S, 2022. As workers battle cancer, the government admits its limit for a deadly chemical is too high. *ProPublica*, 12/15/2022. https://www.propublica.org/article/goodyear-niagara-rubber-plant-ortho-toluidine

[19] Kwok, 2017, *supra* note 12.

[20] NIOSH, 2011. Deepwater Horizon Roster Summary Report, 4.
Young AL, "BP hires prison labor to clean up spill while coastal residents struggle." *The Nation*, 7/21/2010.

[21] Sarpy SA, Burke MJ, 2021. An evaluation of safety training for a diverse disaster response workforce: The case of the Deepwater Horizon oil spill. *Eur J Investing Health Psychol Educ* 11(4):1635.

[22] Cassidy E, "There were 137 oil spills in the US in 2018. See where they happened." *Resource Watch Blog* Feb. 7, 2019. https://blog.resourcewatch.org/2019/02/07/there-were-137-oil-spills-in-the-us-in-2018-see-where-they-happened/

gallons to catastrophic spills like the 2010 BP Deepwater Horizon (DWH) oil spill, which discharged an estimated 210 million gallons into the Gulf of Mexico.[23]

Finally, the medical community has known of the extreme health risk to oil spill workers for over thirty years. Six weeks after the *Exxon Valdez* oil spill in 1989, Dr. Robert Rigg, a former medical director for Standard Alaska (BP), warned the Alaska fishermen response workers, "It is a known fact that neurologic changes (brain damage), skin disorders (including cancer), liver and kidney damage, cancer of other organ systems, and medical complications… can and will occur to workers exposed to crude oil and other petrochemical by-products. While short-term complaints, i.e., skin irritation, nausea, dizziness, pulmonary symptoms, etc., may be the initial signs of exposure and toxicity, the more serious long-term effects must be prevented."[24] Dr. Rigg advised pulling workers ""off the beaches – and out of the Sound – [to] avoid further tragedy in the form of human suffering, illness, and disease…"[25]

Twenty-one years later, the National Institute of Medicine hosted a workshop in June 2010, at the request of the Secretary of U.S. Department of Health and Human Services (DHHS) to assess effects of the BP DWH oil spill on human health, inform monitoring efforts for anticipated adverse health effects, and communicate the health risk to the public.[26] Workshop participants were briefed on acute physical effects of oil spill exposure, based mostly on a 2010 literature review of studies from 7 (of 38) supertanker oil spills since the 1960s.[27] The 2010 review and subsequent ones identified a suite of cold/flu-like symptoms as acute symptoms characteristic of oil spill exposures[28] – *the very symptoms that Dr. Rigg had specified in 1989 and that OSHA exempted from its work-related recording and reporting requirements*. Workshop participants were also informed of the first findings of persistent genotoxicity and chronic respiratory harm from human health biomonitoring activities following the 2002 *Prestige* oil spill.[29] Finally, participants were briefed on heat stress, another hazard of concern, and assured "that the effects of heat stress were easy to identify and manage" and that "the adverse effects of heat [were] quickly observable and readily reversible."[30]

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[23] U.S. Coast Guard, 2011. On-Scene Coordinator Report Deepwater Horizon Oil Spill, submitted to the National Response Team. "This put the total amount released at 4.9 million barrels of oil, before accounting for containment" (33).

[24] Rigg R, MD, Letter to Cordova District Fishermen United, May 13, 1989, Cordova, AK. In: City of Cordova, Alaska, *Cordova Fact Sheet*:1989 1[29].

[25] *Id.*

[26] NAS Institute of Medicine, McCoy MA, Salerno JA, rapporteurs, 2010. Assessing the Effects of the Gulf of Mexico Oil Spill on Human Health: A Summary of the June 2010 Workshop (National Academies Press: Washington, DC). ISBN 978-0-309-38538. Free download: http:/nap.edu/12949

[27] Aguilera F, et al., 2010. Review on the effects of exposure to spilled oils on human health. *J Applied Tox* 30(4):291–301.

[28] Levy B, Nassetta W, 2011. "The adverse health effects of oil spills: A review of the literature and a framework for medically evaluating exposed individuals," *Int J Occup Environ Health* 17:121–167. Laffon B, Pasaro E, Valdiglesias V, 2016. Effects of exposure to oil spills on human health: Updated review. *J Toxicol Environ Health* Part B 19(3-4):105–128. doi: 10.1080/10937404.2016.1168730

[29] *Id.,* 22-24.

[30] Institute of Medicine workshop, 2010, *supra* note 26, at 44 (effects easy to identify and manage) and 51 (effects reversible).

The main concern of this petition is persistent cold/flu-like symptoms from oil-chemical exposures and resulting long-term harm, which is not readily reversible but can be minimized with accurate reporting, diagnosis, and treatment. Dismissing potential cases of work-related oil-chemical inhalation symptoms as mere common colds and flu obstructs documentation of the very real dangers faced by employees in the workplace. Further, it fails to mitigate the risk of potential, near certain long-term chronic illness and cancers among oil spill response workers and the exposed public that have, so far, inevitably occurred.[31] Our case study on the BP DWH oil disaster, with supporting evidence from the forerunner chronic health studies conducted after the *Prestige* and the *Hebei Spirit* oil spills,[32] demonstrates the need to revise OSHA's cold/flu exception to protect workers (and residents) and provide decision-makers with quality information.

2. A Case Study: The BP Deepwater Horizon Oil Spill & Supporting Evidence

On April 20, 2010, British Petroleum's (BP) oil drilling rig Deepwater Horizon (DWH) exploded and sank into the Gulf of Mexico.[33] Oil spilled into the Gulf for the next eighty-seven days until the well was capped to stop the oil discharge. Approximately 210 million gallons of crude oil were released into the surrounding waters during those three months.[34] To provide some context, the BP DWH oil spill released roughly the amount spilled by the oil tanker *Exxon Valdez* (about 11 million gallons) every five days.

Response operations began almost immediately, and active cleanup continued for more than three years in several states.[35] Over the course of the response operations, more than 45,000 people participated in the cleanup.[36] Response workers included members of the United States Coast Guard (USCG) and other federal and state employees, BP employees, independent contractors, prison laborers, coastal fishermen, and volunteers. Most of these workers were covered by the regulations promulgated by OSHA.

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[31] U.S. NIOSH testimony, 2010, *supra* note 15.

[32] In 2002, the tanker *Prestige* floundered in heavy seas, eventually breaking in half, off the coast of Galicia, Spain, spilling 17.8 Mn gal of heavy fuel oil that oiled coasts of six countries. https://wwz.cedre.fr/en/Resources/Spills/Spills/Prestige
In 2007, the tanker *Hebei* Spirit, anchored off the Port of Incheon, Republic of South Korea, spilled 3.4 Mn gal of Iranian heavy crude and two light crudes (Kuwait and Upper Zakum) when the crane of a drifting barge punctured 3 cargo tanks. https://wwz.cedre.fr/en/Resources/Spills/Spills/Hebei-Spirit

[33] U.S. EPA, Deepwater Horizon – BP Gulf of Mexico Oil Spill, https://www.epa.gov/enforcement/deepwater-horizon-bp-gulf-mexico-oil-spill

[34] U.S. Coast Guard On-Scene Coordinator Report, 2011, *supra* note 23.

[35] Fitzsimmons, EG. 'Active cleanup' of oil spill is ended on Louisiana coast. *New York Times*, 4/16/2014. https://www.nytimes.com/2014/04/17/us/bp-oil-cleanup-gulf-coast.html
U.S. Coast Guard, Different tactics but Deepwater Horizon response is far from complete, 4/16/2014. https://coastguardnews.com/different-tactics-but-deepwater-horizon-response-is-far-from-complete/2014/04/16/

[36] Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, 2011. *Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling*, at 133. https://www.govinfo.gov/content/pkg/GPO-OILCOMMISSION/pdf/GPO-OILCOMMISSION.pdf

a) Airborne Human Health Hazards Present During Oil Spills

Peak oil spill emissions occurred during the first three months of the oil disaster and consisting of a mixture of fine particulates and polycyclic aromatic hydrocarbons (PAHs) from episodic burning and near continuous flaring of oil, accounting for 11% of the oil released, and VOCs evaporating from freshly surfaced oil, as the largest source of primary air emissions.[37] Evaporating hydrocarbons affect air quality in three ways.[38] First, VOCs, included BTEX (benzene, toluene, ethylbenzene and xylene) compounds, classified as hazardous air pollutants, and n-hexane, which causes "dying-back neuropathy" with acute symptoms of tingling sensations in hands and feet. Second, the evaporating hydrocarbons reacted rapidly (within 24 hours) in the atmosphere to form secondary organic aerosols (SOAs), very small particles which were present in relatively large concentrations, were dispersed in a wide plume, and continued to increase in mass downwind, making them a potential health risk in coastal communities directly downwind of the spill. Third, the evaporating hydrocarbons reacted with nitrous oxides – in the atmosphere and emitted by flaring operations and ship emissions close to the spill site – and sunlight to form secondary pollutants such as ozone and PAN (peroxyacetyl nitrate), a lung and eye irritant in petrochemical smog.[39] These pollutants all contribute to reduced air quality and can cause or worsen respiratory irritation and cardiac disease.[40]

Dangerous levels of dangerous chemicals were measured in oil-impacted coastal communities. Oil spill aerosols traveled at least 80 miles inland from the coast.[41] For example, oil spill emissions produced elevated levels of nitrogen dioxide, sulfur dioxide, and carbon monoxide in coastal communities.[42] Further, levels of benzene and $PM_{2.5}$ exceeded public health standards in southeast coastal and rural Louisiana during the peak 5 months of oil spill emissions.[43] The data from coastal and regional areas carried an oil spill signature, identified by high variance from oil droplets and aerosols that was statistically different from urban areas.[44] $PM_{2.5}$ is considered a universal pollutant and one of six criteria pollutants, the outdoor levels of which are regulated by EPA to mitigate harmful effects on human health and the environment. The latest Integrated Science

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[37] de Gouw JA, Middlebrook AM, Warnecke C, + 24, Watts LA. Organic aerosol formation downwind from the [BP] Deepwater Horizon oil spill. **2011** Mar; *Science* 331:1295–99. 10.1126/science.1200320
Middlebrook AM, et al., 2012. Air quality implications of the Deepwater Horizon oil spill. *Proc Nat Acad Sci* 109(50):20280–5. doi:10.1073/pnas.1110052108
Brock CA, Murphy DM, Bahreini R, Middlebrook AM. Formation and growth of organic aerosols downwind of the [BP] Deepwater Horizon oil spill. *Geophys Res Lett* 38 **2012**; L17805. doi.org/10.1029/2011GL048541

[38] Middlebrook, 2012, *supra* note 37.

[39] *Id.*

[40] World Health Organization, *Ambient (Outdoor) Air Pollution*, https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health

[41] Middlebrook, 2012, *supra* note 37.

[42] Beland L-P, Oloomi S, 2019, Environmental disaster, pollution, and infant health: Evidence from the Deepwater Horizon oil spill, *J Envt'l Econ Mgmt* 98:102265. doi.org/10.1016/j.jeem.2019.102265

[43] Nance E, King D, Wright B, Bullard RD, 2016. Ambient air concentrations exceeded health-based standards for fine particulate matter and benzene during the BP Deepwater Horizon oil spill. *J Air Waste Manag Assoc* 66(2):224-36. doi: 10.1080/10962247.2015.1114044

[44] *Id*.

