

**Hearing Order OH-001-2014
Trans Mountain Pipeline ULC (Trans Mountain)
Application for the Trans Mountain Expansion Project (Project)**

Written evidence of Dr. Riki Ott

**Name of
intervenor:** North Shore No Pipeline Expansion (“NSNOPE”)

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1 1.0 Introduction

2 1.1 Scope of Work

- 3 1. This is the written evidence of Dr. Riki Ott filed on behalf of the intervener North
4 Shore No Pipeline Expansion (NSNOPE) to address human health impacts and
5 risks of oil spills.
6
- 7 2. In particular, I was asked to provide my professional opinion on: (1) the health
8 impacts to spill response workers from exposure to oil spills and oil spill response
9 activities including use of chemical and biological products; (2) the health impacts
10 to the general public from exposure to oil spills and oil spill response activities
11 including use of chemical and biological products; and (3) the health impacts to
12 the communities from oil spills.
13

14 1.2 Statement of Qualifications

15 1.2.1 Education

- 16 3. I am a trained marine toxicologist specializing in research regarding the
17 environmental and human health impacts of oil spills. I hold the following
18 degrees: a Doctorate of Philosophy (1985) from University of Washington, WA,
19 School of Fisheries with emphasis on effects of heavy metals on benthic
20 invertebrates; a Masters of Science (1980) from University of South Carolina,
21 SC, Baruch Institute in marine biology with emphasis on effects of oil on
22 zooplankton; and a Bachelor of Science (1976) from Colby College, Waterville,
23 Maine, in biology and geology.
24
- 25 4. I completed a Sea Education Association Boston-based program (1975) through
26 the Woods Hole Oceanographic Institute collecting tar ball samples in the
27 Mediterranean Sea under the supervision of scientists from the Bermuda
28 Biological Station.
29
- 30 5. I completed a Thomas Watson Fellowship (1977) on marine oil pollution fates
31 and effects in Bermuda and Europe. Specifically, I was part of research teams at
32 the Bermuda Biological Station, studying biodegradation rates of beach-stranded,
33 weathered oil; at The Laboratory in Plymouth, England, studying effects of BETX
34 fraction of oil on copepods; and at the University of Malta, studying effects of
35 different dispersants used on beach-stranded weathered oil on intertidal
36 invertebrate communities.
37

38 1.2.2 Experience

- 39 6. Upon completing my PhD in 1985, I intended to take one summer off before
40 pursuing a career path in marine toxicology. I crewed on a commercial salmon drift
41 gillnet fishing boat in Prince William Sound and the Copper River Delta,

1 designated as Area E by the Alaska Dept. of Fish & Wildlife. The following year,
2 in 1986, I bought an Area E commercial salmon drift gillnet limited entry fishing
3 permit and a boat through my fishing corporation, O.C. Inc. I fished my permit, or
4 as crew on my fishing boat when I transferred my permit to my fishing partner
5 during the *Exxon Valdez* oil spill (EVOS) in 1989, until 1994 when I sold my
6 share of the business to my fishing partner.
7

- 8 7. I served on the Board of Cordova District Fishermen United from 1987 to 1994 as
9 the point person on oil issues, including chronic pollution at Alyeska Marine
10 Tanker Terminal in Port Valdez, Alaska, and EVOS environmental impacts.
11
- 12 8. I served on the statewide Board of United Fishermen of Alaska from 1987 to
13 1994 and as Chair of the Habitat Committee from 1988 to 1994. In the latter
14 capacity, I dealt with statewide oil, timber, and mining issues as they impacted
15 fish habitat and water quality.
16
- 17 9. During my tenure on the boards of CDFU and UFA, I represented these
18 organizations as a stakeholder in the Alaska Regional Response Team's working
19 group to develop Oil Dispersant Guidelines for Prince William Sound (1988-'89,
20 document completed two weeks before the EVOS)¹; as a delegate to the
21 International Oil Spill Conference, invited by the U.S. Coast Guard to present on
22 the Open Ocean and Coastal Spill panel (1989, six weeks before the EVOS)²; as
23 a member (1990–1996) of the Technical Advisory Group to U.S. EPA and Alaska
24 Department of Environmental Conservation for federal National Pollution
25 Discharge Elimination System ballast water discharge permit for Alyeska Pipeline
26 Services Company at the marine tanker terminal in Port Valdez; as the CDFU
27 delegate to and founding member of the Oil Reform Alliance, an ad hoc coalition
28 of commercial fishing and environmental organizations that successfully
29 advocated passage of the then strongest oil spill prevention and response laws in
30 all 50 states (1989–1992); and as a member of the (Alaska) Governor's Task
31 Force on Water Quality (1992–1996). Also, on behalf of UFA and CDFU, I wrote
32 many white papers to support my testimony in Congress and the Alaska State
33 Legislature; gave public talks at numerous universities and conferences
34 throughout the U.S. and some international events.
35
- 36 10. Following the EVOS-related collapse of the Prince William Sound ecosystem and
37 commercial fisheries in 1993,³ I sold my fishing business and applied my

¹ Alaska Federal and State Preparedness Plan for Response to Oil and Hazardous Substance Discharges and Releases, 1989, Unified Plan, vol. 1, Oil Dispersant Guidelines for Alaska, Annex F, F-11–F- 13. www.akrrt.org/UnifiedPlan/F-Annex.pdf and <http://www.akrrt.org/UnifiedPlan/index>.

² Ott, Riki, 1989, Spilled Oil and the Alaska Fishing Industry: Looking Beyond Fouled Nets and Lost Fishing Time. Keynote presentation at the International Oil Spill Conference on the Open Ocean and Coastal Spill Panel. San Antonio, TX, 12–15 February 1989.

³ Peterson, Charles, et al., 2003, Long-Term Ecosystem Response to the *Exxon Valdez* Oil Spill, *Science*, December 19, 2003, 2082–2086.

1 research training and organization skills to problem-solving EVOS-related issues
2 in Cordova, Alaska, and Prince William Sound. I co-founded several nonprofit
3 organizations including the Copper River Watershed Project, dedicated to value-
4 based economic development in Alaska (1994 as ad hoc group, incorporated
5 1997, retired in 1998); the Alaska Forum for Environmental Responsibility to hold
6 the Alaska oil industry and government accountable to laws designed to protect
7 public and worker health and the environment (1996~2006); and the Oiled
8 Regions of Alaska Foundation to help EVOS claimants with financial
9 management and charitable giving to their communities (2001–2007).

- 10
- 11 11. Along with my former fishing partner, I filed a claim for compensation from fishing
12 losses and ultimately became part of the class action civil lawsuit stemming from
13 the EVOS (1991).
14
- 15 12. In 1997, I was recognized in the State of Alaska courts as an expert witness on
16 oil spill impacts in the marine and coastal environment.
17
- 18 13. From 1998 to 2008, I wrote three books about the EVOS, including *Alaska's*
19 *Copper River Delta* (University of Washington Press, 1998) to promote eco-
20 tourism in the region and help make up revenue lost from EVOS-related
21 commercial fisheries closures and/or long-term impacts; *Sound Truth and*
22 *Corporate Myths: The Legacy of the Exxon Valdez Oil Spill* (Dragonfly Sisters
23 Press, 2004) to help the general public understand the EVOS impacts to people
24 – mostly workers – and the environment by synthesizing all available scientific
25 studies and other information, and to recommend policy changes to protect
26 workers and the environment based on updated scientific information; and *Not*
27 *One Drop: Betrayal and Courage in the Wake of the Exxon Valdez Oil Spill*
28 (Chelsea Green Publishing, 2008) to help the general public understand the
29 community-level psychosocial mental health trauma impacts from the EVOS –
30 and how to heal that trauma – by synthesizing all available scientific studies and
31 other information, including first-hand experience from living in Cordova, Alaska,
32 subject of a 21-year long case study on man-made disaster trauma.
33
- 34 14. I was invited to the Republic of Korea in 2005 for the 10-year memorial of the
35 *Sea Prince* oil spill (1.6 million gallons of heavy crude) to speak about
36 community-level trauma from the EVOS, and again in 2008 for the 1-year
37 memorial of the *Heibi Spirit* oil spill (3.65 million gallons of heavy crude) to speak
38 about EVOS impacts to people, communities, and the environment. My book,
39 *Sound Truth and Corporate Myths*, was translated into Korean.
40
- 41 15. In 2009, I co-founded Ultimate Civics, a project of Earth Island Institute (EII) to
42 deal with social issues related to the EVOS.
43
- 44 16. From May 2010 to April 2011, I worked as a volunteer in Gulf Coast communities
45 impacted by the BP Deepwater Horizon (DWH) disaster, coaching people
46 prepare for, and work to prevent or minimize, the chemical illnesses, mental
47 health trauma, and psychosocial trauma, based on lessons learned from the
48 EVOS.

- 1
2 17. In July 2011, I was invited to similarly coach communities impacted by the
3 Enbridge Line 6B tar sands pipeline rupture in Battle Creek/Kalamazoo area of
4 Michigan, based on lessons learned from the EVOS and BP DWH disaster, and
5 in April 2013 to Mayflower, Arkansas, for the same purpose, now also carrying
6 lessons learned from Michigan.
7
8 18. In November 2012, I petitioned the U.S. EPA for a rulemaking on the National Oil
9 and Hazardous Substances Pollution Contingency Plan (NCP) policies governing
10 oil spill response organization, structure, authorities, worker and public health,
11 and product use on behalf of myself, Ultimate Civics/EII, and the ad hoc Citizens'
12 Coalition to Ban Toxic Dispersants. The focus was mostly on conventional oil and
13 concerns raised from the EVOS and BP DWH disasters. (The rules had not been
14 updated for 21 years and did not include the science from the EVOS.)
15
16 19. In 2014, I began to investigate human health impacts from Unconventional Oil
17 and Gas (UOG) and I filed a supplement to the original petition to U.S. EPA on
18 behalf of the same parties, but focusing on UOG. I toured multiple states and
19 communities in crude oil corridors, consisting of oil-by-rail trains, tar sands
20 pipeline corridors, and regions of hydrologic fracturing ("fracking") activities,
21 speaking about ways for people to engage in oil spill response planning to
22 minimize or prevent harm to workers, public health and welfare, communities,
23 and the environment.
24
25 20. I founded ALERT in 2014, also a project of EII, to deal more directly with
26 unfinished business from the EVOS and national oil issues relating to human
27 health and environmental impacts, science, and politics of conventional oil and
28 UOG.
29
30 21. In April 2015, I submitted extensive comments on behalf of myself, ALERT, and
31 the ad hoc Citizens' Coalition to Ban Toxic Dispersants, to the U.S. EPA for its
32 rulemaking on the NCP, Subpart J, policies governing use of dispersants and
33 other chemical and biological agents during spill response. Specifically, I
34 included scientific studies and other evidence of harm from exposure to oil and
35 chemical dispersants to worker health, public health, and the environment.
36 Excerpts from these comments are relevant to this testimony.
37
38

39 **1.2.3 Qualification of Opinions**

- 40 22. My opinions are based on my education, professional experience, and
41 information and data available in the scientific literature, court records,
42 government reports, investigative and other media, graduate student research
43 and studies, my own research and other writings, and my personal experience.
44 My curriculum vita is attached as Appendix A.
45
46
47

2.0 Impacts to Worker Health & Wildlife from Oil Spills

2.1 State of Knowledge Before the BP DWH Disaster

23. In 1985, the American Petroleum Institute published one of the earliest literature reviews of human health impacts from oil exposure in the marine environment.⁴

24. By 1989 mere weeks before the EVOS, there was sufficient evidence for regulatory agencies to declare oil spills as hazardous waste cleanups.⁵ Labor unions and others successfully argued that oil is inherently hazardous to human health; that oil spill workers were getting sick from work-related chemical illnesses; and that workers needed Occupational Safety and Health Act's (OSHA) HAZWOPER (Hazardous Waste Operator) training to minimize harm to their health.