Assessment concluded there is *likely to be a causal relationship* between short- and long-term $PM_{2.5}$ exposure and several respiratory-related outcomes, including worsening of asthma, worsening of chronic obstructive pulmonary disease (COPD), and combined respiratory-related diseases.[45] The assessment also concluded there is *a causal relationship* between short- and long-term $PM_{2.5}$ exposure and cardiovascular effects (e.g., arrhythmia, thrombosis), cardiovascular diseases such as ischemic heart disease, and cardiovascular-related deaths.[46]

During the 3 months of peak oil spill emissions, approximately 1.8 million gallons of dispersants were intentionally released into Gulf waters[47] with daily use subsea at the broken wellhead and on the sea surface, despite concerns raised internally by the U.S. Coast Guard and the Environmental Protection Agency (EPA).[48] The health risks posed by chemical dispersants used in oil spill response operations have increasingly become a public concern.[49] Broadly, dispersants are oil-based mixtures of surfactants and solvents applied to oil in order to break it into smaller droplets.[50] Proprietary dispersant formulations vary significantly in composition, effectiveness, and toxicity.[51] However, once dispersants combine with oil, the toxicity is different than for either parent chemical complex. Dispersants available for use during oil spill response are listed on the NCP Product Schedule.

Two Corexit formulations, specifically 9500A and 9527A, were used in unprecedented quantities and duration following the BP DWH.[52] Nearly one million gallons of dispersants were applied daily over a period of almost three months by spraying from boats or aircraft offshore, and some 801,000 gallons were injected subsurface near the

[45] US EPA, 2019. Integrated Science Assessment for Particulate Matter with errata sheet Sept. 2021. Center for Public Health and Environmental Assessment, Office of Research and Development. EPA/600/R-19/188. https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=347534.

[46] *Id.* at 125.

[47] Restore the Gulf, 2011. *Operations and Ongoing Response: August 17, 2011*. https://www.restorethegulf.gov/release/2015/07/01/operations-and-ongoing-response-august-17-2011

[48] National Archives and Records Administration (NARA), FOSC USCG Phase V, Admiral Nash Documents, Dispersants. HOV00009027 Batch A. Notes from EPA-USCG Conference Call: Dispersants, 6/22/2010, showing concerns raised over subsea dispersant use regarding daily volume (Rear Admiral USCG "RADM" Watson at 24), lack of protocol and pre-planning (Admiral USCG "ADM" Allen at 24, and lack of data to justify BP's argument that subsea use reduces hazardous oil gases ("VOCs") at the surface (EPA Administrator Jackson at 25)

[49] National Academy of Sciences (NAS), *Oil in the Sea IV: Inputs, Fates, and Effects.* Washington, DC: The National Academies Press. Dec 2022. https://doi.org/10.17226/26410 E.g., "well-publicized debate over the use of unprecedented amount of dispersants…" and "…initial failure to release total information about the chemical composition of dispersants…" at 350.

[50] Fingas M, The Basics of Oil Spill Cleanup (3rd ed. 2013). A "surfactant" lowers the surface tension of spilled oil and allows it to disperse more easily in water. "Solvents" chemically separate and disperse masses of oil into solution with the surrounding seawater.

[51] *Id*.

[52] GAP (Government Accountability Project), 2013. Deadly Dispersants in the Gulf: Are Public Health and Environmental Tragedies the New Norm for Oil Spill Cleanups? 7 (2013).

broken wellhead daily during this same timeframe.[53] In addition, a (still) undisclosed[54] amount of dispersant was sprayed from small boats daily in nearshore waters over a longer timeframe, as evidenced from photo-documentation and testimonies of coastal residents.[55] Wind and wave energy aerosolized chemically-dispersed surface oil, forming toxic airborne nano-size droplets that travel further and penetrate more deeply into human lungs than undispersed oil droplets.[56]

Thousands of workers self-reported common cold/flu-like symptoms that co-occurred with their response activities during subsequent epidemiology studies. Southeast Louisiana women and their children also self-reported cold/flu-like symptoms, and this epidemiology study is also discussed briefly below as it supports this petition's main argument. While results of these studies are still emerging and will be for years, they are amassing a record of chronic illnesses and cancers associated with oil spill exposures, years after on-site response activities were concluded – a record that is clearly not associated with common colds or flu and one that clearly needs preventative action and long-term monitoring to mitigate work-related harm.

b) Respiratory Symptoms and Harm Prevalent After Oil Spill Exposures

Despite the clear and present danger of airborne oil vapors, mists, aerosols, soot and oil particulate matter, and the broadcast application of unprecedented amounts of dispersants – all containing human health hazards[57] – contract workers were not initially screened for pre-existing health issues. Without health screening, there was no way to identify which jobs would or would not exacerbate a worker's pre-existing conditions. Nor did workers receive the required 40-hour OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) training or, for the first 4–6 weeks, the Personal Protective Equipment (PPE) necessary to protect them from these known toxic pollutants and exposure risks. Meanwhile, coastal residents and their children across four states in

[53] Arnold S, et al., 2022. Estimation of aerosol concentrations of oil dispersants COREXIT™EC9527A and EC9500 during the Deepwater Horizon oil spill response and clean-up operations. *Ann Work Exp Health* 66(S1):i188–i202. https://doi.org/10.1093/annweh/wxab108

[54] NARA, FOSC USCG Phase V, Admiral Nash Documents, Dispersants. HOV00009027 Batch B. EPA Mathy Stanislaus email, 7/3/2010, at 37-38, validating that coastal spraying of dispersants did occur and showing FOSC approval and records of coastal spraying were "removed from daily reports" issued by Unified Command.

[55] Ott R, "Open Letter to US EPA, Region 6." *Huffington Post,* 8/27/2010.
GAP, 2013, *supra* note 52.
GAP, 2015. Addendum Report to Deadly dispersants in the Gulf. https://whistleblower.org/wp-content/uploads/2018/11/GAPAddendumReportFinal.pdf

[56] Afshar-Mohajer N, et al., 2018. A laboratory study of particulate and gaseous emissions from crude oil and crude oil-dispersant contaminated seawater due to breaking waves. *Atmospheric Environ 179:177-186. https://doi.org/10.1016/j.atmosenv.2018.02.017*
Afshar-Mohajer N, et al. 2020. Impact of dispersant on crude oil content of airborne fine particulate matter emitted from seawater after an oil spill. *Chemosphere* 256:127063. doi: 10.1016/j.chemosphere.2020.127063

[57] U.S. NIOSH, 2010 testimony, *supra* note 15.

the spill-impacted region simultaneously experienced similar exposures from inhalation as the unprotected beach and nearshore workers.[58]

In part because of high public awareness of the "BP syndrome" – the ubiquitous cough, wheezing, shortness of breath, headache, dizziness or nausea – BP was forced to recognize and list as compensable many of the illnesses linked with initial oil-chemical exposures.[59] Acute specified physical conditions included acute rhinosinusitis, acute tracheobronchitis, acute exacerbation of pre-existing asthma and COPD (chronic obstructive pulmonary disease), and acute pharyngitis (throat irritation) with symptoms nasal congestion, nasal discharge or post-nasal drip, headache, facial pain/pressure or sinus pain, decreased sense of smell, cough, sputum production, wheezing or shortness of breath – *the very cold/flu-like symptoms that OSHA currently exempts in illness recordkeeping requirements*.[60] Other listed acute symptoms included neurological conditions with symptoms of dizziness, fainting, and seizure, gastrointestinal distress with symptoms of nausea, diarrhea, vomiting, and abdominal cramps or pain, and dermal conditions with symptoms of itchy, burning skin and skin rashes or lesions, among others. Some of the symptoms associated with neurological and gastrointestinal conditions are also familiar to those with bad colds or flu – and *ones that OSHA currently exempts in its illness recordkeeping requirements*. BP was also forced to specify several chronic physical conditions, including chronic rhinosinusitis and reactive airways dysfunction syndrome (irritant-induced asthma).[61] *The medical benefits settlement alone is striking evidence that the OSHA cold/flu recordkeeping exception is failing to accurately record and report work-related illnesses associated with oil-chemical exposure during oil spill response under the NCP.*

A clinical study, initiated shortly after the BP disaster with 7-year follow-up visits, assessed pulmonary function (and hematologic and hepatic markers[62]) in a cohort of south Louisiana response workers who had worked at least 3 months and been exposed to the oil spill and dispersant.[63] Test results were compared to similar assessments of unexposed people who lived at least 100 miles inland. The most reported *initial* symptoms of exposure were headaches, shortness of breath, skin rash, chronic cough, fatigue, painful joints, and chest pain, which, except for skin rash, mimic the cold/flu-like symptoms currently

[58] Nance, 2016, *supra* note 43.

[59] *Plaisance, et al., on behalf of the Medical Benefits Settlement Class v. BP Exploration & Production,* [BP] Deepwater Horizon Medical Benefits Class Action Settlement Agreement, as amended on May 1, 2012. Case 2:10-md-02179-CJB-SS, Doc. 6427-1, 05/03/12, No. 12-CV-968. Exhibit 8. https://www.laed.uscourts.gov/sites/default/files/OilSpill/6.pdf

[60] *Id.* at Table 1.

[61] *Id.* at Table 3.
A court ruled that people not covered by the medical settlement must file individual lawsuits. Thousands did. Kirby B, 2022. "12 years later, BP still fighting hundreds of lawsuits over Deepwater Horizon spill." *Fox10 TV* 7/8/2022. https://www.fox10tv.com/2022/07/08/12-years-later-bp-still-fighting-hundreds-lawsuits-over-deepwater-horizon-spill/

[62] *See* discussion *infra* notes 108–114 and accompanying text.

[63] D'Andrea MA, Reddy GK, 2013. Health consequences among subjects involved in Gulf oil spill clean-up activities. *Amer J Med* 126(11):966–74. doi: 10.1016/j.amjmed.2013.05.014.

exempted from OSHA recordkeeping of work-related illnesses.[64] *Significantly, prolonged or worsening illness symptoms were still present 7 years after the initial exposure*.[65] Shortness of breath was the most frequently reported symptom among oil exposed subjects at both their initial (75%) and their 7-year (84%) follow-up visits. While none (0%) of the workers experienced severe pulmonary function abnormalities during their initial visit, most of the workers had progressive deterioration of their respiratory system by the 7-year visit – 91% developed chronic rhinosinusitis and 45% chronic reactive airways dysfunction syndrome. Chronic rhinosinusitis and chronic reactive airway dysfunction syndrome were new symptoms that were not reported during their initial visit – and both are listed in the BP medical benefits settlement as compensable work-related illnesses (as well as compensable illnesses for residents).[66] This clinical study demonstrates that *the OSHA cold/flu recordkeeping exception is failing to accurately record and report work-related illnesses associated with oil-chemical exposure during oil spill response under the NCP.* Without accurate records, workers are unlikely to be compensated for their work-related illnesses either through a worker-compensation claims process or litigation.