25. In 1989, after the EVOS, Dr. Robert Rigg, a former Alaska medical director for Standard Alaska (BP), warned in a letter to Cordova District Fishermen United, "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—secondary to exposure to—working unprotected in (or inadequately protected) 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." Further, he recommended pulling cleanup crews "off the beaches—and out of the Sound—[to] avoid further tragedy in the form of human suffering, illness and disease..."⁶

26. The *Exxon Valdez* was the first oil spill response conducted under OSHA's HAZWOPER standard, even though oil spill waste had previously been exempted as a hazardous substance.⁷ Within weeks, the Alaska Dept. of Labor reduced the required 40-hour HAZWOPER training to 4-hours at Exxon's request. Although OSHA's research arm, the National Institute of Occupational Safety and Health (NIOSH), deemed Exxon's 4-hour training adequate,⁸ occupational medical doctors and researchers, labor unions, worker safety

⁴ I. R. Politzer, I. R. DeLeon, J. L. Laseter, *Impact on Human Health of Petroleum in the Marine Environment*, American Petroleum Institute, Washington, DC, 1985.

⁵ OSHA, 1989. Hazardous Waste Operations and Emergency Response Standard, 29 CFR 1910.120 (Federal Register 54 [42]:9294-9336). U.S. Department of Labor, March 6, 1989.

⁶ Robert Rigg, MD, Letter to Cordova District Fishermen United, May 13, 1989, Cordova, AK. Also in City of Cordova, AK, *Cordova Fact Sheet*:1989 1[29].

⁷ 40 CFR 300.5 definition of hazardous substance.

⁸ VECO, Inc., 1989, VECO EVOS hazardous waste cleanup training video, VHS, Alaska Resource Library and Information Services, Anchorage, AK.

1 experts, and other qualified persons found numerous flaws with the training and
2 overall Exxon Worker Safety Program.

3
4 27. For example, workers were not prescreened for medical issues that may have
5 been exacerbated or triggered by exposure to oil; they were not properly trained
6 to recognize symptoms of chemical exposure; they were not properly equipped
7 with respirators and other Personal Protective Equipment (PPE) as required
8 under the HAZWOPER standards; and when workers started to get sick, there
9 were no feedback loops to determine the cause of the problem and address it,
10 much less to provide follow up monitoring and health care for sick workers.⁹

11
12 28. To further compound matters, OSHA standards are not protective. OSHA (still)
13 relies on inappropriate surrogates such as mineral oil and particulate dust to
14 establish safety standards for oil mist and PAHs, respectively.¹⁰ These
15 surrogates do not even come close to accurately representing the toxic
16 properties and associated health risks posed by the original chemicals. Using
17 such surrogates and other assumptions such as a 40-hour week with five 8-hour
18 days, an Occupational Exposure Limit (OEL) is determined as a “safe” level of
19 exposure to a substance for a certain frequency and duration over a working
20 lifetime. OSHA then determines Permissible Exposure Limits (PELs), based
21 basically on politics and the OELs, as enforceable legal limits that cannot be
22 exceeded. The standards do not account for increased risk of exposure from
23 extended hours, shift-work, and 24/7 exposure that occur during oil spill
24 response. OSHA has acknowledged that its PEL standards are out-of-date and
25 not as protective as the OEL (not enforceable) standards used by other
26 agencies.¹¹ As a result of inadequate and outdated standards, workers can and
27 do get sick at levels below the OSHA PELs, but U.S. government officials only
28 take protective action when there is a violation of the standard, not when there is
29 evidence of harm.

30
31 29. In addition, OSHA inspections were inadequate to nonexistent. OSHA did not
32 have anywhere near a sufficient number of personal to monitor and evaluate
33 Exxon’s Worker Safety Program for the scale of the response, according to
34 expert witness testimony obtained from court records.¹² Further, OSHA was
35 prevented from inspecting on-the-water operations because of competing

⁹ Stuart, T. 1989, Alaska Dept. of Labor letter to Dr. Knut Ringen, Director, Laborers’ National Health and Safety Fund, April 21, in U.S. Congress House, 1989a, 1061–1062.

Teitelbaum, Daniel T., MD, 1994. Deposition, October 12, in *Stubblefield v. Exxon* (1994) in Riki Ott, *Sound Truth and Corporate Myths*, (Dragonfly Sisters Press, 2004).

¹⁰ See Teitelbaum deposition and Ott, *Sound Truth*, especially chapters 1–3 and 10.

¹¹ OSHA, DWH Response, p. 7.

¹² Teitelbaum deposition and Ott, *Sound Truth*, chapters 1–3.

1 jurisdiction with the U.S. Coast Guard.¹³ OSHA assumed, as a fallback plan, that
2 it would subpoena Exxon’s medical records and air quality monitoring data – but
3 never did because of budget issues. **In 1991**, absent air monitoring data and
4 medical records and unable to conduct a records-based evaluation of EVOS
5 worker health, NIOSH concluded in its Health Hazard Evaluation, “Based on
6 available data, there is no basis for recommending long-term medical
7 surveillance of the health of the workers involved in the cleanup of the oil spill”
8 (emphasis added).¹⁴
9

10 30. Meanwhile, the U.S. Coast Guard, as the FOSC, appeared to have focused on
11 physical injuries rather than chemical illnesses.¹⁵ Chemical illnesses are now
12 known to be a consistent and debilitating health hazard associated with oil spill
13 response or exposure. **In 1993**, the Coast Guard federal OSC concluded that the
14 matter of whether there were long-term or delayed ill effects from the cleanup on
15 worker health “is likely to remain unresolved for some time, and worker health
16 issues may ultimately be litigated, perhaps in significant numbers.”¹⁶ In other
17 words, the Coast Guard federal On Scene Coordinator (OSC) simply observed
18 that there was likely to be a problem and that the legal system would somehow
19 resolve it.
20

21 31. **In 1994**, three years after the NIOSH Health Hazard Evaluation absolved Exxon
22 of long-term medical monitoring, evidence surfaced that would have lead the
23 regulators to a different conclusion. Exxon’s medical records and air quality
24 monitoring data surfaced briefly as public records in a court case before Exxon
25 successfully argued to have the records sealed for thirty years or until 2024.
26 Significant numbers of illnesses, now well known to be characteristic of oil
27 exposure as discussed below, were reported to Exxon medical clinics during the
28 1989 EVOS response operations. Exxon’s own clinical data revealed 6,722
29 cases of respiratory problems from a total workforce of about 15,000.¹⁷ Exxon

¹³ OSHA Instruction CPL 2-1.20 November 8, 1996 Directorate of Compliance Programs, Subject:
OSHA/U.S. Coast Guard Authority Over Vessels.

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=1526&p_table=DIRECTIVES

¹⁴ NIOSH, 1991, Health Hazard Evaluation Report, prepared by R.W. Gorman, S. P. Berardinelli, and T.
R. Bender. U.S. DHHS, May. HETA, 89-200 & 89-273-2111, Exxon/Valdez Alaska Oil Spill.

¹⁵ USCG EVOS report, p. 399, Table 17.1.

¹⁶ USCG EVOS report, p. 404.

¹⁷ Exxon Company, USA, 1989. Clinical data on upper respiratory infections: URIs–Breakdowns. In *Garry
Stubblefield and Melissa Stubblefield v. Exxon Shipping Company, Exxon Corporation, VECO, Inc.,
and Norcon, Inc.* 3AN–91–6261 CV (HBS), AK Superior Court, Third Judicial District at Anchorage
(1994); in Ott, *Sound Truth*.

Med-Tox, 1989a. Air monitoring results for oil mist: VOCs master by task and VOCs master by date. In
Stubblefield v. Exxon (1994), in Ott, *Sound Truth*.

Med-Tox. 1989b. Results of air sampling for PAHs. In *Stubblefield v. Exxon* (1994), in Ott, *Sound Truth*.

Med-Tox, 1989c. Statistical summary of industrial hygiene monitoring. In *Stubblefield v. Exxon* (1994), in
Ott, *Sound Truth*.

Ott, *Sound Truth*, Appendix Table A.1. Exposure levels of some hazardous compounds present during
the 1989 EVOS cleanup compared to OSHA PEL and NIOSH REL, p. 450.

1 medical doctors diagnosed the “Valdez crud” or upper respiratory *infections*
2 despite lack of evidence of a virus. This allowed Exxon to circumvent OSHA’s
3 strict reporting requirements for “OSHA-recordable illnesses” during hazardous
4 waste cleanups by using the exemption for colds and flu [29 CFR
5 1904(5)(b)(2)viii], despite the fact that initial symptoms for chemical illness mimic
6 cold and flu-like symptoms.¹⁸ Exxon also reported a near zero work-related
7 illness rate to Alaska health officials.¹⁹ While the Alaska Dept. of Labor did
8 maintain a separate database for the EVOS claims, OSHA’s coding system, then
9 and now: fails to recognize and accurately code chemical-illness data (as
10 evidenced also by the glaring exemption) as the system was designed before
11 chemical illnesses were understood; fails workers who do not understand the
12 nature of chemical illness and so report their illnesses inaccurately; and fails to
13 use staff with expertise in occupational medicine and industrial hygiene and so
14 compounds any errors. Based on a coding system that fails to diagnose chemical
15 illnesses, the Alaska Dept. of Labor failed to notice anything unusual about the
16 EVOS accident types and rates compared to previous years.

- 17
18 32. Thus, despite the Coast Guard OSC’s assumption, significant numbers of EVOS
19 workers did not litigate likely because most did not connect their lingering
20 illnesses to their occupational exposure. But they had been given no reason to
21 believe their illness was connected: their training had not forewarned them; they
22 had been told repeatedly that the chemical products (Corexit dispersants and
23 dispersant-like Inipol EPA22) were “as safe as pancake syrup;” and Exxon had
24 circulated a waiver indemnifying the company from any work-related harm – and
25 had paid workers to sign it.²⁰
26
27 33. While the federal and Alaska state governments, spiller, and court system did not
28 adequately assess, research or address the problem of sick workers,
29 independent researchers (including myself) and investigative media drew entirely
30 different conclusions from the same data set. **In 1993**, the industry Marine Spill
31 Response Corporation, newly formed under the Oil Pollution Act of 1990,
32 addressed the chemical aspects of occupational health and marine oil-spill
33 response, but significantly limited the review to exposures to crude oil only, not
34 oil spill response products.²¹ **In 1999**, the same authors of the 1993 review

¹⁸ OSHA regulations include the following exemptions for reporting work-related injuries and illnesses:
“Exclude from record keeping those injuries/illnesses that do not provide information useful to the
identification of occupational injuries and illnesses and thus would skew natural injury/illness data” [29
CFR 1904.5(b)(2)]. The list includes: “Colds and flu will not be considered work-related” [29 CFR
1904.5(b)(2)(vii)].

¹⁹ Alaska Dept. of Labor, 1990, Prince William Sound oil spill, in Occupational Injury and Illness
Information—AK, 1989, 25–34, Juneau, AK: ADOL, in Ott, *Sound Truth*, p. 33.

²⁰ ADOL, Alaska Workers’ Compensation Board, 1992, Partial compromise and release regarding
recovery of overpayment of benefits, filed 2 October, in ADOL, AWCB 1992, in Ott, *Sound Truth*.

²¹ M. G. Holliday, J. M. Park, *Occupational Health Implications of Crude Oil Exposure: Literature Review
and Research Needs*, Technical Report 93-007, Marine Spill Response Corporation, Washington,
DC, 1993.

1 independently completed a second review to update their earlier report. The
2 researchers concluded, “Mists and aerosols containing polynuclear aromatic
3 hydrocarbons (PAHs) are, in principle, a cancer risk...”²² The authors limited
4 their review to crude oil exposures. Also **in 1999**, the *Anchorage Daily News*
5 published the first in-depth investigative story on EVOS worker health impacts,
6 based on Exxon’s medical records and air quality monitoring data.²³ **In 2001** the
7 *Los Angeles Times* published another investigative report, based on the same
8 data.²⁴ These sources support the conclusion, based on the weight of evidence,
9 that EVOS response workers had been exposed to dangerous levels of
10 dangerous chemicals – oil, specifically PAHs – and that the exposure had
11 resulted in work-related chemical illnesses.
12

- 13 34. **In 2003**, a Yale study found a significant number of former EVOS workers self-
14 reported lingering symptoms characteristic of oil spill exposure.²⁵ These most
15 frequently reported symptoms included lingering respiratory issues, central
16 nervous system issues (such as headaches, mood swings, tingling appendages,
17 brain fog), chemical sensitivities, and blood disorders. Other issues included liver
18 and kidney problems, reproductive problems, skin problems, and immune
19 suppression. Also **in 2003**, a multi-disciplinary team of principle investigators
20 published a peer-reviewed synthesis of comprehensive ecosystem studies
21 conducted in the wake of the EVOS. The synthesis, published in *Science*,
22 signaled a paradigm shift in the field of oil ecotoxicology. The scientists
23 established that exposure to oil, specifically PAHs, causes long-term harm to
24 wildlife and ecosystem function, including endocrine abnormalities and
25 reproductive problems, immune system dysfunction, genotoxic effects, stunted or
26 slowed growth and skeletal deformities, and disruption of behavioral and social
27 functions critical for survival, among others. Oil was 1,000 times more toxic than
28 thought in the 1970s: PAH levels of 1 to 20 parts per billion were found to sicken
29 wildlife and reduce entire populations of fish, birds, and mammals.²⁶
30
- 31 35. **In 2004**, I published an extensive synthesis of the scientific literature and other
32 available data conducted in the wake of the EVOS. I found striking similarities in
33 biological impacts to humans and wildlife from exposure to oil, notably,
34 respiratory dysfunction, central nervous system problems, immune system

²² Park, J. M. and M. G. Holliday, Occupational-health aspects of marine oil spill response, *Pure Applied Chemistry*, 1999, 71(1):113–133.

²³ Phillips, Natalie. 1999. Still painful. 10 years later, front-line spill workers link physical ailments to cleanup work. *Anchorage Daily News*, 23 March.

²⁴ Murphy, Kim, 2001. Exxon spill’s cleanup workers share years of crippling illness. *Los Angeles Times*, Nov. 5.

²⁵ O’Neill, Annie, 2003, Self-reported exposures and health status among workers from the EVOS cleanup. Master’s thesis M. P. H. Yale University, Department of Epidemiology and Public Health. Available as PDF on www.rikiott.com

²⁶ Peterson, et al., 2003, Long-term Ecosystem Responses to the *Exxon Valdez* Oil Spill, *Science* 302:2082–86.

1 suppression, endocrine disruption and reproductive problems, and behavioral
2 issues.²⁷

- 3
- 4 36. In 2006, the U.S. Air Force Emergency Management published a pocket guide
5 for oil and hazardous substance disasters. One section titled, “Learn to
6 Recognize the Symptoms of Toxic Poisoning,” states: “Be prepared to seek
7 medical assistance if you have any of the following symptoms: difficulty
8 breathing; irritation of the eyes, skin, throat, or respiratory tract; changes in skin
9 color; headache or blurred vision; dizziness, clumsiness or lack of coordination;
10 cramps or diarrhea.”²⁸
- 11
- 12 37. In 2011, a literature review of seven previous oil spills (not including the BP DWH
13 disaster) categorized key human health impacts and restated the common
14 knowledge, grounded in well-established facts: “Acute effects have included:
15 respiratory, eye, and skin symptoms; headache; nausea; dizziness; and
16 tiredness or fatigue. Chronic effects have included: psychological disorders,
17 respiratory disorders, genotoxic effects, and endocrine abnormalities.”²⁹
18 Significantly, widespread application of dispersants was not conducted during
19 any of the spills included in this review.
- 20

21 2.2 State of Knowledge After the BP DWH Disaster

- 22 38. The widespread application of at least 1.8 million gallons of Corexit 9500 and
23 Corexit 9527A in response to the BP disaster was an unprecedented
24 experiment—with immediate unprecedented consequences for the environment,
25 workers, and the general public.
- 26
- 27 39. The BP disaster is relevant to this discussion because the oil industry mixes
28 large volumes of oil-based solvents and other chemicals with oil, as dispersants
29 to break up oil slicks, as diluents to thin tar sands for transportation,³⁰ and as
30 fracking fluids to extract oil from oil-bearing shale. By nature, these oil-based
31 solvents act as an oil delivery system, facilitating the entry of oil into the body,
32 and into cells, which can damage every organ system in the body.³¹ Human
33 health and environmental impacts from the BP oil-dispersant disaster foreshadow

²⁷ Ott, Riki, 2004, *Sound Truth and Corporate Myths: The Legacy of the Exxon Valdez Oil Spill* (Dragonfly Sisters Press: Cordova, Alaska).

²⁸ Air Force Emergency Management, 2006, pocket guide for oil and hazardous substance disasters, AFEM. Helpdesk@tyndall.af.mil

²⁹ Barry Levy and William Nassetta, “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* 2011; 17:121–167.

³⁰ Song, Lisa, 2012, A Dilbit Primer: How it is different from conventional oil, Inside Climate News, June 26. <http://insideclimatenews.org/news/20120626/dilbit-primer-diluted-bitumen-conventional-oil-tar-sands-Alberta-Kalamazoo-Keystone-XL-Enbridge>

³¹ Burns, K. and Harbut, M.R., 2010. *Gulf Oil Spill Hazards*, Sciencecorps, Lexington, MA, June 14, 2010. Available at <http://www.sciencecorps.org/crudeoilhazards.htm>

- 1 impacts from a dilbit disaster, because with dilbit, the oil and solvents are already
2 pre-mixed.
3
- 4 40. Corexit dispersants contain chemical ingredients known to be neurotoxins,
5 mutagens, teratogens (able to disturb the growth and development of an embryo
6 or fetus), and carcinogens, and known to rupture red blood cells, causing
7 hemolysis (bleeding), blood disorders, and liver and kidney damage, among
8 other things.³² So do diluents, as petrochemical solvents, as evidenced by
9 example of the Canadian Trican Diluent Material Safety Data Sheet.³³
10
- 11 41. According to a **July 2010** scientific consensus statement published by the Marine
12 Environmental Research Institute, "The properties that facilitate the movement of
13 dispersants through oil also make it easier for them to move through cell walls,
14 skin barriers, and membranes that protect vital organs, underlying layers of skin,
15 the surfaces of eyes, mouths, and other structures."³⁴
16
- 17 42. Not surprisingly, dispersants acted like an oil delivery system.³⁵ Ecosystem
18 studies in the wake of the BP DWH oil-dispersant disaster found compounded
19 harm in a wide variety of sea life from the base of the food web such as bacteria,
20 zooplankton, corals,³⁶ oysters, blue crabs, and killifish³⁷ to apex predators such

³² Burns, K. and Harbut, *Gulf Oil Spill Hazards*.

³³ Trican, 2013, Material Safety Data Sheet, Trican Diluent.
<http://www.rocanda.com/pdf/Trican%20Diluent%20'13b.pdf>

³⁴ Consensus Statement: Scientists oppose the use of dispersant chemicals in the Gulf of Mexico, July 16, 2010. Statement drafted by Dr. Susan D. Shaw, Marine Environmental Research Institute. Quotes on pp. 1–2.
<http://www.meriresearch.org/Portals/0/Documents/CONSENSUS%20STATEMENT%20ON%20DISPERSANTS%20IN%20THE%20GULF%20updated%20July%2017.pdf>

³⁵ Kirby, David, 2013, Corexit, oil dispersants used by BP is destroying Gulf marine life, scientists say, *Huffington Post*, April 25, 2013. http://www.huffingtonpost.com/2013/04/25/corexit-bp-oil-dispersant_n_3157080.html

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³⁶ McClain, Craig, et al., 2015, Given the choice, corals would prefer oil to dispersants, *Deep Sea News*, April 8, 2015. <http://deepseanews.com/2015/04/given-the-choice-corals-would-prefer-oil-to-dispersant/>

³⁷ Almeda R, Wambaugh Z, Wang Z, Hyatt C, Liu Z, et al. (2013) Interactions between Zooplankton and Crude Oil: Toxic Effects and Bioaccumulation of Polycyclic Aromatic Hydrocarbons. *PLoS ONE* 8(6): e67212. doi:10.1371/journal.pone.0067212

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Goodbody-Gringley G, et al., 2013, Toxicity of [BP] *Deepwater Horizon* Source Oil and the Chemical Dispersant, Corexit® 9500, to Coral Larvae. *PLoS ONE* 8(1): e45574. doi:10.1371/journal.pone.0045574