The three epidemiology studies used very different cohorts yet found very similar results. The USCG study cohort was comprised largely of uniformly young, fit, white males with pre- and post-spill medical records and archived biological samples available for all participants. Recall bias was minimal, as most participants completed exit surveys shortly after completing oil spill response work.[67] The Gulf Longitudinal Follow-up (GuLF) study cohort was a unique population of culturally, ethnically, and linguistically diverse peoples with some of the highest rates of unemployment and poverty and the lowest rates of access to healthcare in the United States.[68] The Women and Their Children's Health (WaTCH) study cohort was from southeast Louisiana, largely the same region in the southeast Louisiana air quality study. The cohort reflected the diversity of the GuLF study participants, and it included women spill responders and commercial fisher women.[69]

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[64] *Id.*

[65] D'Andrea MA, Reddy GK, 2018. The development of long-term adverse health effects in oil spill cleanup workers of the Deepwater Horizon offshore drilling rig disaster, *Frontiers Pub Health* 6:117. doi: 10.3389/fpubh.2018.00117

[66] Although several acute and chronic physical conditions were listed as compensable, most people with listed conditions are not likely to be compensated because the proof requirements are too narrow, e.g., symptoms reported with 24 or 72 hours of exposure, living with 0.5 miles of the coast, written diagnoses of chemical illness, etc. *Therefore, the number of compensated cases should not be confused with the number of valid cases of chronic harm.*

[67] Rusiecki J, et al., 2018. The [BP] Deepwater Horizon oil spill Coast Guard cohort study. *Occup Environ Med* 75(3):165-175. doi.org/10.1093/annweh/wxab113

[68] Kwok, 2017, *supra* note 12.
Resnik DB, et al., 2015. Ethical issues in environmental health research related to public health emergencies: Reflection on the GuLF Study. *Environ Health Perspect* 123(9): A227-31. doi: 10.1289/ehp.1509889.
Lawrence KG, Werder EJ, Sandler DP, 2021. Association of neighborhood deprivation with pulmonary function measures among participants in the Gulf Long-Term Follow-up Study. *Environ Res* 6:11170

[69] Peters ES, et al., 2017. The women and their children's Health (WaTCH) study: Methods and design of a prospective cohort study in Louisiana to examine the health effects from the BP oil spill. *BMJ Open* 7(7):e014887. doi: 10.1136/bmjopen-2016-014887

These epidemiology studies found short- and long-term respiratory harm in workers and coastal residents, including children.[70] The symptoms that were used to identify acute respiratory harm in the questionnaires included runny nose, cough, sore throat, asthmatic wheezing, eye irritation, and difficulty breathing – *all cold/flu-like symptoms*. However, unlike the common cold or flu that persists for one to two weeks, the symptoms associated with oil spill exposures persisted for up to at least 5 to 7 years in the epidemiology[71] and clinical studies[72] (the limits of the studies to-date, not the symptoms), and lead to new or worsening of chronic respiratory illnesses and decreased lung function. Further, unlike the common cold or flu, certain jobs with higher exposure levels from burning crude oil or decontamination work were linked with a higher risk of developing chronic respiratory disease.[73] Exposure to dispersant, which was found to increase the total mass of airborne oil aerosols entering the respiratory system by a factor of ten,[74] was also linked with a higher risk of developing chronic respiratory disease.[75]

Also unlike the common cold or flu, observed harm and the extent of harm depended on what methodologies were used to determine exposure rather than on identification of a biological agent. For example, while one GuLF study concluded that respiratory harm did not persist after 1 to 3 years,[76] another with the same cohort found *increased symptom-based asthma* 1 to 3 years after the spill.[77] These seemingly contradictory findings can be explained by examining the two different methods used to assess harm. The study that did not detect lingering harm used a Job-Exposure Matrix, a quantitative approach that modeled exposures based on "total hydrocarbons," a subset of

[70] Alexander M, et al., 2018. The BP DHOS Coast Guard cohort study: A cross-sectional study of acute respiratory health symptoms. *Environ Res* 162:196-202. doi: 10.1016/j.envres.2017.11.044
Chen D, et al., 2022. Fine particulate matter and lung function among burning-exposed [BP] Deepwater Horizon oil spill workers. *Environ Health Perspect* 130(2):27001. doi: 10.1289/EHP8930
McGowan CJ, et al., 2017. Respiratory, dermal, and eye irritation symptoms associated with Corexit™ EC9527A/EC9500A following the BP DHOS: Findings from the GuLF STUDY. *Environ Health Perspect* 125(9): 097015. doi: 10.1289/EHP1677
Rusiecki J, et al., 2022. Incidence of chronic respiratory conditions among oil spill responders: Five years of follow-up in the Deepwater Horizon oil spill Coast Guard cohort study. *Environ Res* 203:111824. doi: 10.1016/j.envres.2021.111824
Peres LC, et al., 2016. The [BP] Deepwater Horizon oil spill and physical health among adult women in southern Louisiana: The Women and Their Children's Health (WaTCH) Study. *Environ Health Perspect* 124(8):1208–13. doi: 10.1289/ehp.1510348

[71] *E.g.,* Rusiecki, 2022, *supra* note 67.

[72] *E.g.,* D'Andrea and Reddy, 2018, *supra* note 65.

[73] Gam KB, et al., 2018a. Association between Deepwater Horizon oil spill response and cleanup work experiences and lung function. *Environ Int'nat'l* 121(Pt1):695–702. doi: 10.1016/j.envint.2018.09.058.

[74] Afshar-Mohajer, 2019, *supra* note 16.

[75] McGowan, 2017, *supra* note 70.
Afshar-Mohajer, 2018, *supra* note 56.
Afshar-Mohajer, 2020, *supra* note 56.

[76] Gam KB, et al. 2018b. Lung function in oil spill response and clean-up workers 1-3 years after the Deepwater Horizon disaster. *Epidemiology* 29(3):315-322. doi: 10.1097/EDE.0000000000000808.

[77] Lawrence KG, et al., 2022 Associations between airborne crude oil chemicals and symptom-based asthma. *Environ Int* 167:107433. doi: 10.1016/j.envint.2022.107433

total exposures, as a surrogate for oil spill exposure.[78] The study that found persistent harm used a more holistic semi-quantitative approach to capture the full range of harm from the full breath of uncertain exposures to complex, multi-phase mixtures of oil compounds.[79] In so doing, it also found a "*true undercounting of clinical asthma*" in medically underserved Gulf Coast populations that were assessed with the quantitative approach.[80]

One set of GuLF studies examined the health risks and effects of oil-derived soot (fine particulate matter, $PM_{2.5}$) from controlled burning of oil and gas on exposed workers. While the overall mass flux of SOAs to the air was the largest source of primary air emissions, the soot emissions during the episodic burns likely exceeded the daily $PM_{2.5}$ concentration in federal standards associated with adverse health effects for the general population.[81] The health risk of $PM_{2.5}$ was likely understated due to the inability to account for SOA formation and background levels. Significant declines in lung function were found in burn-exposed offshore workers 1–3 years after the oil spill for those in the highest exposure category.[82] The decline was functionally equivalent to 1 to several years of lung function loss from aging.[83]

Lab studies conducted with human airway epithelial cells treated with BP crude oil and/or one of the two Corexit dispersants (9500 and 9527) used during the BP DWH spill response identified mechanisms to support findings of persistent long-term harm.[84] One study found, for example, that oil-dispersant mixtures promote double- and single-stranded DNA breaks and activation of DNA damage response mechanisms, indicating that oil-dispersant mixtures induce genotoxic effects.[85] Such effects are associated with later development of chronic disease, including an increased likelihood of chronic respiratory disease and cancer.[86]

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[78] Stewart PA, et al., 2018. Development of a total hydrocarbon ordinal job exposure matrix for workers responding to the BP DHOS: The GuLF STUDY. *J Expo Sci Environ Epidemiol* 28(3):223–230. doi: 10.1038/jes.2017.16.

[79] Lawrence, 2022, *supra* note 77, found higher incidence of asthma among medically-underserved oil spill workers when characterized by self-reported wheeze symptoms and self-reported medical diagnose of asthma.

[80] *Id.* at 5.

[81] Pratt, 2020, *supra* note 17, at 11, finding this comparison was necessary, as there "are no occupational standards" for this hazard, and that the federal standards for the general public were sometimes exceeded.

[82] Chen, 2022, *supra* note 70.

[83] Pratt, 2020, supra note 17, at 13.

[84] Major D, et al., 2016. Effects of Corexit oil dispersants and the WAF [water-accommodated fraction] of dispersed oil on DNA damage and repair in cultured human bronchial airway cells, BEAS-2B. *Gene Rep* 3:22-30. doi: 10.1016/j.genrep.2015.12.002

Liu YZ, et al., 2016. The impact of oil spill to lung health – Insights from an RNA seq study of human airway epithelial cells. *Gene* 578:38–51. doi: 10.1016/j.gene.2015.12.016

Liu YZ, et al., 2017. Carcinogenic effects of oil dispersants: A KEGG pathway-based RNA-seq study of human airway epithelial cells. *Gene* 602:16-23.

[85] Major, 2016, *supra* note 84.

[86] Liu YZ, 2016, 2017, *supra* note 84.

Gilbert, SF. Developmental Biology, Differential Gene Expression, 6th ed., 2000. Differential gene expression refers to differences in the levels at which cells transcribe DNA into mRNA and

Similarly, in other studies, a series of RNA-sequence analyses identified a pattern of genotoxic effects caused by oil and oil dispersants.[87] Specifically, the pattern was one of cancer initiation through transcription errors that blocked various receptors for protein processing and signaling. Corexit 9527, with and without oil, elicited the most pronounced effects on DNA damage and proliferation, including, specifically, initiating 8 cancer pathways, including small cell lung cancer (aka neuroendocrine tumors), prostate cancer, chronic myeloid leukemia, and non-small cell lung cancer, among others.[88] Oil and Corexit 9527 combined functionally shifted the cancer pathway to a smaller set of genes that have more cancer pathways. Biological processes triggered by oil dispersants were also consistent with several common lung diseases such as COPD, asthma, and cystic fibrosis.[89] Authors point out that such results are "not surprising,"[90] given that Corexit 9527 contains the toxin 2-butoxyethanol and its toxic effects have been previously established.[91] (What did surprise the authors, however, was that these two dispersants were still used in the United States, despite the known risks to humans.[92])

Both lab and field evidence from animal studies confirm respiratory damage at the cellular and organism levels. A study with mice found that Corexit dispersant and oil combinations promoted genotoxicity/DNA damage, cell death, inflammation (one of the hallmarks of cancer), and tumor formation in the pulmonary system.[93] Like the earlier RNA-sequence studies with human tissue, Corexit 9527 treatments with mice tissue triggered more cancer pathways than Corexit 9500 (19 versus 7, respectively).[94] Similarly, damage to lung function (e.g., airway hyperresponsiveness and pulmonary emphysema) and gene

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subsequently synthesize proteins based on the transcribed genetic material. Although cells naturally exhibit different patterns of gene expression, exposure to environmental conditions or toxins may also result in departures from expected expression patterns for a given cell type.

Krupina K, et al., 2021. Causes and consequences of micronuclei. Curr Opin Cell Biol 70:91-99. *https://pubmed.ncbi.nlm.nih.gov/33610905/* Single- and double-stranded breaks are types of genetic damage in which either one or both strands of the DNA molecule are severed, typically by a toxin or by certain forms of radiation. They can increase the likelihood of harmful chromosomal rearrangements that increase the likelihood of developing cancer or other diseases.

Nelson BC, Dizdaroglu M, 2020. Implications of DNA damage and DNA repair on human diseases. Mutagenesis 35(1):1-3. doi: 10.1093/muage/gez048

[87] Liu YZ, 2016, 2017, *supra* note 84.

[88] Liu YZ, 2017, supra at 84. Corexit 9500 + oil treatment was characterized by "upregulation" or blocking of receptors that prevent an inflammatory response and promote an immune response in 8 different cancer initiation pathways, while Corexit 9527 treatment "upregulated" or triggered 27 specific cancer initiation pathways, mostly associated with blocking ribosome biogenesis (synthesis of proteins into an amino acid sequence).

Cancer pathways are defined in terms of "KEGG pathways." Kanehisa M, Goto S, 2000. KEEG: Kyoto Encyclopedia for Genes and Genomes. *Nucleic Acids Res* 28(1):27-30. *doi: 10.1093/nar/28.1.27*

[89] Liu YZ, 2017, *supra* note 84.

[90] *Id.* at 10.

[91] CDC (Centers for Disease Control), NIOSH Pocket Guide to Chemical Hazards, 2-butoxyethanol, last reviewed Oct. 30, 2019. https://www.cdc.gov/niosh/npg/npgd0070.html

[92] Liu YZ, 2017, supra note 84, at 10.

[93] Liu YZ, et al., 2020. The impact of the Deepwater Horizon oil spill upon ung health-mouse model-based RNA-seq analyses. *Int J Environ Res Public Health* 17(15):5466. *doi: 10.3390/ijerph17155466*

[94] *Id.*

expression[95] also were found in rodents, exposed to airborne crude oil pollutants at levels modeled after the BP DWH exposure.[96] After the *Exxon Valdez* oil spill, direct respiratory damage (e.g., interstitial pulmonary emphysema) was found in 43–73% of the moderately to heavily oiled sea otters that were necropsied.[97] Similarly, after the BP DWH oil disaster, Barataria Bay (Louisiana) dolphins were five times more likely to have persistent moderate to severe lung disease (e.g., substantial alveolar interstitial syndrome, lung masses, and pulmonary consolidation) than the unoiled control group from Sarasota Bay, Florida.[98] Further, the pulmonary abnormalities and impaired stress response persisted for at least 4 years after the DWH disaster.[99] The damage was thought to be "due largely to exposure to oil and volatile compounds produced from the dispersing products."[100]

Supporting evidence from studies after the *Prestige* and *Hebei Spirit* oil spills found increased prevalence of acute respiratory symptoms and decreased lung function associated with oil spill exposures. For example, military personnel who participated in the *Hebei Spirit* oil spill response also experienced cold/flu-like symptoms including respiratory (cough, sore throat, runny nose, sputum), neurological (headache, dizziness, nausea, fatigue, hot flushing), ophthalmic (red, sore, or watery eyes) symptoms in patients who did not have a previous history of such symptoms.[101] Increased risk of symptoms was positively associated with duration of work, proximity to the spill site (Taean County), and inappropriate use of personal protective equipment.[102]

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[95] *See supra* note 86.