1 as tuna and dolphins.³⁸ Scientists found deformed and dying sea life in the region
2 was “spatially coordinated with oil from the [BP] *Deepwater Horizon*, both surface
3 oil and subsurface oil,” according to Dr. Jim Cowan with Louisiana State
4 University’s Department of Oceanography and Coastal Sciences.³⁹ This remains
5 the case: ongoing studies on bottlenose dolphins found the high rate of dolphin
6 deaths and strandings “overlap in time and space with locations that received
7 heavy and prolonged oiling” during the BP DWH disaster.⁴⁰ Scientists now
8 confirm BP’s oil-dispersant disaster is the cause of adrenal and lung disease
9 such as bacterial pneumonia, and a host of other maladies such as liver damage,
10 lymph node depletion, encephalitis, fibrosis, bacterial infections, and more, all
11 likely contributing to the ongoing Unusual Mortality Events in these dolphins.⁴¹
12 Like the *Exxon Valdez* oil spill, the weight of evidence shows that the killing did

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- ³⁸ Carmichael, Ruth, et al., “Were Multiple Stressors a ‘Perfect Storm’ for Northern Gulf of Mexico Bottlenose Dolphins (*Tursiops truncatus*) in 2011?” *PLoS ONE* 2012; 7(7): e41155
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- Schwacke, Lori, et al., Health of Common Bottlenose Dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, Following the *Deepwater Horizon* Oil Spill, dx.doi.org/10.1021/es403610f *Environ. Sci. Technol.* 2014, 48, 93–103, <http://pubs.acs.org/doi/abs/10.1021/es403610f>
- ³⁹ Dahr Jamail, “Gulf seafood deformities alarm scientists,” *Aljazeera English*, April 20, 2012. <http://www.aljazeera.com/indepth/features/2012/04/201241682318260912.html>
- ⁴⁰ Schleifstein, Mark, 2015, Study associates 3-year pattern of Gulf of Mexico bottlenose dolphin deaths with BP oil spill, *NOLA.com/The Times-Picayune*, Feb. 12, 2015.
- Venn-Watson, Stephanie, et al., 2015, Demographic Clusters Identified within the Northern Gulf of Mexico Common Bottlenose Dolphin (*Tursiops truncatus*) Unusual Mortality Event: January 2010 - June 2013, *PLoS ONE*, Feb. 11, 2015, DOI: 10.1371/journal.pone.0117248. <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0117248>
- ⁴¹ Wiegler, Laurie, 2015, High incidence of dolphin deaths in Gulf of Mexico conclusively linked to BP oil, *The Examiner*, May 21. <http://www.examiner.com/article/high-incidence-of-dolphin-deaths-gulf-of-mexico-conclusively-linked-to-bp-oil-1>
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1 not stop the year of the spill, and impacts continue to ripple through the
2 ecosystem and human communities.⁴²

- 3
- 4 43. Not surprisingly, BP DWH workers also became sick with symptoms
5 characteristic of oil exposure. Nine fishermen working unprotected without
6 respirators during the initial in-situ burn operations were evacuated by helicopter
7 (Medevac) to West Jefferson Hospital with acute respiratory failure. At the
8 hospital, fishermen reported headache, upper respiratory irritation or congestion,
9 and nausea, all symptoms characteristic of oil exposure. NIOSH investigators
10 concluded the medical records did not include sufficient detail about the
11 fishermen's oil and chemical exposures to determine whether their symptoms or
12 diagnoses could have been related to oil or chemical exposure. The investigators
13 decided the incidents were likely related to heat stress.⁴³
- 14
- 15 44. Similarly, other contract workers were also not given adequate training or
16 personal protective equipment, in part because the response was not conducted
17 as a hazardous waste operation. BP's worker safety program failed for many of
18 the same reasons described for the EVOS. Government worker safety oversight
19 programs also failed for the same reasons described for the EVOS. As is evident
20 from their reports, government regulators focused on heat stress as the most
21 significant health threat to the response and response workers. Accordingly,
22 these agencies associated the most often reported symptoms as "a constellation
23 of symptoms considered as a specific indicator of heat stress," a finding repeated
24 consistently throughout their reports. However, the goal of these investigations
25 and reports was to describe acute health effects. The government agencies
26 didn't revisit the same people over months, much less years, to determine the
27 accuracy of their findings.
- 28
- 29 45. The constellation of symptoms also happens to include many of the symptoms
30 considered by Occupational and Environmental Medicine medical professionals
31 to be common characteristics of chemical illnesses. **In March 2012**, after denying
32 health claims related to the disaster (except bodily injury) for nearly two years,⁴⁴

⁴² Li, Fu Jun, et al., 2015, Heme oxygenase-1 protects Corexit 9500a-induced respiratory epithelial injury across species, *Plos One*, April 2, 2015, DOI: 10.1371/journal.pone.0122275.

<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0122275>

⁴³ U.S. Dept of Labor, Occupational Safety and Health Administration, 2011, *Deepwater Horizon Oil Spill: OSHA's Response*, May 2011. Hereafter, *OSHA's Response*, 2011.

https://www.osha.gov/oilspills/dwh_osh_response_0511a.pdf

National Institute for Occupational Safety and Health (NIOSH) and Centers for Disease Control (CDC), *Health Hazard Evaluation of [BP] Deepwater Horizon Response Workers*, prepared by Bradley King and John Gibbins, Health Hazard Evaluation Report, HETA 2010-0115 & 2010-0129-3138, Aug. 2011. <http://www.cdc.gov/niosh/hhe/reports/pdfs/2010-0115-0129-3138.pdf>

⁴⁴ Administrator of BP's Gulf Coast Claims Facility (GCCF) Ken Feinberg said "the GCCF did not pay for respiratory illnesses, skin conditions or other spill-related ailments." Quoted in Susan Buchanan, "Health claims to be considered in BP's spill settlement," *The Louisiana Weekly*, March 12, 2012. <http://www.louisianaweekly.com/health-claims-to-be-considered-in-bp-s-spill-settlement/>

1 BP agreed to a Medical Benefits Class Action Settlement that was uncapped, but
2 earmarked millions of dollars for medical treatment, medical monitoring, and
3 compensation. The negotiated and agreed upon qualifying illnesses and
4 symptoms listed in Exhibit 8 of the Medical Benefits Class Action Settlement are,
5 by design, consistent with exposure to crude oil and dispersants.⁴⁵
6

- 7 46. The BP DWH disaster was the first time that combined effects of oil and
8 dispersants on human health were studied, and the studies support the evidence
9 of harm. One study on cleanup workers exposed to oil and dispersants reported
10 that participants had significantly altered blood profiles and liver enzymes,
11 indicating higher risk for blood-related disorders, and a high prevalence of
12 somatic symptoms – headaches, shortness of breath, skin rash, cough, dizzy
13 spells, fatigue, painful joints, night sweats, and chest pain – consistent with
14 previously reported studies on major spills.⁴⁶ A study with human lung epithelial
15 cells found the water-soluble fraction of oil-dispersant mixtures (Corexit 9527A,
16 9500A, and 9580A) caused cell death in a dose-dependent manner.⁴⁷ Cell death
17 was through apoptosis, which is a genetically-directed process of cell destruction
18 activated by the presence of a stimulating agent (the oil-dispersant mixture), and
19 autophagy or controlled digestion of damaged organelles within a cell. A study
20 with human fecal microbiota found oil-dispersant (Corexit 9500) mixtures
21 decreased the abundance and diversity of the community more so than oil or
22 dispersant alone.⁴⁸ Inhalation tests with rats exposed to Corexit 9500A vapors
23 measured neural dysfunction in the brain with a potential imbalance in
24 neurotransmitter signaling⁴⁹; possible effects on breathing, also caused by brain
25 dysfunction⁵⁰; and dose-dependent increases in heart rate and blood pressure
26 with reduced peripheral vascular function.⁵¹ The latter were short-term
27 exposures, and results were transient.

⁴⁵ BP-Plaintiffs Medical Benefits Class Action Settlement Agreement, Exhibit 8: Specified Physical Conditions Matrix, Table 1: Acute SPECIFIED PHYSICAL CONDITIONS, and Table 3: Chronic SPECIFIED PHYSICAL CONDITIONS. <http://www.laed.uscourts.gov/OilSpill/6.pdf>

⁴⁶ D'Andrea, Mark and Kesava Reddy, 2013. "Health consequences among subjects involved in Gulf oil spill cleanup activities," *The American Journal of Medicine*, Vol. 126(11):966-974. <http://download.journals.elsevierhealth.com/pdfs/journals/0002-9343/PIIS0002934313004944.pdf>

⁴⁷ Wang, H., et al., 2012, Lung epithelial cell death induced by oil-dispersant mixtures, *Toxicol. in Vitro*, 26(5): 746–751. doi: 10.1016/j.tiv.2012.03.011. <http://www.ncbi.nlm.nih.gov/pubmed/22504303>

⁴⁸ Cerniglia, Carl, et al., 2012, Effects of crude oil, dispersant, and oil-dispersant mixtures on an *in vitro* culture system. *mBio* 3(5):e00376-12. doi:10.1128/mBio.00376-12.

⁴⁹ Sriram, K., et al., 2011, Neurotoxicity following acute inhalation exposure to the oil dispersant Corexit EC9500A, *J. of Toxicol. Environ. Health A: Current Issues*, 74(21):1405–18. doi: 10.1080/15287394.2011.606796. <http://www.ncbi.nlm.nih.gov/pubmed/21916746>

⁵⁰ Roberts, Jenny, et al., 2011, Pulmonary effects after acute inhalation of oil dispersant (Corexit EC9500A) in rats, *J. of Toxicol. Environ. Health A*, 74(21):1381–1396. doi: 10.1080/15287394.2011.606794. <http://www.tandfonline.com/doi/abs/10.1080/15287394.2011.606794#.VOKY9UI8o5M>

⁵¹ Krajnak, K., et al., 2011, Acute effects of Corexit EC9500A on cardiovascular functions in rats, *J. of Toxicol. Environ. Health A*, 74(21):1397–1404. doi: 10.1080/15287394.2011.606795. <http://www.ncbi.nlm.nih.gov/pubmed/21916745>

- 1
2 47. However, the symptoms were not transient for many people in harm's way. In
3 **April 2013**, the Government Accountability Project (GAP) released its
4 investigative report on BP DWH health impacts to workers and the general
5 public. Ninety-five percent of the witnesses in GAP's investigation reported that
6 they continued to experience spill-related health problems, and more than 50%
7 living in affected areas reported that their children and/or grandchildren's health
8 had deteriorated. Severe lingering health effects included: abdominal pain; blood
9 in urine; heart palpitations; hyper-allergic reactions to processed food and
10 common household cleaning or petroleum based products; hypertension; inability
11 to withstand exposure to sun; kidney damage; liver damage; migraines; multiple
12 chemical sensitivity; neurological damage resulting in memory loss and in some
13 cases IQ drop; rapid weight loss; respiratory system and nervous system
14 damage; seizures; skin irritation, burning and lesions; sudden inability to move or
15 speak for sustained periods; temporary paralysis; and vomiting episodes.⁵²
16
- 17 48. **In April 2015**, GAP released new findings from its ongoing investigation and
18 reported, "the overwhelming majority of original and new witnesses continue to
19 experience adverse health impacts associated with dispersant and oil exposure.
20 The phenomenon has been coined the 'BP Syndrome' or 'Gulf Coast
21 Syndrome'." Symptoms remain consistent with initial reports and also now
22 include but are not limited to blood in urine and rectal bleeding; hyper-allergies to
23 processed foods; violent vomiting episodes that last for hours and result in rapid
24 weight loss; weakness and fatigue, at times leading to depression; migraines;
25 abdominal pain attacks; skin irritation, burning and widespread lesions; rashes;
26 inability to withstand exposure to sun; Multiple Chemical Sensitivity, resulting in
27 new sensitivities to everyday household cleaning products or petroleum based
28 products (plastic water bottles); impotence; heart palpitations; and hypertension.
29 Further, "witnesses have begun reporting long-term health effects, including
30 reproductive damage (such as genetic mutations), endocrine disruption, and
31 cancer."⁵³