[96] Amor-Carro O, et al., 2020. Airway hyperresponsiveness, inflammation, and pulmonary emphysema in rodent models designed to mimic exposure to fuel oil-derived volatile organic compounds encountered during an experimental oil spill. *Environ Health Perspect* 128(2): 27003. https://doi.org/10.1289/EHP4178 Notably, researchers found significantly increased numbers of dead alveolar septal cells, likely from DNA damage, in exposed mice and an unusual pattern of distribution over the most peripheral areas of the lung parenchyma. Healthy septal cells maintain a barrier to prevent leakage of fluid and protein across the alveolar wall into the air spaces. Researchers suggested an alternative disease mechanism for inhalation of fuel oil-derived VOCs, i.e., *that the death of large numbers of these cells in peripheral regions was sufficient to cause emphysema without inflammation, which is different than the inflammatory mechanism for cigarette smoke-induced emphysema.*

[97] Lipscomb TR, et al., 1993. Histopathologic lesions in sea otters exposed to crude oil. *Veterinary Pathology* 30(1):1–11.

[98] Schwacke L, et al., 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the Deepwater Horizon Oil Spill. *Environ Sci Technol* 48:93−103. dx.doi.org/10.1021/es403610f

Venn-Watson S, et al., 2015. Adrenal gland and lung lesions in Gulf of Mexico Common Bottlenose Dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. *PLoS ONE* 10(5):e0126538. doi: 10.1371/journal.pone.0126538.

[99] Smith CR, et al., 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013–2014), with evidence of persistent lung disease and impaired stress response. *Endangered Species Research* 33:127–142.

[100] NAS *Oil in the Sea IV*, *supra* note 49, at 276.

[101] Gwack J, et al., 2012. Acute health effects among military personnel participating in the cleanup of the *Hebei Spirit* oil spill, 2007, in Taean County, Korea. *Osong Public Health Res Perspect* 3(4):206–212. http://dx.doi.org/10.1016/j.phrp.2012.10.001

[102] *Id.*

Studies also found persistent chronic human health harm from oil spill exposure. Reduction in lung function was found to persist for up to five years post-spill in workers and residents, living in proximity to oil spills, and no improvement among the exposed workers after six years.[103] Children who lived near the oiled coastline in Taean County had significantly higher rates of airway hyperresponsiveness and asthma, a lower forced expiratory volume in one second, and a higher rate of wheezing at 1.5 years after the *Hebei Spirit* accident, compared with those who lived further from the coastline. [104] Further, male sex, family history of asthma, and residence near the spill area were significant risk factors for asthma.[105] Children who lived in the area impacted by the spill and those who participated in response activities had persistent symptoms of allergic rhinitis years after the oil spilled. [106] These findings are currently consistent with BP DWH studies to-date.

c) Other Illnesses and Cancers Prevalent after Oil Spill Exposures

Unlike common cold/flu symptoms derived from a biological causation, cold/flu-like symptoms from *oil spill exposures are linked with a wide range of other acute and chronic health effects because inhaled petroleum hydrocarbons rapidly enter the bloodstream*.[107] During the BP DWH oil spill and response, very high levels of petroleum hydrocarbons were found in the blood of workers, coastal residents, and children during the spring and summer months of peak oil spill emissions,[108] and residual levels were still evident up to 3 years later.[109]

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[103] Zock JP, et al., 2012. Persistent respiratory symptoms in clean-up workers 5 years after the *Prestige* oil spill. *Occup Environ Med* 69(7):508–13. doi:10.1136/oemed-2011-100614
Zock JP, et al., 2014. Evaluation of the persistence of functional and biological respiratory health effects in clean-up workers 6 years after the *Prestige* oil spill. *Environ Int'l* 62:72–77, finding of no change in respiratory health of exposed workers from the previous 4 years but an unexpected deterioration of respiratory health in non-exposed controls that compromised detection of long-term harm in exposed workers.

[104] Noh SR, et al., 2019. *Hebei Spirit* oil spill and its long-term effect on children's asthma symptoms. *Environ Pollut* 248:286–294, finding persistence of asthma 5 years after spill.
Park MS, et al., 2019. Health effect research on Hebei Spirit oil spill (HEROS) in Korea: A cohort profile. *BMJ Open* 9:e026740. doi:10.1136/ bmjopen-2018-026740

[105] *Id.*

[106] Jeon Y-J, et al., 2016. Impact of allergic diseases in elementary school students by the *Hebei Spirit* oil spill. *Korean Public Health Res* 42:57–68. In: Park MS, et al., 2019. Health effect research on *Hebei Spirit* oil spill (HEROS) in Korea: A cohort profile. *BMJ Open* 9:e026740. doi:10.1136/ bmjopen-2018-026740

[107] Schwacke, 2014, *supra* note 98.
NAS *Oil in the Sea IV*, *supra* note 49, at p. 275.

[108] Summarco PW, et al., 2016. Concentrations in human blood of petroleum hydrocarbons associated with the BP/Deepwater Horizon oil spill, Gulf of Mexico. *Arch Toxicol* 90(4):829-37. doi: 10.1007/s00204-015-1526-5

[109] Doherty BT, et al., 2017. Associations between blood BTEXS concentrations and hematological parameters among adult residents of the U.S. Gulf states, Table 2. *Environ Res* 26;156:579-587. doi:10.1016/j.envres.2017.03.048
Werder EJ, et al., 2019. Blood BTEX levels and neurologic symptoms in Gulf states residents. *Environ Res* 175:100-107. doi: 10.1016/j.envres.2019.05.004
Werder EJ, et al., 2018. Predictors of blood volatile organic compound levels in Gulf coast residents. *J Expo Sci Environ Epidemiol* 28(4):358-370 doi: 10.1038/s41370-017-0010-0.

Once oil enters the bloodstream, the oil is metabolized mainly in the liver and the metabolites produce reactive oxygen species that are excreted in the urine. The metabolites cause oxidative stress in the body, affecting DNA, protein, lipids, and cellular membranes. Before the BP DWH disaster, benzene exposure was already known to be associated with hematological (blood) toxicity and increased cancer risk – rare adverse outcomes such as leukemia, myeloma, and lymphoma that may take years to develop.[110] So were more immediate health effects of oil spill exposure that can be assessed by altered profiles of blood and liver enzymes, and urinary metabolites.[111]

This is why the BP DWH oil spill clinical study noted earlier[112] also assessed hematologic and hepatic (liver) markers and renal function during initial and 7-year follow-up visits. During the initial visits, exposed workers had significantly altered blood profiles with decreased platelet counts and increased hematocrit levels and white blood cell counts, compared to the unexposed group.[113] Exposed workers also had significant amounts of phenol in their urine (compared to the unexposed group), indicating that workers were inherently exposed to the carcinogen benzene in their work-related oil spill response activities. Exposed workers also had higher levels of 3 liver enzymes than the unexposed group, enzymes that are specific markers of hepatic dysfunction and damage.[114] Further, biomarkers of blood and liver damage varied significantly among individuals, indicating that oil spill exposures did not uniformly affect those exposed,[115] meaning that dose-response relationships in oil spill exposures are not reliable predictors of harm. During the follow-up visits, there was no improvement in the altered hematological and hepatic functions, indicating a prolonged and persistent adverse health effect due to the oil spill exposure 7 years after the disaster.[116] *Clearly, the OSHA cold/flu recordkeeping exception is failing to accurately record and report work-related illnesses during oil spill response under the NCP.*

As for end organ damage, besides the deteriorating pulmonary function discussed earlier,[117] most of the exposed workers also experienced some type of cardiac function abnormalities during their initial clinic visit. These abnormalities included abnormal ECG, ventricular conduction delay, anterior fascicular block, sinus rhythm nonspecific T wave, sinus bradycardia ST and T wave abnormality, sinus rhythm early repolarization, and

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[110] Costantini AS, et al, 2008. Risk of leukemia and multiple myeloma associated with exposure to benzene and other organic solvents: Evidence from the Italian Multicenter Case-Control Study. *Am J Ind Med* 51:803-811.
Khalade A, et al., 2010. Exposure to benzene at work and the risk of leukemia: A systematic review and meta-analysis. *Environ Health* 9:31.

[111] Reardon S, 2011. Gulf oil spill. Ten months after Deepwater Horizon, picking up the remnants of health data. *Science* 331:1252.

[112] *See supra* notes 63–66 and accompanying text.

[113] D'Andrea, 2013, *supra* note 63.

[114] *Id.*

[115] *Id.*

[116] D'Andrea, 2018, *supra* at 65.

[117] *See supra* notes 63–66 and accompanying text.

ventricular hypertrophy.[118] These abnormalities persisted 7 years after the disaster in many of the exposed response workers.[119]

Likewise, the ongoing U.S. Coast Guard and GuLF epidemiology studies also found acute- and long-term cardiovascular harm in exposed workers at the time of this writing. Acute symptoms used to identify cardiovascular harm included chest tightness or pain, among others, however these *symptoms also mimic common cold/flu-like symptoms*. A USCG study found an increased prevalence of chest pain, and a trend of increased prevalence of sudden heartbeat changes, were associated with increased self-reported exposures to crude oil and to combined crude oil and dispersants via inhalation and direct skin contact.[120] Analysis of associated medical data revealed an elevated hazard risk of essential hypertension diagnosis *(*mostly benign*)* during 2010–2012 and, during 2013–2015, elevated hazard risk for mitral valve disorders and heart palpitations, which are major risk factors for developing coronary heart disease (CHD).[121] The cardiovascular symptoms/conditions were generally stronger among workers reporting exposure to both crude oil and oil dispersants than those reporting neither. Because the study cohort was young and healthy (mean age 30 years), the investigators "did not expect to observe severe heart disease such as MI [myocardial infarctions, i.e., heart attacks] or CHD after only five and a half years of follow-up."[122] Long-term follow-up is planned.

In comparison, the GuLF study with an older, less fit, and more diverse cohort found in its 5-year follow-up that increased risk of heart attacks (myocardial infarctions) and fatal CHD were associated with longer duration of response work, living in proximity of the spill, and higher estimated exposure to "total hydrocarbons" as a surrogate for oil spill exposures.[123] By the 10-year follow-up, a positive association was found between controlled burning-related $PM_{2.5}$ exposure and CHD risk among burning-exposed response workers.[124] The highest average exposure category had 2.1 times the hazard of CHD, compared to controls, similar to the increase in CHD risk among men from smoking 20 cigarettes a day. The finding of increased risk of CHD to workers several years after exposure is novel. It demonstrates that even relatively short-term $PM_{2.5}$ exposure of days to weeks to high levels of burning oil and gas can have *persistent* effects years later.

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[118] *Id.*

[119] D'Andrea, 2018. *supra* at 65.

[120] Denic-Roberts H, et al., 2022. Acute and longer-term cardiovascular conditions in the [BP DWH] oil spill Coast Guard cohort. *Environ Int'l* 158, 106937, p. 8 (quote). doi.org/10.1016/j.envint.2021.106937

[121] *Id*.

[122] *Id.* at 8.

[123] Strelitz J, et al., 2019. Self-reported myocardial infarction and fatal coronary heart disease among oil spill workers and community members 5 years after Deepwater Horizon. *Environ Res* 168:70–79. doi: 10.1016/j.envres.2018.09.026.

Strelitz J, et al., 2019. Exposure to total hydrocarbons during cleanup of the Deepwater Horizon oil spill and risk of heart attack across 5 years of follow-up. *Amer J Epidemiology* 188(5):917–927. https://doi.org/10.1093/aje/kwz017

[124] Chen D, et al., 2023. Fine particulate matter and incident coronary heart disease events up to 10 years of follow-up among *Deepwater Horizon* oil spill workers. *Environ Res* 217:114841. https://doi.org/10.1016/j.envres.2022.114841

Further, the ongoing U.S. Coast Guard and GuLF epidemiology studies also found short- and long-term neurological harm, respectively. A Coast Guard study found a set of acute symptoms, including headaches, lightheadedness, difficulty concentrating, numbness/tingling sensation, blurred vision, and memory loss/confusion, was associated with an increased frequency of self-reported crude oil exposure via inhalation.[125] Similar results were found for skin contact with crude oil except for memory loss/confusion, while exposure to combined oil and dispersants resulted in associations that "were appreciably greater" than oil alone.[126] *Note that several of these diagnostic metrics mimic cold and flu symptoms*.

The GuLF study assessed neurobehavioral function with clinic tests conducted 4–6 years after the BP DWH oil spill.[127] This study found only limited evidence of associations between "total hydrocarbon" levels (measured as composite volatile hydrocarbons including BTEX) or job groups and decreased neurobehavioral function. However, the modest associations found between job group exposures and decreased sustained attention, memory, and response speed were consistent with the literature for benzene and toluene exposure.[128] The magnitude of the deficit in one measure (summary response latency) in response workers across the range of exposure categories varied and was comparable to aging 4 to 9 years.[129] In addition, the latter study found that the THC (Total Hydrocarbon) levels to which most spill response workers were exposed, including n-hexane, "were at the lower end of levels typically encountered in occupational settings, but above levels typically experienced by the general population." Authors concluded, "BTEX affects cognitive functions even when levels are below occupational exposure limits."[130]

Significantly, both sets of epidemiology studies noted a possible threshold effect, meaning that the dose-response model may not be a reliable predictor of associations of harm, because, for cancer-causing petrochemicals, there is no established safe threshold for exposure.[131] A disease mechanism involving activation of mast cells from toxic exposure

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[125] Krishnamurthy JK, et al., 2019. Neurological symptoms associated with oil spill response exposures: Results from the Deepwater Horizon oil spill Coast Guard cohort study. *Environ Int* 131, 104963. doi: 10.1016/j.envint.2019.104963

[126] *Id.*

[127] Quist AJL, et al, 2019. Deepwater Horizon oil spill exposures and neurobehavioral function in GuLF STUDY participants. *Environ Res* 179(Pt B):108834. doi: 10.1016/j.envres.2019.108834
The Behavioral Assessment and Research System tests used in this study included a continuous performance test (CPT) that measures sustained visual attention and short-term memory, a digit span test (DST) that measures attention and memory, a match-to-sample test (MTS) that measures visual memory, a symbol-digit test (SDT) that measures executive function and coding, a simple reaction time test (SRT) that measures response speed, a finger tapping test (TAP) that measures response speed and coordination, and a progressive ratio test (PRT) that measures effort-related motivation.

[128] *E.g.,* Golbabaci F, et al., 2018. Evaluation of occupational exposure levels of mixed organic solvents and cognitive function in the painting unit of an automotive industry. *Heal Promot Perspect 8(4):296–302.* doi: 10.15171/hpp.2018.42

[129] Quist, 2019, *supra* note 127, at 7.

[130] *Id.* at 3 and 9.

[131] *E.g.,* NAS *Oil in the Sea IV*, 2022, *supra* note 49, at 347, "lung function was unrelated to the extent of estimated THC [total hydrocarbon] exposure." Also, "current understanding of the toxicological mechanism of action of THC components would not readily explain the observed higher association

events and subsequent triggering by similar or other toxic chemicals is not dose dependent, and it does explain why there is not an attenuation of effects over time.[132] This may also explain why findings of harm are occurring below levels thought to be health protective. OSHA standards for various oil fractions like BTEX and VOCs, "total hydrocarbon," and PAHs, may all be under-protective of worker health as the standards are based on dose-response models. It also demonstrates why evidence-based standards, based on symptoms of harm are likely more useful in oil spill exposures than OSHA PELs.[133]

Finally, two BP DWH studies found adverse impacts of oil spill exposure on birth outcomes. One study found increased concentrations of $PM_{2.5}$, nitrogen dioxide, sulfur dioxide, and carbon monoxide in oil-impacted coastal counties from Louisiana to Florida were associated with increased incidence of low birthweight (<2500 grams) and premature born infants (<37 weeks of gestation) through 2012 compared to pre-spill data from 2006 to 2010.[134] Further, adverse infant health outcomes were more pronounced for black, Hispanic, less educated, unmarried, and younger mothers.[135] Another BP DWH study found high levels of direct contact with oil were associated with higher risk of lower birthweight and preterm births in coastal residents of southeast Louisiana up from 2011 to 2016.[136] Infant health predictors like birth weight are important predictors of cognitive development and school outcomes.[137] The literature is replete with studies on adverse effects of environmental pollution, especially oil pollution, on newborn birth outcomes and infant-child development in the U.S. and other countries.[138]

Supporting evidence from the *Prestige* and *Hebei Spirit* oil spills also found blood damage, persistent oxidative stress biomarkers, persistent metabolic and genetic health effects, development of hematological cancers, persistent cardiovascular harm, and reproductive harm in newborns and infants. Oil spill exposure caused changes in various blood parameters over three years of residents who participated in response activities and

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with maximum THC levels than median THC levels, particularly as there does not appear to be an attenuation of the effect during the 5-year follow up."

[132] Masri S, et al., 2021. Toxicant-induced loss of tolerance for chemicals, foods, and drugs: Assessing patterns of exposure behind a global phenomenon. *Environ Sci Eur* 33:65. https://doi.org/10.1186/s12302-021-00504-z

Miller CS, et al., 2021. Mast cell activation may explain many cases of chemical intolerance. *Environ Sci Eur* 33:129. https://doi.org/10.1186/s12302-021-00570-3

[133] To be clear, this petition is asking for OSHA to require recording and recordkeeping of cold and flu symptoms during oil spill response actions. This information is the prerequisite to developing evidence-based standards but the petition itself is not seeking evidence-based standards.

[134] Beland and Oloomi, 2019, *supra* note 42.

[135] *Id.*

[136] Harville EW, et al., 2017. Self-reported oil spill exposure and pregnancy complications: The GROWH study. *Int'l J Envt'l Res and Public Health* 14(7), Article 692. https://doi.org/10.3390/ijerph14070692

[137] Figlio David, et al., 2014. The effects of poor neonatal health on children's cognitive development. *The American Economic Review* 104.12: 3921-3955.

[138] *E.g.,* Apergis N, Hayat T, Saeed T, 2019. Fracking and infant mortality: Fresh evidence from Oklahoma. *Envt'l Sci Pollut Res* 26(31):32360–32367. https://doi.org/10.1007/s11356-019-06478-z

Eleke C, et al., 2021. Effects of environmental crude oil pollution on newborn birth outcomes: A retrospective cohort study. *J Nursing Res* 29(4):p_e161. doi: 10.1097/JNR.0000000000000435

lived in the oiled area.[139] The changes occurred 2–5 years after the spill, they were consistent with reported changes in blood, liver, respiratory, kidney, and nervous system functions that were measured initially and 7 years after the BP DWH oil disaster.[140] Another set of studies found levels of oxidative stress biomarkers MDA (malondialdehyde) and 8-OHdG (8-hydroxy-2'-deoxyguanosine)[141] increased with increasing duration of oil spill response work, were positively associated with PAH urinary metabolites, and persisted for 1.5 years.[142] Even 6 years after the spill, residents living near the oiled coast had significantly higher levels of 8-OHdG, and levels of both biomarkers were still positively associated with duration of response activities.[143] Further, the risk of metabolic syndrome – a cluster of conditions that occur together, increasing risk of heart disease, stroke, and type 2 diabetes – was significantly higher 1 year after the spill among people who worked response activities longer and lived closer to the oiled coast.[144]

Furthermore, damage to several genetic regions most significantly affected by oil exposure may increase risk of hematological cancers.[145] *Prestige* studies found a strong correlation between oil-induced chromosome breakpoints and "fragile sites," which are large chromosome regions, over megabases, that are prone to breakage upon replication stress and are a driving force of cancer initiation or oncogenesis.[146] *Prestige* studies identified four specific chromosome bands (2q21, 3q27, 5q31, and 17p11.2) in peripheral blood lymphocytes[147] with a greater tendency to break over time after an acute oil spill exposure. These four bands were found only in exposed individuals after the spill and in both the 2- and 6-year visits. Since these four bands are different from the bands previously identified in fragile sites most frequent in the general population, authors suggested that

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[139] Choi Y-H, et al., 2017. A retrospective mid- and long-term follow-up study on the changes in hematologic parameters in the highly exposed residents of the Hebei Spirit oil spill in Taean, South Korea. *Osong Public Health Res Perspect* 8(5):358–366. https://doi.org/10.24171/j.phrp.2017.8.5.10

[140] *Id.*
D'Andrea & Reddy, 2013, *supra* note at 63.
D'Andrea & Reddy, 2018, *supra* note at 65.

[141] MDA indicates oxidative DNA damage, and 8-OHdG indicates lipid peroxidation, which degrades the lipids within cell membranes, leading to cell damage and eventually death.

[142] Noh SR, et al., 2015. Oxidative stress biomarkers in long-term participants in clean-up work after the *Hebei Spirit* oil spill. *Sci Total Environ* 515-516:207–14. doi: 10.1016/j.scitotenv.2015.02.039

[143] Kim JA, et al, 2017. Urinary oxidative stress biomarkers among local residents measured 6 years after the *Hebei Spirit* oil spill. *Sci Total Environ* 580:946-952. doi: 10.1016/j.scitotenv.2016.12.044

[144] Lee I-J, et al., 2015. Association between metabolic syndrome and participation in cleanup work at the *Hebei Spirit* oil spill. *Korean J Environ Health Sci* 41:335–348. doi: 10.5668/JEHS.2015.41.5.335

[145] Laffon B, et al., 2014. Follow-up study of genotoxic effects in individuals exposed to oil from the tanker Prestige, seven years after the accident. *Mutat Research Gen Toxicol Envtl Mutagen* 10(6):760, finding greater rates of micronuclei formation following exposure to oil spill cleanup emissions. Micronuclei are small extracellular bodies containing chromosome fragments that failed to properly incorporate into the nuclei of the daughter cells following cell division, which typically results from exposure to a toxin affecting DNA.

[146] Frances A, et al., 2016. Persistence of breakage in specific chromosome bands 6 years after acute exposure to oil. *PLoS One* 11(8): e0159404. doi:10.1371/journal. pone.0159404
Rodriguez-Trigo, G, et al., 2010. Health changes in fishermen 2 years after clean-up of the *Prestige* oil spill. *Annals Intern Med* 153:489–499. doi: 10.7326/0003-4819-153-8-201010190-00279

[147] Peripheral blood lymphocytes are one of several types of white blood cells that are crucial for the immune system. They comprise T cells, B cells, and natural killer cells, which produce antibodies that are used to attack invading bacteria, viruses, and toxins.

the four breakpoints originating from oil exposure may affect the genome regions, which themselves are prone to breakage, leading to chromosome instability and the earliest stages of cancer development.[148]

For example, a significant number of chromosome alterations in blood diseases such as T-cell lymphoma, acute lymphoblastic leukemia, and acute myeloid leukemia, are associated with these four bands and, specifically, with 5q31 in patients with acute lymphoblastic leukemia, myelodysplastic syndrome, chronic myelomonocytic leukemia, and acute myeloid leukemia.[149] Acute oil exposure could affect the stem cells of the bone marrow, leading to genomic instability and an increased risk of blood malignancies.[150] *Hebei Spirit* studies found an increased incidence rate of prostate cancer and, in women, leukemia in Taean compared to coastal areas and nationwide after the oil spill, however the latter was not significantly high because leukemia is a rare disease and Taean has a small population.[151]

It must be noted that, although community organizations and filmmakers have witnessed and raised awareness of increases in clusters of rare and unusual illnesses and cancers in adults and children from oil-impacted Gulf Coast communities,[152] the scientific community studying chronic harm from BP DWH is still silent on this issue.