32 **3.0 Impacts to Public Health from Oil Spills**

33 **3.1 Reports from the BP DWH Disaster**

⁵² Ott, Riki, and Shanna Devine, 2014, Presentation to the Office of Management & Budget on Sept. 24, 2014, by the Coalition to Ban Toxic Dispersants and the Government Accountability Project, Washington, DC. <http://www.reginfo.gov/public/do/viewEO12866Meeting?viewRule=false&rin=2050-AE87&meetingId=578&acronym=2050-EPA/SWER>

⁵³ Government Accountability Project, Devine, Shanna, and Tom Devine, 2015, Addendum Report to "Deadly Dispersants in the Gulf: Are Public Health and Environmental Tragedies the New Norm for Oil Spill Cleanups?" Apr 22, 2015.

- 1 49. After the BP DWH oil-dispersant disaster, scientists found oil and oil-dispersant
2 droplets aerosolized daily and became part of the Gulf hydrologic cycle.⁵⁴ Gulf
3 coast residents and media documented BP's oily sheen on the leading edges of
4 airplanes after flying over the Gulf,⁵⁵ in puddles on door stoops after rain, on
5 hotel beach furniture, and in outdoor swimming pools,⁵⁶ shallow bayous, bays,
6 and coastal seas.⁵⁷ As Venice, Louisiana, resident Kindra Arneson observed in
7 the documentary film, *Dirty Energy*, "This sh-t was everywhere!"
8
- 9 50. Regarding onshore deposition, studies reported that tarry masses of BP crude oil
10 and Corexit dispersants: (1) are remobilized by high energy storms and
11 redistribute, collecting near shore in runnels accessible by beach-goers who are
12 wading and swimming⁵⁸; (2) have "PAH concentrations consistently in excess of
13 the IDLH (Immediately Dangerous to Life or Health) limits (80 mg/m3)," ⁵⁹ as
14 stated by NIOSH and OSHA⁶⁰; (3) increase the penetration or downward
15 migration of highly toxic PAHs into beach subsurface sediments, risking
16 groundwater contamination⁶¹; (4) create a discernible fluorescent signature when
17 illuminated by 370 nm UV light,⁶² indicating presence of dispersed oil and
18 dispersant even on beaches that appeared clean and safe under natural light
19 conditions⁶³; (5) behave as an absorption accelerant upon contact with *wet*
20 human skin, facilitating far more efficient dermal absorption of oil; in these tests,
21 presence of oil and dispersant on human skin was demonstrated with ultraviolet
22 light, which was *not visible under natural light conditions*,⁶⁴ and (7) are toxic to
23 the two main species of bacteria known to biodegrade crude oil *in situ*.⁶⁵ White

⁵⁴ "Oil Rain" Confirmed by NASA chief mission scientist: Clouds from Gulf did "rain oil" on land (video), Feb. 21, 2011. <http://www.floridaoilspilllaw.com/oil-rain-confirmed-nasa-chief-mission-scientist-clouds-gulf-rain-oil-land-video/>

⁵⁵ Wathen, John, Hurricane Creekkeeper, July 22, 2010 VIDEO.

<http://bpoilslick.blogspot.com/2010/07/breathing-toxic-oil-vapors.html>

⁵⁶ Florida Oil Spill Law, 2010, EXCLUSIVE: Tests find sickened family.

<http://www.floridaoilspilllaw.com/exclusive-tests-find-sickened-family-has-50-3-ppm-of-corexits-2-butoxyethanol-in-swimming-pool-just-one-hour-north-of-tampa-lab-report-included/>

⁵⁷ News 5 2010, Testing the water. http://www2.wkrg.com/special_section/2010/jul/17/news-5-investigates-testing-the-water-ar-2121731/

⁵⁸ James "Rip" Kirby, III, "Findings of Persistency of Polycyclic Aromatic Hydrocarbons in Residual Tar Product Sourced from Crude Oil Released during the Deepwater Horizon MC252 Spill of National Significance," supported by the Surfrider Foundation, April 14, 2012, http://surfrider.org/images/uploads/publications/Corexit_Connections.pdf

⁵⁹ *Ibid.*, Kirby, Persistent PAHs.

⁶⁰ NIOSH Pocket Guide To Chemical Hazards; DHHS (NIOSH) Publication No. 2005-149; Sept 2007.

⁶¹ *Ibid.* Kirby, Persistent PAHs.

⁶² See Kirby, Persistent PAHs.

⁶³ Photos at <http://www.tampabay.com/blogs/alleyes/2010/06/gulf-oil-disaster-pensacola-beach.html>. See also <http://news.nationalgeographic.com/news/2010/07/photogalleries/100708-environment-science-gulf-oil-spill-glowing-ultraviolet-pictures/>

⁶⁴ *Ibid.*, Kirby, Persistent PAHs, see esp. Figures 6 and 7, p. 16.

⁶⁵ Leila Hamdan and Preston Fulmer, "Effects of COREXIT® EC9500A on bacteria from a beach oiled by the Deepwater Horizon spill," *Aquatic Microbial Ecology*, 2011; 63:101-109.

1 sand beaches that appeared clean under daylight would fluoresce at night,
2 indicating presence of microscopic oil-dispersant droplets bound to sand grains.

- 3
- 4 51. According to the Government Accountability Project, BP and the government did
5 not warn residents and visitors of the health risks of oil-dispersant exposure, and
6 instead asserted that Corexit was low in toxicity and routinely compared
7 dispersants to Dawn dishwasher soap.⁶⁶
- 8
- 9 52. Coastal residents, BP spill response workers, filmmakers, writers, media,
10 fishermen, tourists, and others also reported or documented adverse short-term
11 health impacts. This consistently included the major symptoms characteristic of
12 exposure to oil spills: respiratory symptoms, central nervous system issues
13 (headaches, vertigo, dizziness, tingling extremities, nausea, and fatigue), skin
14 rashes and irritations, and eye issues (blurred vision). In addition, other
15 symptoms were widely reported, including bleeding from nose and ears; blood in
16 urine, stool, and vomit; blisters in the throat and reoccurring MRSA-like skin
17 lesions; seizures; hair loss; and more.⁶⁷
- 18
- 19 53. Corexit 9527A was sprayed in coastal waters as well as subsea at the broken
20 wellhead.⁶⁸ The MSDS (Material Safety Data Sheet) for Corexit 9527A warns that
21 repeated or excessive exposure to 2-butoxyethanol may cause injury to red
22 blood cells (through hemolysis or rupturing), the kidney, or liver.⁶⁹ Unprecedented
23 high levels of oil compounds were reported in the blood of coastal residents
24 during summer and fall of 2010.⁷⁰ A health and economic survey conducted in
25 south Louisiana after the BP well was capped in July 2010 reported “almost
26 three-quarters of respondents who believed they were exposed to crude oil or

⁶⁶ Devine, Shanna and Tom Devine, Government Accountability Project, 2013. Deadly Dispersants in the Gulf: Are Public Health and Environmental Tragedies the New Norm for Oil Spill Cleanups?

<http://www.whistleblower.org/gulftruth>

⁶⁷ Griffith, Shawn, executive producer, *Beyond Pollution*, 2012.

Hopkins, Bryon, producer, *Dirty Energy*, 2012.

Jamail, Dahr, BP blamed for ongoing health problems, *Aljazeera English*, April 20, 2012.

<http://www.aljazeera.com/indepth/features/2012/04/2012420725163795.html>

Juhasz, Antonia, *Black Tide: the Devastating Impact of the Gulf Oil Spill* (Wiley, April 2011).

Ott, Riki, “Bio-remediation or bio-hazard? Dispersants, bacteria, and illness in the Gulf,” Sept. 17, 2010.

http://www.huffingtonpost.com/riki-ott/oil-spill-illness_b_873582.html

Tickell, Josh and Rebecca, producers, *The Big Fix*, 2011.

List is not exhaustive.

⁶⁸ Ott, Riki, 2010, An open letter to US EPA Region 6. Aug. 27, 2010. http://www.huffingtonpost.com/riki-ott/an-open-letter-to-us-epa_b_697376.html

Devine, Shanna and Tom Devine, Government Accountability Project (GAP), 2013, *Deadly Dispersants in the Gulf: Are Public Health and Environmental Tragedies the New Norm for Oil Spill Cleanups?* April 19, 2013. Part 5, Don and Shirley Tillman, affidavit, June 14, 2012. <http://whistleblower.org/gulftruth>

⁶⁹ NALCO Environmental Solutions, LLC, 2012, Safety Data Sheet for Corexit EC9500A.

⁷⁰ Wilma Subra, “BP spill blood test results – Louisiana residents: Evaluation of the test results of whole blood volatile solvents testing,” Jan. 5, 2011. <http://leanweb.org/our-work/community/public-health/bp-spill-blood-test-results-louisiana-residents>

1 dispersant also reported experiencing symptoms. Additionally, nearly half of all
2 respondents reported an unusual increase in health symptoms consistent with
3 chemical exposure.”⁷¹
4

- 5 54. Studies have reported that 40 percent or more of residents and workers directly
6 exposed to crude oil and dispersants in the environment reported symptoms
7 characteristic of oil exposure, that children were especially vulnerable, and that
8 oil-dispersants combined were far more toxic to humans than oil alone.⁷²
9
- 10 55. Current evidence supports the conclusion that people exposed to low levels of oil
11 and oil-based solvents like dispersants, diluents, and fracking fluids over longer
12 durations of time may experience the same symptoms and illnesses of workers
13 exposed to higher levels of shorter durations, and this knowledge is becoming
14 more widespread in the fields of Occupational and Environmental Medicine
15 (OEM) health care and research. However, OEM and treatment for industrial oil
16 and chemical exposures remains a specialty field outside the knowledge of most
17 general healthcare practitioners. The public at large remains largely uninformed

⁷¹ Louisiana Bucket Brigade, *Self-Reported Health and Economic Impact Survey: An Analysis of the Deepwater Horizon Oil Disaster in Seven Coastal Louisiana Communities*, March 3, 2011.
http://www.labucketbrigade.org/downloads/2010_HEStudy_SummaryFINAL_1.pdf

⁷² Abramson, David, et al., 2013. “Children’s Health after the Oil Spill: A Four-State Study. Findings from the Gulf Coast Population Impact (GCPI) Project.” National Center for Disaster Preparedness, NCDP Briefing Report 2013_1. Columbia University Mailman School of Public Health, New York.
<http://academiccommons.columbia.edu/item/ac:156715>

GAP 2013, *Deadly Dispersants*. <http://whistleblower.org/gulftruth>

Jamail, Dahr, “BP’s ‘widespread human health crisis’, *Aljazeera English*, Oct. 27, 2013.

<http://www.aljazeera.com/indepth/features/2013/10/bp-widespread-human-health-crisis-2013102717831227732.html>

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<http://www.whistleblower.org/program-areas/public-health/corexit>

Riles, Eric, 2010, Health effects related to the sinking of the [BP] *Deepwater Horizon* oil rig, *Medicine at Michigan, fall 2010, vol 12(3)*

Subra, Wilma, 2011, Results of Health Survey of Individuals in Mississippi Impacted by the BP *Deepwater Horizon* Oil Disaster, Environmental Pollutants Released by Industrial Facilities in Southeast Mississippi, Subra Company/Louisiana Environmental Action Network.

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Young, Jeff, 2011, “Toxic Tide – Discovering the Health Effects of the [BP] *Deepwater* Disaster (sic),” Part 1, NPR Living on Earth, week of Feb. 11, 2011.

<http://www.loe.org/shows/segments.html?programID=11-P13-00007&segmentID=3>

Young, Jeff, 2011, “Toxic Tide – Discovering the Health Effects of the [BP] *Deepwater* Disaster (sic),” Part 2, week of Feb. 21, 2011. Including segment on oil rain confirmed by scientist: Clouds from Gulf did “rain oil” on land (video). <http://www.loe.org/shows/segments.html?programID=11-P13-00007&segmentID=3>

1 about the health risks from oil exposures and so is unprepared to protect itself
2 during oil spills and oil spills-turned-chemical disasters by wide-scale, extended
3 use of petrochemical agents. In South Korea, scientists who studied human
4 health impacts from the *Hebei Spirit* oil spill devised a quantifiable metric for the
5 diminished quality of life from oil spill exposure: “years lived with disability” (YLD)
6 due to an oil spill.⁷³

- 7
8 56. Besides direct exposure via inhalation or skin contact, another route of exposure
9 is ingestion of contaminated seafood. Fisheries opened in oil-impacted areas of
10 the Gulf of Mexico resulted in oiling of nets and boats and in potentially
11 dangerous harvests of contaminated seafood,⁷⁴ some of which made it all the
12 way to markets and restaurants. Instead of acting to protect consumers, the U.S.
13 Food and Drug Administration lowered its cancer risk standard by allowing three
14 and four times more toxic PAHs in Gulf shrimp and crabs, respectively, than
15 allowed in West Coast seafood.⁷⁵ The lower standard of protection thoroughly
16 alarmed Gulf fishermen, who were liable for harvests of potentially contaminated
17 seafood.⁷⁶ Further, it put all Gulf residents at a higher risk of health issues from
18 consumption of contaminated seafood, especially in light of the fact that Gulf
19 residents consume three to twelve times more seafood than the estimates used
20 in FDA’s health risk assessment calculations.

21 22 **3.2 Reports from Dilbit Disasters in the U.S.**

- 23 57. The physical properties of Alberta and other tar sands oil are different than
24 conventional crude oil. Tar sands oil is normal crude oil that has lost much of the
25 lighter hydrocarbons and gases over time and, further, that has been exposed *in*
26 *situ* underground to oleophilic or oil-eating microbes, which have consumed most
27 of the bioavailable hydrocarbons. According to chemist Jeff Short, tar sands oil is
28 “pre-weathered.”⁷⁷ Because tar sands oil is denser and more viscous than
29 conventional crude oil, it submerges or sinks in both fresh and salt water.
30 According to the International Spill Control Organization, “Sinking oils (Group V
31 Class C/D) including oil sands, Dilbit, Bitumen, Lamp Black, and other non-

⁷³ Kim, Young-Min, et al., 2013, Burden of disease attributable to the Hebei Spirit oil spill in Taean, Korea, *BMJ Open*, Sept 20, 2013; 3(9):e003334. <http://www.ncbi.nlm.nih.gov/pubmed/24056482>

⁷⁴ Jamail, Dahr, “Gulf seafood deformities alarm scientists,” *Aljazeera English*, April 20, 2012. <http://www.aljazeera.com/indepth/features/2012/04/201241682318260912.html>

Jamail, Dahr, “Gulf ecosystem in crisis after BP spill,” *Aljazeera English*, Oct. 20, 2013. <http://www.opednews.com/articles/Gulf-ecosystem-in-crisis-a-by-Dahr-Jamail-Corporation-BP-Ecosystems-Gulf-Oil-Spill-Disaster-Gulf-Shrimping-Industry-131020-15.html>

⁷⁵ Flynn, Dan, 2010, FDA lowers the bar for Gulf seafood safety, *Food Safety News*, Sept. 8, 2010.

<http://www.foodsafetynews.com/2010/09/fda-raised-the-bar-for-gulf-seafood-safety/#.VOAG8kl8o5M>

⁷⁶ Hopkins, Bryon, producer, 2012, *Dirty Energy*, The Deepwater Horizon Disaster: First-hand Stories from the Louisiana Bayou. <http://dirtyenergymovie.com>

⁷⁷ Short, Jeff, 2015, Fate and effect of oil spills from the Trans Mountain Expansion Project in Burrard Inlet and the Fraser River estuary, prepared for Tsleil-Waututh Nation, City of Vancouver, and Living Oceans Society. May 11. <http://vancouver.ca/green-vancouver/neb-evidence-libr ary.aspx>

1 buoyant oils have a specific gravity of [greater than] 1.0, which is heavier than
2 water and, if spilt (sic), will submerge or sink in water" (emphasis added).⁷⁸
3

- 4 58. Tar sands oil is also so dense and viscous that it must be diluted with refined
5 low-weight petroleum products before it can be shipped through pipelines.⁷⁹ The
6 industrial solvents used to dilute tar sands oil are typically either raw gas
7 condensate, essentially gasoline, creating "dilbit," or synthetic crude oil, produced
8 by refining tar sands oil, creating "synbit." A typical blend is 70 percent tar sands
9 oil and 30 percent solvent and is slightly less dense than water; i.e., it floats.
10
- 11 59. However, the blended product of tar sands oil and solvent also behaves
12 differently than conventional crude oil when spilled. The solvents, by nature, are
13 extremely volatile, and they evaporate quickly as VOCs (Volatile Organic
14 Compounds) and dissolve quickly into the water column as WSF (Water Soluble
15 Fraction). Once separated, the remaining mixture of mostly tar sands oil sinks.
16
- 17 60. Thus, the solvent-blended tar sands oil product is concentrated in PAHs and the
18 volatile light ends consisting of benzene, ethyl benzene, toluene, and xylene
19 (BETX) compounds. These are some of the most deadly hydrocarbons to
20 humans and environment. For example, according to the Material Safety Data
21 Sheet for Wabasca heavy crude (tar sands) oil that spilled in Arkansas,
22 "exposure to benzene is associated with cancer (acute myeloid leukemia and
23 myelodysplastic syndrome), damage to the blood producing system, and serious
24 blood disorders."⁸⁰
- 25 61. The health impacts to humans and the environment from exposure to PAHs and
26 spills of conventional oil were discussed in Section 2. Refined petrochemical-
27 based solvents are also well known as human health hazards.⁸¹ As discussed in
28 Section 2, the same properties that facilitate the movement of refined petroleum-
29 based solvents through oil also facilitate their movement into the bodies of
30 humans and other organisms.
- 31 62. Not surprisingly, people exposed to spills of blended Alberta tar sands oil and
32 solvents in Michigan and Arkansas, where I have personal experience, reported
33 symptoms characteristic of exposure to crude oil and/or oil-based solvents,

⁷⁸ International Spill Control Organization, 2014, Press Release – International Forum on Group V (Non-buoyant) Oils, Sept. 9–10, Detroit, Michigan. <http://www.spillcontrol.org/isco-what-s-new/276-press-release-international-forum-on-group-v-non-buoyant-oils>

⁷⁹ Song, Lisa, 2012, A Dilbit Primer: How it is different from conventional oil, Inside Climate News, June 26. <http://insideclimatenews.org/news/20120626/dilbit-primer-diluted-bitumen-conventional-oil-tar-sands-Alberta-Kalamazoo-Keystone-XL-Enbridge>

⁸⁰ ExxonMobil, 2013, Material Safety Data Sheet for Wabasca heavy crude oil. http://www.phmsa.dot.gov/pv_obj_cache/pv_obj_id_1EC8974C6F8F923D1CA7FD43F341C9227F5B7600/filename/ExxonMobil_MSDS_Sheet_for_Wabasca_Crude_Oil.pdf

⁸¹ Schlettler, Ted, Gina Solomon, Maria Valenti, and Annette Huddle, 1999, *Generations at Risk: Reproductive Health and the Environment* (MIT Press).

1 similar to the symptoms reported during the BP DWH and other oil disasters.
2 Studies on human health impacts of UOG have found increased cancer rates,
3 prenatal developmental problems, and a range of cardiovascular, dermal,
4 gastrointestinal, neurological, ocular, renal, and respiratory impacts.⁸²
5

- 6 63. In July 2010 the Enbridge Lakehead Pipeline 6B ruptured, spilling at least
7 800,000 gallons of blended Alberta tar sands oil and solvent (dilbit) into Battle
8 Creek, Michigan. This was the largest non-maritime release of oil in the U.S. The
9 oil separated, as anticipated, into two fractions; the light ends evaporated while
10 the remaining mixture of mostly tar sands oil sunk. Predictably, traditional spill
11 response tools for conventional oil that floats captured only a portion of the
12 spilled oil. The U.S. National Transportation Safety Board likened Enbridge's
13 failed response efforts to a Keystone Kops charade. Residents were not informed
14 for several weeks that the spilled crude was actually diluted tar sands oil.
15 Response efforts continued for over three years and included several attempts to
16 dredge the riverbed of submerged oil. As of December 2013, EPA estimated over
17 180,000 gallons of submerged oil still remain in the river.⁸³ Residents have even
18 found Enbridge's oil incorporated into tufa rock formations that when broken
19 apart – like when stepped on by recreational swimmers or boaters – release the
20 oil into the water.⁸⁴ The response is the most expensive oil spill cleanup on
21 record – \$1,185 per gallon.⁸⁵