A *Hebei Spirit* study also found increased risk of angina, a symptom of coronary artery disease, or heart attack (myocardial infarction, MI) in residents and workers/volunteers.[153] The risk of angina or heart attack increased with longer duration of exposure – from 15–59 days, 60–179 days, and more than 180 days.

To put all this in perspective, one *Hebei Spirit* study was the first to calculate the "burden of disease" (BOD) from both mental and physical harm due to the oil spill. BOD is a way to assess the scale of health damage at the population level and the associated costs of health care. The World Health Organization developed a way to measure BOD using disability-adjusted life year (DALY), which measures the difference between an adverse

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[148] *Id.*

[149] Monyarch G, et al., 2013 Chromosomal bands affected by acute oil exposure and DNA repair errors, 8(11) PLoS One 8(11): e81276. doi.org/10.1371/journal.pone.0081276

[150] Hildur K, et al., 2015. Follow-up genotoxic study: Chromosome damage two and six years after exposure to the Prestige oil spill, *PLoS One* 10(7): e0132413. doi: 10.1371/journal.pone.0132413, cautioning that persistent evidence of genetic damage may indicate impacts to bone marrow cells).

[151] Choi KH, et al., 2018. Cancer incidence trend in the *Hebei Spirit* oil spill area, from 1999 to 2014: An ecological study. *Int J Environ Res Public Health* 15(5):1006. doi:10.3390/ijerph15051006

[152] Eastern Shore Community Health Project, using National Cancer Institute statistics for 2013–2017. Updated in **2021**. http://easternshorechp.org/cluster-maps/

GAP, 2015, *supra* note 55.

GAP, 2020. Ten Years After Deepwater Horizon: Whistleblowers continue to suffer an unending medical nightmare triggered by Corexit. https://whistleblower.org/wp-content/uploads/2020/04/Ten-Years-After-Deepwater-Horizon.pdf

Conception Media Films, 2020. *The Cost of Silence,* executive producer Mark Manning. https://www.costofsilencefilm.com/about-the-film

[153] Lee M, Park M-S, Cheong H-K, 2020. An association between oil spill clean-up work and cardiovascular disease. *Ecotoxicol Environ Saf* 194:110284. doi: 10.1016/j.ecoenv.2020.110284

health situation and the ideal situation where everyone lives up to the national standard life expectancy in perfect health. In this study, the years lived with disability (YLD) in 2008 due to the December 2007 oil spill were calculated for six diseases (asthma, allergic rhinitis, dermatitis, conjunctivitis, PTSD – Post Traumatic Stress Disorder, and depression) by sex, age, and region.[154] Asthma was the most prominent disease burden (based on DALYs) in the contaminated areas among the six diseases, followed by PTSD and rhinitis. The asthma burden was 6.5 times higher than the national asthma burden in 2008 with significant direct economic costs and loss of productivity costs in the areas with smaller populations where the spill occurred. The YLD of mental health disease (PTSD and depression) were higher among men than women, and for residents in their 20s, while the YLD of asthma and allergic disease (rhinitis, dermatitis, and conjunctivitis) were higher among women than men, and for residents in their 40s. The area encompassing the oil spill site had the highest incidence of additional diseases and the highest burden of disease (DALY).[155]

3. Non-Enforceable Actions by Other Agencies and Academics to Better Protect Oil Spill Workers from Long-Term Harm Are Not Working

Based on the facts that (1) acute oil spill exposures are associated with multi-system chronic illnesses and cancers in humans and wildlife, (2) plausible mechanisms are involved, and (3) the occupational harm is occurring at levels well below levels thought to be protective, academics and agencies are recommending actions to better protect oil spill workers. In fact, several of the studies recommended stricter regulations to protect oil spill workers – especially if oil dispersants are used, along with worker (and volunteer) training programs in hazard awareness and proper use of effective respiratory protection, guidance for clinical investigations and biomonitoring, and long-term follow-up health monitoring.[156]

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[154] Kim YM, 2013, *supra* note 163.

[155] *Id.*

[156] Liu YZ, 2017, *supra* note 84.

Amor-Carro, 2020, *supra* note 96.

Jung D, et al., 2017. Human health and ecological assessment programs for *Hebei Spirit* oil spill accident of 2007: status, lessons, and future challenges. Chemosphere 173:180–9. Finding that coordinated efforts of monitoring and assessing both human and ecosystem health are necessary to generate quality information (e.g., information that is accurate, complete, and timely) for decision-makers.

Kim YM, et al., 2009. Scientific basis of environmental health contingency planning for a coastal oil spill. J Prev Med Public Health 42:73–81. Finding that the government should establish environmental health contingency planning and should assemble a response team that includes environmental health specialists to prepare for future oil spills.

Kim YM, 2013. Burden of disease attributable to the *Hebei Spirit* oil spill in Taean, Korea, *BMJ Open* 3(9):e003334, http://www.ncbi.nlm.nih.gov/pubmed/24056482. Finding that health effects from oil spills are considerable and long-lasting and, therefore, careful follow-up studies are needed, and community-specific rehabilitation policies should be developed, to mitigate adverse long-term illnesses.

Gwack, 2012, *supra* note 101, emphasizing that the number of workers should be minimized for early-stage cleanup, sufficient personal protective equipment with approved quality for blocking noxious gas should be supplied, and systematic health care for the workers should be provided; further, that nonprofessionals such as residents and volunteers should be trained on the importance and appropriate use of protective equipment, and that national and regional preparedness plans and a

Several of the more recent BP DWH epidemiology studies resorted to comparing worker exposures with public health standards instead of occupational exposure standards for more accurate estimates of health risk in chronic exposure situations (months vs. days).

a) Recommendations and Reactions

Recommended protective policies and practices may prevent or reduce harm from oil spill exposures, but only if industry implements them and agencies enforce them. So far, industry has chosen not to implement ones that could directly quantify worker exposures and dose. Prior to the June 2010 workshop hosted by the National Institute of Medicine,[157] neither the regulatory agencies nor BP had paid any attention to worker biomonitoring.[158] However, during the six weeks following the workshop, three different agencies – NIOSH, the National Institute of Environmental Health Sciences (NIEHS), and the Nuclear Regulatory Commission (NRC) – each prepared, separately, worker biomonitoring program protocols and gave them to BP.[159] None of these programs were implemented by BP.

Instead, BP voluntarily initiated an air quality monitoring program, which was never about "exposure assessment", instead it was about "perceptions," as internal BP documents reveal: "Although we are documenting zero exposures in most monitoring efforts, the monitoring itself adds value in the eyes of public perception, and zeros add value in defending potential future litigation."[160] NIOSH director John Howard found BP's air quality monitoring program was insufficient to assess worker exposure, since it did not reflect total exposure or high episodic exposures that get diluted out, and it was affected by winds such that measurements of aerosols, in particular, were underestimated.[161] Total exposure, Director Howard maintained, is more associated with longer term health effects, and to assess total exposure, a biomonitoring program was critical. Director Howard warned that continuing to monitor worker health without the addition of a biomonitoring program "leaves us scientifically incomplete" and unable to explain "that harmful exposures are occurring despite negative air sampling results." Further, it "impairs our ability to conduct long-term health studies…"[162]

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professional response team for emergency environmental assessment and action should be established to make prompt decisions during spill response.

Laffon, 2013. Endocrine and immunological parameters in individuals involved in Prestige spill cleanup tasks seven years after the exposure. *Environ Int'l* 59:103. Recommending surveillance of exposed oil spill workers for early detection of possible health problems related to the endocrine or immunological systems.

Rui, 2021, *supra* note 178.

[157] National Institute of Medicine, 2010, *supra* note 26.

[158] In: Deepwater Horizon BELO cases, Case 3:19-cv-00963-MCR-HTC, F Northern District of Florida, Pensacola Division. Document 547, 10/28/22. Plaintiffs' Motion for Admission of Plaintiffs' Expert Opinions Because of BP Defendants' Spoilage of Evidence of Plaintiffs' Exposures

[159] *Id.* at 12.

[160] *Id.* at 19 and 29, citing Doc. 547 Exhibit 14, BP John Fink email, 7/31/2010 at 1.

[161] *Id.* at 13–14, citing Doc. 547 Exhibit 6, Greg Lotz (CDC/NIOSH/DART) email, 6/24/2010 at 1.

[162] *Id.* at 14–15, citing Doc. 547 Exhibit 8, John Howard (NIOSH) email, 6/27/2010 at 1.

This is exactly how things turned out. As discussed in our case study, the BP DWH epidemiology studies were compromised by lack of information on response worker exposures, while the *Prestige* and *Hebei* Spirit studies were not. Court cases involving human health harm from BP DWH oil spill exposures are now being compromised and dismissed because of lack of causation, i.e., inability to explain how harmful exposures occurred despite "zero exposures" in air sampling results.[163] With quantitative exposure data – the kind that comes from biomonitoring – these cases may have turned out differently for injured workers.[164] However, a federal court ruled that "BP had no duty to initiate on its own a monitoring program…"[165] This petition would create that duty.

b) The Proposed Change Supports the Goals of the ERHMS Framework

The federal National Response Team, comprised of OSHA, NIOSH, NIEHS, NRC, and the Centers for Disease Control and Prevention (CDC), among others, now provides guidance for recording cold- and flu-like symptoms and biomonitoring of emergency oil spill responders, based on lessons learned from the BP DWH oil spill debacle. The NRT, NIOSH, and other federal agencies, state departments, labor unions, and volunteer emergency responder groups developed the Emergency Responder Health and Monitoring Surveillance (ERHMS) framework.[166] The purpose of the guidance is to "provide a recommended health monitoring and surveillance framework… which includes specific recommendations and tools for all phases of a response, including the pre-deployment, deployment, and post-deployment phases" of each response worker's service.[167] These recommendations are designed "to identify exposures and/or signs and symptoms early in the course of an emergency response in order to prevent or mitigate adverse physical and psychological outcomes and also to ensure workers maintain their ability to respond effectively and are not harmed in the course of this response work."[168]

The ERHMS repeatedly recommends recording cold/flu-like symptoms. The "Tools Section" provides sample questionnaires to demonstrate the kinds of symptoms employers should monitor at each phase of deployment.[169] For the deployment phase, ERHMS uses NIOSH's Deepwater Horizon Health Hazard Evaluation Survey as a model. The survey asks workers to report symptoms including sinus problems, cough, sore throat, nose irritation, and other respiratory problems.[170] For the post-deployment phase, the guidance uses the Department of Homeland Security's post-deployment questionnaire, which asks workers to report symptoms including cough, trouble breathing, fever, chest pressure, and other

[163] *See supra* note 160.
[164] *Id.* at 18.
[165] *Fairley v BP*, CV No. 17-3988 Section M (4), Eastern District of Louisiana, Order and Reasons ruling, Nov. 3, 2022, *In:* In: Deepwater Horizon BELO cases, Case 3:19-cv-00963-MCR-HTC, F Northern District of Florida, Pensacola Division. Document 522, Exhibit 1, Order and Reasons, 11/3/22 at 7.
[166] NIOSH, 2018. Emergency Responder Health Monitoring and Surveillance (ERHMS). https://www.cdc.gov/niosh/erhms/default.html.
[167] NRT, 2012. Emergency Responder Health Monitoring and Surveillance, Technical Assistance Document. https://www.nrt.org/sites/2/files/ERHMS_Final_060512.pdf. At iii.
[168] Id.
[169] *Id* at 68–175.
[170] *Id.* at 104.

related symptoms.[171] Furthermore, a sample "welcome home letter" instructs workers to "tell your doctor if you are experiencing symptoms such as fever, flu-like illness, chills, headache, [or] joint/muscle aches."[172]

While ERHMS is a very positive development, it is a given that, unless preventative action is taken to better protect *human health* during oil spills, the now predictable cold/flu-like symptoms characteristic of oil spill exposures will lead to now predictable long-term illnesses, cancers, and premature deaths in response workers and the exposed populace. *The way to change this outcome is to change the law* and require biomonitoring, instead of leaving it up to the discretion of an industry that is bound by law to minimize its liability from work-related illnesses to maximize shareholder profits. Our petition would *require* employers to record and report cold/flu-like symptoms during NCP oil spill response to support future biomonitoring programs currently *recommended* by agencies.