-
- ⁸² Bailey, Diane and Danielle Droitsch, 2014, Tar sands crude oil: Health effects of a dirty and destructive fuel, NRDC. <http://www.nrdc.org/energy/tar-sands-health-effects.asp>
Colburn, Theo, The Endocrine Disruption Exchange: health effects of chemicals in natural gas operations <http://endocrinedisruption.org/chemicals-in-natural-gas-operations/chemicals-and-health>
Faulkner County Citizens Advisory Group, 2013, Independent air tests at Mayflower Hill, a report. <http://www.gcmonitor.org/article.php?id=1672>
Huffling, Katie, 2014, "Susceptibility During Pregnancy: What You Need to Know," Alliance of Nurses for Healthy Environments, webinar hosted by the Center for Environmental Health on May 5, 2014. <http://www.ceh.org/news-events/events/content/fracking-maternal-health-what-it-means-for-your-family/>
Kwiatkowski, Carol, 2014, "Natural Gas Development, Public Health, and Protecting the Most Vulnerable Populations," The Endocrine Disruption Exchange, webinar hosted by the Center for Environmental Health on April 21, 2014. [http://www.ceh.org/news-events/events/content/fracking-maternal-health-what-it-means-for-your-family/The Endocrine Disruptor Exchange maintains a publicly available database, papers, lectures, and other material on the potential health effects of chemicals used during natural gas operations, including fracking. <http://endocrinedisruption.org/chemicals-in-natural-gas-operations/chemicals-and-health>
Paulson, Jerome, 2014, "Unconventional Natural Gas Extraction and Special Vulnerabilities for Children," webinar hosted by the Center for Environmental Health on April 21, 2014. <http://www.ceh.org/news-events/events/content/fracking-maternal-health-what-it-means-for-your-family/>
Tenenbaum, David, 2009, Oil Sands Development: A Health Risk Worth Taking? *Environ Health Perspect.* Apr 2009; 117\(4\): A150–A156. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2679626/>
⁸³ Hasemyer, David, 2013, Enbridge dilbit spill still not cleaned up as 2013 closes, irritating the EPA, *InsideClimate News*, Dec. 23. <http://insideclimatenews.org/news/20131223/enbridge-dilbit-spill-still-not-cleaned-2013-closes-irritating-epa>
⁸⁴ Nikiforuk, Andrew, 2013, Michigan's mysterious tar-like rocks, *The Tyee*, Dec. 16, 2013. <http://thetyee.ca/News/2013/12/16/Michigan-Tar-Rocks/>](http://www.ceh.org/news-events/events/content/fracking-maternal-health-what-it-means-for-your-family/The%20Endocrine%20Disruptor%20Exchange%20maintains%20a%20publicly%20available%20database,%20papers,%20lectures,%20and%20other%20material%20on%20the%20potential%20health%20effects%20of%20chemicals%20used%20during%20natural%20gas%20operations,%20including%20fracking.%20http://endocrinedisruption.org/chemicals-in-natural-gas-operations/chemicals-and-health)

- 1
2 64. While state officials estimate it will be 2018 before the full environmental damage
3 assessment from the oil spill is tallied,⁸⁶ the spill's effects on humans may never
4 be fully tallied or reconciled. But there were impacts to human health. The
5 Michigan Department of Community Health conducted several surveys between
6 11 to 24 days after the spill. The health care provider survey found 96 percent of
7 nearby residents were experiencing minor (31 percent) to moderate (65 percent)
8 "medical outcomes", based on number of self-reported symptoms. Similarly, four
9 community health surveys identified 320 individuals of 550 or 58 percent had
10 adverse health symptoms. Neurological symptoms (headache) were most
11 prevalent, followed by gastrointestinal issues such as nausea and vomiting,
12 difficulty breathing/ respiratory problems, and a host of other problems including
13 cardiovascular problems, skin rashes, and blurry vision, among others.⁸⁷
14
15 65. After documenting a significant prevalence of acute symptoms, the state health
16 department failed to conduct a long-term health survey, claiming the decision
17 was due to cost considerations. The state officials told CTV British Columbia they
18 had concluded that the oil remaining in the Kalamazoo River "will not result in
19 long-lasting health effects" or a "higher than normal risk of cancer."⁸⁸ Simply
20 saying so does not make it so; absence of data is not the same as absence of
21 long-term health issues.
22
23 66. In 2011 one year after the Enbridge pipeline spill, people were still sick. People
24 described many of the same symptoms – only now worsening – that they had
25 experienced after they first noticed the foul smelling air from the spill. At
26 community gatherings that I attended, and as reported by investigative media,
27 people described ongoing neurological symptoms such as migraine headaches,
28 brain fog, disorientation, persistent sore throat and cough, burning eyes, immune
29 suppression ("getting sick all of the time"), an on-again-off-again skin rashes
30 especially in children, trouble breathing, chemical sensitivities, and more. These
31 are all consistent with long-term chemical illnesses stemming from oil exposure –

Nikiforuk, Andrew, 2013, Mystery of Michigan tar rocks solved?, *The Tyee*, Dec. 17, 2013.

<http://thetyee.ca/News/2013/12/17/Michigan-Tar-Rocks/>

⁸⁵ Linnitt, Carol, 2014, Official price of the Enbridge Kalamazoo spill, a whopping \$1,039,000,000, *DesmogCanada*, August 26. <http://desmog.ca/2013/08/26/official-price-enbridge-kalamazoo-spill-whopping-1-039-000-000>

⁸⁶ Hasemyer, 2013, Enbridge dilbit spill still not cleaned up as 2013 closes...

⁸⁷ Stanbury, Martha, et al., 2010, Acute Health Effects of the Enbridge Oil Spill, Michigan Dept. of Community Health, rev. Dec. 20, 2010.

http://www.michigan.gov/documents/mdch/enbridge_oil_spill_epi_report_with_cover_11_22_10_3391_01_7.pdf

⁸⁸ CTV British Columbia, 2012, Experts fear long-term health impact of Michigan spill, Aug. 15.

<http://bc.ctvnews.ca/experts-fear-long-term-health-impact-of-michigan-spill-1.915380>

1 and what would be expected based on the Michigan Dept. of Community
2 Health's initial surveys and conclusions.⁸⁹
3

- 4 67. Besides affecting the health and lives of hundreds of residents, the Alberta tar
5 sands oil spill in Michigan also displaced residents. According to a report by the
6 Cornell University Global Labor Institute, "Following the spill, Enbridge developed
7 a home buyout program for residents living directly along Talmadge Creek and
8 the Kalamazoo River. The home purchasing program was offered to people
9 whose properties were located in an area identified as the "red zone," or within
10 200 feet of the affected waterways. About 200 homes were identified for this
11 program, which expired one year after the spill. Enbridge purchased at least 130
12 homes (in two communities)... However, the majority of homes in those two
13 communities are located more than 200 feet from the river and generally these
14 homes were not included in the home buyout program. Unless they also served
15 as a residence, commercial and industrial properties along the river were also
16 excluded."⁹⁰
17
- 18 68. Enbridge's home buyout program did not include rental properties. For example,
19 residents of Baker Estates Trailer Park, located 200–300 feet from the oiled river
20 in Battle Creek, Michigan, suffered characteristic symptoms of oil exposure.
21 These low-income residents were not part of any state survey, and had to pay for
22 their own health care – or go without. In the five years since the spill, 18
23 residents have died – many believe from spill-related health issues – and others
24 have moved away.⁹¹
25
- 26 69. There was also no compensation for nuisance and disturbance of private
27 property during spill response operations. For example, Ceresco resident Debra
28 Miller owned a small carpet business near the Ceresco dam about four miles
29 from the spill source. The dam became a collection site for pooled oil. According
30 to the Cornell report, "In the months immediately following the spill, workers
31 required regular access of Miller's property in order to conduct cleanup
32 operations. Miller said that more than 100 cleanup workers came onto her
33 property with trucks and equipment, blocking the roads and preventing public
34 access to both her office and her warehouse. The business was also closed for
35 13 weeks to facilitate cleanup efforts."⁹² Her business profits decreased by 35
36 percent the year of the spill and eventually closed. She relocated due to spill-
37 related health issues.

⁸⁹ Jamail, Dahr, 2011, The pipeline of 'poison'. *Al Jazeera English*, Oct. 17.

<http://www.aljazeera.com/indepth/features/2011/10/2011101151776808.html>

⁹⁰ Skinner, Lara and Sean Sweeney, 2012, The Impact of Tar Sands Pipeline Spills on Employment and the Economy, a report by Cornell University Global Labor Institute.

https://www.ilr.cornell.edu/sites/ilr.cornell.edu/files/GLI_Impact-of-Tar-Sands-Pipeline-Spills.pdf

⁹¹ BarlundSmith, Michelle, former resident of Baker Estates Trailer Park, Battle Creek, Michigan, personal communication with Riki Ott between 2011 and 2015.

⁹² Skinner and Sweeney, 2012 Cornell report.

- 1
2 70. Children and developing fetuses are especially vulnerable to oil and
3 petrochemical exposures.⁹³ Oil contains endocrine disrupters, neurotoxins,
4 teratogens that disturb the growth and development of fetuses, power
5 carcinogens and mutagens, and more. Published reports stated that day care
6 and elementary school children in Kalamazoo, Michigan, and Mayflower,
7 Arkansas, became ill with symptoms characteristic of oil exposure – headaches,
8 nausea, and vomiting – after the Alberta tar sands-solvent spills in both Michigan
9 and Arkansas.⁹⁴
- 10
11 71. In April 2013 the ExxonMobil’s Pegasus Pipeline ruptured, spilling over 500,000
12 gallons of blended Alberta tar sands oil and solvent (dilbit)⁹⁵ into a subdivision of
13 a Mayflower, Arkansas, neighborhood. Within 45 minutes, the spill spread
14 through the Northwoods subdivision, flowing across lawns and down the street
15 into storm drains. Quick, creative action by first responders prevented the oil from
16 entering Lake Conway, a source of local drinking water.⁹⁶ Unfortunately, oily
17 wastewater was pumped into a nearby wetland.⁹⁷

⁹³ Jung, Suk-Chul, et al., 2013, Respiratory effects of the Hebei Spirit oil spill on children in Taean, Korea, *Allergy Asthma Immunol Res.* 2013 Nov; 5(6):365–370. Doi:

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3810542/>

Sook, Hyun, et al., 2013, Mothers and children’s environmental health study in *Hebei Spirit* oil spill, <http://ehp.niehs.nih.gov/isee/p-3-27-19/>

Kim, Young-Min, et al., 2013, Burden of disease attributable to the *Hebei Spirit* oil spill in Taean, Korea, *BMJ Open*, Sept 20, 2013; 3(9):e003334. <http://www.ncbi.nlm.nih.gov/pubmed/24056482>

Mohan, Geoffrey, 2015, Air pollution takes a double toll on babies’ brains, *Los Angeles Times*, March 25, 2015. <http://www.latimes.com/science/sciencenow/la-sci-sn-air-pollution-baby-brains-20150324-story.html>

Peterson, Bradley, et al., 2015, Effects of prenatal exposure to air pollutants (polycyclic aromatic hydrocarbons) on the development of white brain matter, cognition, and behavior in later childhood, *JAMA Psychiatry*, March 25, 2015. doi:10.1001/jamapsychiatry.2015.57.