4. Case Study Summary in the Context of Scientific Advancements

Human health effects of exposures during oil spills have been studied following only 8 of the 39 supertanker oil spills since the 1960s, counting the BP DWH oil disaster. From these 8 studies emerged a suite of acute symptoms now considered characteristic of oil spill exposures. Most of these acute symptoms (except for skin rashes/lesions) mimic common cold/flu-like symptoms, including respiratory (cough, wheezing, difficulty breathing, runny nose, burning/itchy eyes), neurological (headache, dizziness, nausea), and cardiovascular (tightness of chest, tiredness/fatigue) symptoms.

Of these 8 studies, only 3 initiated long-term studies to examine chronic health effects after the initial exposures. From these three oil spills – the *Prestige,* the *Hebei Spirit*, and the BP Deepwater Horizon (DWH) – have emerged consistent findings of adverse chronic health harm that is supported by clinical and laboratory studies on humans and animals/wildlife. The collective understanding is that inhaled oil rapidly enters the bloodstream, then cells and organs, disrupting physiological function with oxidative stress and inflammation (although non-inflammatory mechanisms have also been identified), and initiating pathways for cytotoxicity (cell death), genotoxicity (DNA/RNA damage), and oncogenesis (cancers), as well as a host of chronic illnesses affecting various body systems, including respiratory, urinary, nervous, cardiovascular, lymphatic, endocrine, digestive, and reproductive – all directly correlated with oil spill exposure whether through dose-response relationships or by mast cell activation and triggering. After an unexpectedly short latency period of years (versus decades), persistent harm emerges as severely compromised health, premature deaths, and rare illnesses and cancers in children and adults that can now be linked with initial oil exposures. Advancements in biomedical research led to plausible mechanisms leading from cellular DNA damage to various cancers and other biological damage,[173] and from cellular nanoparticle ($PM_{2.5}$ and smaller) damage (e.g., oxidative stress, inflammation, genotoxicity, and tumorigenicity) to respiratory and

[171] *Id.* at 130.
[172] *Id.* at 123.
[173] Nelson and Dizdaroglu, 2021, *supra* note 86.

cardiovascular diseases.[174] There is *a causal relationship* between short- and long-term oil spill exposure and respiratory, cardiovascular, and neurological harm.

Significantly, this documented chronic harm from oil spill exposures (1) occurs at levels of petroleum hydrocarbons that are orders of magnitude below currently allowable worker exposure levels; (2) increases with exposure to oil dispersants; (3) increases in higher risk populations; (4) may decrease with proper use of Personal Protective Equipment, except for genotoxic damage; and (5) does not always follow a dose-dependent relationship. Further, *this chronic harm from oil spill exposure is forecasted by an initial suite of acute symptoms that mimic common cold/flu-like symptoms.*

Advancements in managing big data led to understanding that high-level exposures to pollutants over a short time create the same biological harm as low-level exposures over a longer time. Thus, it is not surprising that the chronic harm from acute relatively high oil spill exposures is consistent with the chronic harm from chronic low-level exposures of petroleum hydrocarbons. For example, a 2021 meta-analysis of petroleum-exposed workers and residents living near petroleum facilities found petroleum industry work was generally associated with an increased risk of multiple myeloma (with non-significant elevated risk for acute myeloid leukemia, chronic lymphocytic leukemia, and leukemia), and cancers of the prostate and urinary bladder, and, in offshore workers, an increased risk of lung cancer.[175] Residential proximity to petroleum was associated with childhood leukemia. It is well established in the literature that volatile organic compounds like benzene and other solvents are known to induce blood cancers including acute myeloid leukemia, multiple myeloma, chronic lymphatic leukemia, and other blood- and hepatic-related disorders.[176] Further, exposure to a range of levels of $PM_{2.5}$ – of the size range generated during oil spills as secondary organic aerosols or chemically-dispersed oil – was associated with respiratory tract diseases like asthma/wheezing, bronchitis, lower respiratory track illness, and lung cancer, with children more susceptible than adults.[177]

Better understanding of the initial symptoms, mechanisms, pathways, and disease outcomes has led to calls from academics and federal agencies for better policies and

[174] Sonwani S, et al., 2021. Inhalation exposure to atmospheric nanoparticles and its impacts on human health: A review. *Front Sustain Cities* 3:690444. doi: 10.3389/rsc.2021.690444.

[175] Onyije FM, et al., 2021 Cancer incidence and mortality among petroleum industry workers and residents living in oil-producing communities: A systematic review and meta-analysis. *Int'l J Environ Res Pub Health* 18,4343. doi.org/10.3390/ijerph18084343 Findings also included high risk of other cancers likely not attributed to petroleum hydrocarbon exposure such as mesothelioma (tumors of mesothelial tissue that lines lungs, heart, stomach and other organs) likely from exposure to asbestos used in combustion petroleum pipes, and skin cancer attributed to ultraviolet radiation from outdoor exposure.

[176] Constantini AS, et al., 2008. Risk of leukemia and multiple myeloma associated with exposure to benzene and other organic solvents: Evidence from the Italian-Multicenter Case control study. *Am J Ind Med* 51(11):803–11. doi: 10/1002/ajim.20592

[177] Liu Q, et al., 2017. Effect of exposure to ambient PM2.5 pollution on the risk of respiratory tract diseases: a meta-analysis of cohort studies. *J Biomed Res* 31(2):130-142. doi: 10.7555/JBR.31.20160071.

practices to minimize harm from occupational exposures and manage chronic illnesses.[178] For example, a 2021 study found that early identification of workers who develop rhinitis and conjunctivitis from inhalation exposure is important for early identification of occupational asthma, as these symptoms often precede the onset of asthma symptoms.[179] To reduce the delay between suggestive symptoms of occupational asthma and a subsequent diagnosis, the study recommended workers' education to increase awareness to trigger agents, and a medical surveillance program directed especially at at-risk workers with timely and appropriate preventive measures.[180] This mirrors what the NRT, including OSHA, *recommended* in 2012 with the ERHMS guidance.

But regulation through recommendation has proven unsuccessful, as evidenced by BP's recently discovered refusal to conduct the biomonitoring necessary to assess response workers' health during oil spills.[181] And regulation through exposure limits that are not based on current science has also proven unsuccessful, as evidenced by current disclaimer on the OSHA website: "PELs are outdated and inadequate for ensuring protection of worker health."[182]

This is why we are petitioning OSHA to require recording and reporting of persistent cold/flu-like symptoms to establish evidence-based harm as a critical first step in protecting worker health during oil spill response under the NCP.

E. Argument

1. The Common Cold/Flu Exception Impedes Accurate Illness Recordkeeping, Which Is Necessary for Effective Occupational Safety and Health Regulation

The most fundamental reason for changing the common cold and flu exception is that the exception is overbroad, creating a risk that employers will avoid reporting cold/flu-like symptoms that actually may be early symptoms of occupational oil-chemical exposures. Although the exception only applies to actual cases of common cold and flu,[183] OSHA has not provided guidance concerning how common colds and flus are defined or diagnosed.[184] Without a more tailored regulation or guidance regarding the exception's application, symptoms of occupational illnesses that superficially resemble symptoms of

[178] Bijlsma N, Cohen MM, 2016. Environmental chemical assessment in clinical practice: Unveiling the elephant in the room. *Int J Environ Res Public Health* 13(2):181. doi:10.3390/ijerph13020181

[179] Rui F, 2021. Occupational asthma: The knowledge needs for a better management. *Ann Work Expos Health* 66(3):287–290. doi.org/10.1093/annweh/wxab113

[180] *Id.*

[181] BELO cases, 2022, s*upra* note 158.

[182] OSHA PELs and Lerner, 2022, *supra* note 18.

[183] *29* C.F.R. § 1904.5.

[184] OSHA, Recordkeeping Related Letters of Interpretation, Recordkeeping - Recordkeeping Related Letters of Interpretation | Occupational Safety and Health Administration (osha.gov) No letter of interpretation issued by OSHA, clarifying its recordkeeping requirements since the 2001 amendments created the cold and flu exception, have dealt with the scope of the exception or the meaning of "common cold or flu" for the purposes of the regulations.

common colds or flus will be under-reported by employers operating under the assumption that such symptoms are not recordable.

Records of occupational illness and injury are used in a variety of ways that are crucial to our country's efforts concerning occupational safety and health. For example, one function of the records is to provide information to employers about the types of injuries and illnesses their employees are experiencing, so that employers can identify and address hazardous work conditions on their own.[185] Similarly, these records help employees become better informed about the hazardous conditions they may face.[186] OSHA itself also uses the records to inform inspections, target intervention efforts, and identify and correct safety and health problems to prevent or reduce chronic illnesses, stemming from acute occupational exposures.[187]

Further, a vast array of governmental entities relies upon the records to make decisions concerning occupational safety and health policies, programs, and standards.[188] This is because the records provide the basis for the Bureau of Labor Statistics' (BLS) national statistics on workplace injuries and illnesses, which are used by policy makers at the federal, state, and local levels.[189]

In light of these many uses, it is of paramount importance that the records provide quality information to decision-makers, i.e., information that is accurate, complete, and relevant.[190] However, as discussed throughout this petition, the records are currently not quality information as they do not accurately reflect occupational illnesses associated with oil-chemical exposure, at least in part because of the common cold and flu exception.

2. The Common Cold/Flu Exception Contradicts the National Response Team's ERHMS Guidance

OSHA's rule exempting employers from recording cold- and flu-like symptoms during an NCP oil spill response contradicts the federal government's ERHMS guidance – a document that the Department of Labor has signed onto as a member of the NRT. The discrepancy undercuts the scientific reasoning that informs the ERHMS and its recommended recording tools. Furthermore, the unresolved contradiction may confuse NCP teams that must decide what symptoms to record. To amplify the confusion, the ERHMS provides highly specific suggestions about which cold- and flu-like symptoms to record, while OSHA provides no guidance about which symptoms to exclude for its cold and flu exception. OSHA can elegantly resolve this inconsistency by adopting this petition language and removing the exception for NCP response workers.

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[185] Occupational Injury and Illness Recording and Reporting Requirements, 66 Fed. Reg. 5,916-01 (Jan. 19, 2001).
[186] *Id.*
[187] *Id.*
[188] *Id*.
[189] *Id*.
[190] GAO, 2014. Standards for Internal Control in the Federal Government, GAO-14-704G (Washington, D.C.)

3. Amending the Common Cold/Flu Exception Serves the Purpose of the NCP and Supports the NRT's ERHMS Guidance

Besides contradicting specific recommendations, OSHA's cold/flu exception is at odds with the broader purpose of the NCP with its stated priority of safety of human life[191] and goal of protecting of public health and/or welfare by identifying and removing threats in ways that provide for efficient, effective, and coordinated action to minimize damage.[192] Measuring the human health impacts of oil and hazardous substances is at the heart of the NCP. The NCP draws its authorizing language directly from the Clean Water Act, which authorizes the President to "direct all Federal, State, and private actions to remove the discharge or to mitigate or prevent the threat of the discharge" to protect public health or welfare.[193] On-site workers are inevitably part of the at-risk population, given their proximity to the contamination. The NCP thus requires a proper account of the relative risk or danger that oil spill exposures pose to their health in order to reduce or prevent harm.

Amending the exception also aligns with the fundamental principles of the NRT's ERHMS guidance. ERHMS establishes an exposure assessment category for "uncertain exposures" from complex or mixed exposures such as oil spill exposures, where individual exposure constituents may not exceed occupational exposure limits, but the complex mixture may still pose a threat.[194] For uncertain exposures, ERHMS recommends additional exposure, medical, and biological monitoring to determine the exposure risk – a "holistic approach" and "one that does not rely on environmental results alone to determine risk."[195] The NRT guidance even suggests adopting a "precautionary principle" assessment approach for uncertain exposures and erring "on the side of safety when any decision concerning human health and safety is in the balance."[196] Further, ERHMS recognizes that not all exposures cannot be resolved in terms of acceptability, and for these, the exposure assessment process becomes continuous.[197] Exposure to complex mixtures of carcinogenic compounds like oil spill exposures are never acceptable and, therefore, these situations must require continuous assessment and monitoring.

The ERHMS proposes this holistic approach in response to the "significant gaps and deficiencies in health monitoring" during previous emergency responses, including the BP DWH oil spill.[198] At its outset, the guidance lists measures that are necessary to fix these deficiencies, including "monitoring for potential delayed or long-term adverse effects of the deployment experience."[199] Recording and reporting cold- and flu-like symptoms in real-

[191] 40 CFR § 300.317(a)
[192] 40 CFR §§ 300.317(c), 300.320 and 300.322.
[193] 33 USC § 1321(c)(2)(A) "If a discharge… is a substantial threat to public health or welfare… the President shall direct all…"
[194] ERHMS, 2012, *supra* note 167, at 39.
[195] *Id.*
[196] *Id.*
[197] *Id.* at 190.
[198] *Id.* at ii.
[199] *Id.*

time to reduce or prevent potential long-term illnesses fits this goal precisely. The OSHA must amend its cold and flu exception not merely to implement best practices, but to avoid the significant mistakes that its own National Response Team has identified.

4. Amending the Common Cold/Flu Exception Serves the Purposes of the OSH Act

As previously noted, the OSH Act requires that "employers maintain accurate records of . . . work-related deaths, injuries and illnesses other than minor injuries."[200] Likewise, one of the stated purposes of the OSH Act is to "accurately describe the nature of . . . occupational safety and health problem[s]."[201] Accurate recording and reporting furthers the OSH Act's goals of "exploring ways to discover latent diseases, establishing causal connections between diseases and work in environmental conditions, and conducting other research relating to health problems."[202] Although OSHA has discretion in how it pursues the OSH Act's mandates, it cannot act in a way contrary to the statutory text.[203]

While OSHA may properly exercise its discretion to exclude illnesses that are actual common colds and flus from its recording requirements, it is contrary to the OSH Act to generate records that are inaccurate.[204] A record that omits an otherwise reportable illness that superficially resembles a common cold or flu but is in fact neither would be inaccurate. Failing to report such illnesses is contrary to the OSH Act's purpose of discovering latent diseases causally connected to work conditions through accurate recordkeeping.[205] Modifying the common cold and flu exception to ensure accurate reporting of illnesses that initially present with common cold- or flu-like symptoms, such as oil-chemical exposures associated with oil spill responses, furthers the stated purposes of the OSH Act and complies with OSHA's mandate to facilitate the creation of accurate occupational injury records.[206]

5. OSHA Has Not Provided Guidance on Implementing the Exception

OSHA has provided little to no guidance on how to implement the common cold and flu exception, despite our request to do so.[207] Since OSHA promulgated the common cold and flu exception in its 2001 recordkeeping rule, it has offered no clarification in the intervening years about how employers should determine whether an illness falls within the exception.

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[200] 29 USC § 651(12).
[201] *Id.*
[202] *Id.* at § 651(6).
[203] 5 U.S.C. § 706(2)(A).
[204] 29 U.S.C. § 657deepwater(2) Injury and illness records maintained by regulated employers must be accurate.
[205] *Id*. at §§ 657(6), 657(12).
[206] *Id.* at § 657(c)(2).
[207] ALERT sent OSHA a request for a letter of interpretation of the cold and flu exception in 1904.5(b)(2)(viii) on July 7, 2022.

This lack of guidance is inconsistent with the eight other exceptions to the work-relatedness presumption. Whether in its regulations or interpretive letters, OSHA has issued some type of guidance for each one of the exceptions except for the common cold and flu exception.[208] Accordingly, the requested language has the benefit of making OSHA's regulations consistent, and in a way that is familiar to the agency.

6. The OSH Act's Legislative History Supports a More Tailored Exception

The OSH Act's legislative history provides further evidence that Congress intended for OSHA to obtain accurate data on chronic illnesses associated with oil-chemical exposure, such as those experienced by oil spill responders, through the recordkeeping and reporting requirements.

In the Committee Report accompanying the Senate bill reported to the floor, the Committee noted that, "[i]n the field of occupational health, the view is particularly bleak, and due to the lack of information and records, may well be considerably worse than we currently know."[209] In light of this "grim current scene," the Committee stated that "[f]ull and accurate information is a fundamental precondition for meaningful administration of an occupational safety and health program,"[210] and that the Committee "expects the Secretary of Labor and the Secretary of Health and Human Services will make every effort through the authority to issue regulations and other means, to obtain complete data regarding the occurrence of illnesses, including those resulting from occupational exposure which may not be manifested until after the termination of such exposure."[211]

Further, the Committee specifically discussed the need to better understand chronic illnesses caused by certain exposures in the workplace:

> "Recent scientific knowledge points to hitherto unsuspected cause-and-effect relationships between occupational exposures and many of the so-called chronic diseases – cancer, respiratory ailments, allergies, heart disease, and others. In some instances, the relationship appears to be direct: asbestos, ionizing radiation, chromates, and certain dye intermediaries, among others, are directly involved in the genesis of cancer. In other cases, occupational exposures are implicated as contributory factors. The distinction between occupational and non-occupational illnesses is growing increasingly difficult to define.[212]

And while the Committee acknowledged that the recording and reporting of *some* minor injuries and illnesses may be of limited utility, it was "unwilling to adopt statutory

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[208] *See* 29 C.F.R. § 1904.5(b).
[209] S. Rep. No. 1282, 91st Cong., 2d Sess. 2 (1970), reprinted in Subcommittee on Labor of the Senate Committee on Labor and Public Welfare, Legislative History of the Occupational Safety and Health Act of 1970 (Committee Print 1971) at 142.
[210] *Id.* at 156.
[211] *Id.*
[212] *Id.*

language which, in practice might result in [under-recording and] under-reporting."[213] Similarly, the House Report stated that although some injuries and illnesses may not need to be recorded or reported, "the greater peril" lay in allowing under-recording or under-reporting.[214] Therefore, the report added, "[the] language 'all work-related injuries, [and illnesses]' should be treated as a minimum floor."[215]

7. Reporting Requirements Specific to Oil Spills Are Necessary Due to the Nature of Response Operations

Oil spill response is hazardous waste operation and a chaotic working environment. Multiple authorities need to communicate, coordinate, and adapt to rapidly changing circumstances while training a workforce not typically involved in disaster management.[216] Further, it often involves spill mitigating products, like oil dispersants, that may be more toxic than the oil itself or when combined with oil. The NCP requires that any label, advertisement, or technical literature that refers to product use under the NCP must include EPA's liability disclaimer – reproduced in full and conspicuously displayed.[217]

Initial response operations in which the majority of workers participate take place over the course of months rather than years.[218] If OSHA implements changes to the common cold and flu exception without also requiring a shortened timeline for reporting illnesses, the agency will not be able to gather real-time data concerning health effects experienced by workers during response operations because records are submitted to OSHA on an annual basis.[219] During the BP DWH oil disaster, OSHA continually adapted its health and safety regulations when presented with new information[220] – and this adaptive assessment approach for uncertain exposures carried over as a lesson learned into the NRT's ERHMS guidance.[221] Without accurate reports concerning illnesses experienced by oil spill response workers, OSHA will not be able to conduct this type of adaptive rulemaking with the necessary efficacy.

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[213] *Id.* at 157.
[214] *Id.* at 860.
[215] *Id.*
[216] Nat'l Comm'n on the BP DWH Oil Spill and Offshore Drilling, 2011, *supra* note 36, at ix–x.
[217] 40 CFR § 300.920(e). "DISCLAIMER [PRODUCT NAME] is on the U.S. Environmental Protection Agency's NCP Product Schedule. This listing does NOT mean that EPA approves, recommends, licenses, certifies, or authorizes the use of [PRODUCT NAME] on an oil discharge. This listing means only that data have been submitted to EPA as required by subpart J of the National Contingency Plan, § 300.915.
[218] *Id.* at 130–167, detailing initial response operations and the significant contingent of volunteers and workers from industries significantly different from oil spill response.
[219] 29 CFR § 1904.41(a)(1) and (2).
[220] *See generally* OSHA, 2011. *Deepwater Horizon Oil Spill: OSHA's Role in the Response*. https://www.hsdl.org/c/abstract/?docid=5056
[221] *See supra* notes 194–199 and accompanying text.

F. Request for Rulemaking

Considering the hazardous nature of oil spill response, the uncertain exposures that necessitate continuous health monitoring, the often large workforce unfamiliar with hazardous waste operations, and the unsuccessful attempts by agencies including OSHA to regulate by recommendation, we request that OSHA immediately amend its recordkeeping rule as follows:

Append the following sentence to 29 CFR § 1904.5(b)(2)(viii):

This exception shall not apply to on-site workers, compensated or non-compensated, responding to an oil spill under the National Oil and Hazardous Substances Pollution Contingency Plan. Cold- and flu-like symptoms of these workers must be reported to OSHA according to the requirements of § 1910.120(q)(9)(iii).
Add the following provision to 29 CFR § 1910.120(q)(9):

(iii) Cold- and flu-like symptoms are recorded every calendar week for each operable unit during an oil spill response under the National Oil and Hazardous Substances Pollution Contingency Plan, and must be reported to OSHA within 24 hours of that week for the duration of the incident response, by one of the following methods:

(1) By telephone or in person to the OSHA Area Office that is nearest to the site of the incident.
(2) By telephone to the OSHA toll-free central telephone number, 1-800-321-OSHA (1-800-321-6742).
(3) By electronic submission using the reporting application located on OSHA's public website at www.osha.gov.

G. Conclusion

As discussed throughout this petition, the OSHA records during oil spill responses under the NCP are currently not quality information as they do not accurately reflect occupational illnesses associated with oil-chemical exposure because of the OSHA exception for recording and reporting common cold/flu symptoms. There is *a causal relationship* between short-term oil spill exposure and persistent respiratory, cardiovascular, and neurological harm that can occur years after the exposure. This documented chronic harm from oil spill exposures occurs at levels of petroleum hydrocarbons that are orders of magnitude below currently allowable OSHA worker exposure levels. Further, it is forecasted by an initial, characteristic suite of acute symptoms that mimic common cold/flu-like symptoms – precisely the symptoms that OSHA currently broadly exempts. OSHA has offered no interpretive guidelines to distinguish between common cold/flu symptoms and symptoms of occupational exposures that mimic the common cold/flu symptoms.

Amending the common cold/flu exception would fulfill the purpose of the OSH Act and OSHA's statutory duty to create and implement regulations that keep workers healthy and hold employers accountable for their failure to do so. Further, this action would provide an evidence-based standard to support the National Response Team's recommendations for health monitoring and surveillance of emergency responders, and, in so-doing, it would help reduce or prevent harm to human health under the NCP.

It is of paramount importance that the OSHA injury and illness records provide quality information to decision-makers – information that is accurate, complete, and relevant. But, unless preventative action is taken to better protect *human health* during oil spills, the now predictable cold/flu-like symptoms characteristic of oil spill exposures will lead to now predictable long-term illnesses, cancers, and premature deaths in response workers and the exposed populace. The way to change this outcome is to change the law – require biomonitoring through accurate recording and reporting of cold/flu symptoms in real-time during oil spill response under the NCP.