<http://archpsyc.jamanetwork.com/article.aspx?articleid=2205842>

⁹⁴ Connally, Susan, 2011, resident of Kalamazoo, Michigan, personal communication with Riki Ott.

BarlondSmith, Michelle, 2011, former resident of Battle Creek, Michigan, personal communication with Riki Ott.

Harris, Emily, MPH, 2013, former resident of Mayflower, Arkansas, personal communication with Riki Ott.

McAllister, Edward, Insight: Mayflower, meet Exxon: When oil spilled in an Arkansas town, Apr 11, 2013, *Reuters*, <http://www.reuters.com/article/2013/04/11/us-exxon-spill-mayflower-insight-idUSBRE93A0PI20130411>

Brune, Michael, 2010, We are the Kalamazoo, *Huffington Post*, July 20, 2012.

http://www.huffingtonpost.com/michael-brune/kalamazoo-river-oil-spill_b_1691045.html

⁹⁵ Lennard, Natasha, 2013, Arkansas Exxon spill much larger than initially thought, *Salon.com*, April 11.

http://www.salon.com/2013/04/11/arkansas_exxon_spill_much_larger_than_initially_thought/

⁹⁶ Caplan-Bricker, Nora, 2013, This is what happens when a pipeline bursts in your town, *The New Republic*, Nov. 18. <http://www.newrepublic.com/article/115624/exxon-oil-spill-arkansas-2013-how-pipeline-burst-mayflower>

⁹⁷ Jervey, Ben, 2013, Everything you need to know about the Exxon Pegasus tar sands spill, April 1. See also EPA photos at end of article, followed by a video by AJ Zoltan, showing the wetland dumping grounds. <http://www.desmogblog.com/2013/04/01/everything-you-need-know-about-exxon-pegasus-tar-sands-spill>

- 1
2 72. While local emergency responders evacuated 22 homes in the Northwoods
3 subdivision for residents who had oil in their lawns and streets,⁹⁸ residents in
4 adjacent subdivisions, whose homes were closer to the rupture site than any of
5 the evacuated homes, were told that pipeline contents were “harmless.”⁹⁹ A
6 Mayflower police officer told one such resident that if she couldn’t see the oil on
7 her property, she would be fine. According to Dr. Wilma Subra, local authorities
8 (and most residents) didn’t know that the Pegasus pipeline was there or what it
9 was carrying.¹⁰⁰
10
11 73. According to Emily Harris, M.P.H., a former resident of Mayflower and a former
12 volunteer firefighter, local businesses at a shopping center stayed open in the
13 midst of spill response activities, while, directly across the street from the
14 shopping center, the Mayflower Health Clinic that was operated by the local
15 hospital closed due to the spill.
16
17 74. In an April 19, 2013, newsletter to the community, ExxonMobil stated, “... the
18 Arkansas Department of Health has indicated there should be no impact on the
19 health of Northwoods neighborhood residents... For more than two weeks, data
20 from air monitors in the Mayflower community have shown levels that are either
21 non-detect or below the action levels established by the ADH.”¹⁰¹
22
23 75. However, Harris and other members of the Faulkner County Citizens’ Advisory
24 Group, a nonprofit organization, were trained and equipped by Global
25 Community Monitor to do air monitoring. Samples collected by the Faulkner
26 County Bucket Brigade were analyzed for over 30 hazardous air pollutants, using
27 EPA approved protocols. Their independent study found a number of dangerous
28 chemicals at very dangerous levels, including the BETX compounds, and n-
29 hexane, a neurotoxin.¹⁰²
30
31 76. Not surprisingly, residents in the contaminated neighborhoods experienced a
32 host of symptoms characteristic of crude oil exposure and consistent with the
33 MSDS for Wabasca tar sands oil, including respiratory distress, throbbing
34 headaches, brain fog and cognitive dysfunction, seizure-like events, nausea,

⁹⁸ CBS/AP, 2013, Homes evacuated after ExxonMobil oil pipeline spill in Arkansas, Mar. 31.

<http://www.cbsnews.com/news/homes-evacuated-after-exxonmobil-oil-pipeline-spill-in-arkansas/>

⁹⁹ Harris, Emily, M.P.H., 2015, presentation for ALERT webinar, What’s the Plan? Spill Voices Calling for Stronger Oil Spill Response, April 8. www.alertproject.org.

¹⁰⁰ Caplan-Bricker, 2013, This is what happens...

¹⁰¹ ExxonMobil Pipeline, 2013, Newsletter to the Mayflower community, April 19.

http://www.exxonmobil.com/USA-English/EMPCo/Files/EMPCo/news_mayflower_newsletter_041913.pdf

¹⁰² Horn, Steve, 2013, Study reveals 30 toxic chemicals at high levels at Exxon Arkansas tar sands pipeline spill site, *DeSmogBlog*, Apr. 29. <http://www.desmogblog.com/directory/vocabulary/12519>

1 vomiting, fatigue, nosebleeds, bowel issues, and skin rashes, among other
2 issues.

- 3
- 4 77. Instead of conducting a comprehensive community health assessment as
5 requested by the Faulkner County Citizens' Advisory Group, the Arkansas Dept.
6 of Health implemented an individual health assessment with no report on
7 outcomes. ADH encouraged individuals to seek health care if they felt they
8 needed it, although there was no mechanism for payment or referral. Data on
9 workers' injuries and illnesses were kept secret although there are numerous
10 public photos showing workers without respirators or other protective equipment.
11
- 12 78. Faulkner County Citizens' Advisory Group completed a Rapid Community Health
13 Assessment and found 92.5 percent of homes had been adversely impacted.
14 Ultimately, Exxon offered to buy 62 homes in the Northwoods subdivision, but
15 none in downwind neighborhoods. Unexpected seepage of oil under foundations
16 of homes has required many homes in the Northwoods subdivision to be
17 demolished.¹⁰³
18
19

20 **4.0 Opinion on Health Risk from Oil Spills in Urbanized Areas**

21 **4.1 The Risks of a Spill**

- 22 79. Oil spills are inevitable from the proposed Kinder Morgan Trans Mountain
23 expansion (KM TMX) project. Spills are simply part of this business: One cannot
24 accept the business without accepting the spills. Maritime spills could occur
25 anywhere along the proposed tanker route, at the terminal during loading, or on
26 land from pipeline or other facility mishaps. The KM TMX project would increase
27 pipeline transport capacity by roughly three-fold with a seven-fold increase in
28 large Aframax-class tanker traffic.
29
- 30 80. A report by Cornell University Global Labor Institute found blended tar sands oil
31 and solvents contains not only higher concentrations of hazardous materials and
32 toxins than are found in conventional crude, it is also has higher concentrations
33 of corrosive and abrasive substances, making it more likely to spill.¹⁰⁴ The

¹⁰³ Caplan-Bricker, 2013, This is what happens...

Harris, Emily, M.P.H., 2015, presentation for ALERT webinar...

¹⁰⁴ Skinner, Lara and Sean Sweeney, 2012, *The Impact of Tar Sands Pipeline Spills on Employment and the Economy*, a report by Cornell University Global Labor Institute.

https://www.ilr.cornell.edu/sites/ilr.cornell.edu/files/GLI_Impact-of-Tar-Sands-Pipeline-Spills.pdf

Stansbury, John S., 2011, Analysis of frequency, magnitude, and consequence of worst case spills from the proposed Keystone XL Pipeline. According to Stansbury, spill data for diluted bitumen pipelines compiled by PHMSA suggest that 91 major spills would occur from Keystone XL over a 50-year

1 concentration of silica quartz particles in tar sands is similar to that in sand-
2 blasters. Cornell reported, “pipelines transporting diluted bitumen tar sands oil
3 have a higher frequency of spills than pipelines carrying conventional crude.
4 Between 2007 and 2010, pipelines transporting diluted bitumen tar sands oil in
5 the northern mid-west spilled three times more oil per mile than the national
6 average for conventional crude oil.”¹⁰⁵ Further, in its first year, “the U.S. section
7 of the Keystone pipeline had a spill frequency 100 times greater than Trans-
8 Canada forecast.”¹⁰⁶ This analysis was for inland pipelines; however, the same
9 rationale would logically apply to pipelines at tanker terminals and loading
10 facilities due to similarities in the infrastructure used.
11

- 12 81. Oil spills are most likely to occur near shores than at sea. A 2014 study prepared
13 by WSP Canada for Transport Canada analyzed frequencies of maritime oil spills
14 over the most recent ten years, using international data for crude, refined oil
15 cargo, and fuel. The report found that 45 percent of oil spills occur in the
16 nearshore zone from 0 to 12 nautical miles (nm) from shore; 35 percent in the
17 intermediate zone from 12 to 24 nm from shore; and only 20 percent of oil spills
18 occur in the deep-sea zone from 12 to 200 nm from the shore.¹⁰⁷ Tanker traffic
19 from the proposed KM TMX project would remain within 10 km or 5.4 nm of the
20 shore along the entire route to the open ocean, indicating a high probability that if
21 a spill occurs, it would likely occur in the nearshore or intermediate zone
22 environment.
23
- 24 82. Published reports indicate that, contrary to claims on its website,¹⁰⁸ the
25 Government of Canada is not well prepared for, or ready to respond to, marine
26 accidents from ships in Canadian waters as demonstrated, most recently, by a

period. In Skinner and Sweeney, 2012, *Impact of Tar Sands Pipelines Spills*.

<http://watercenter.unl.edu/downloads/2011-Worst-case-Keystone-spills-report.pdf>

¹⁰⁵ North Dakota, Minnesota, Wisconsin, and Michigan have approximately 5,475 miles of crude pipeline, or about 10.9 percent of the U.S. total. PHMSA. State mileage by commodity statistics. 2011. http://primis.phmsa.dot.gov/comm/reports/safety/mi_detail1.html?nocache=8335#_outerPanel_tab_4. Bureau of Transportation Statistics. Table 1-10: U.S. oil and Gas Pipeline mileage. 2009. www.bts.gov/publications/national_transportation_statistics/html/table_01_10.html. Meanwhile, between 2007 and 2010 crude pipelines in North Dakota, Minnesota, Wisconsin, and Michigan spilled 38,220 barrels of crude, or 30.3% of the 125,862 barrels of crude spilled in the United States.

¹⁰⁶ TransCanada projected a 1.4 spill per decade rate for Keystone 1: Pipeline risk assessment, Pg. 3.1, see: http://www.cardnoentrix.com/keystone/project/eis/appendix%20L_Pipeline%20Risk%20assessment.pdf And there have been at least 14 spills from the Keystone pipeline in the U.S. U.S. State Department, final environmental impact statement (FEIS), Potential Releases, Section 3.13-11. http://www.keystonepipeline.state.gov/clientsite/keystonexl.nsf/19_KXL_feiS_Sec_3.13_Potential_Releases.pdf?openfileResource

¹⁰⁷ WSP Canada, Inc., 2014, Risk Assessment for Marine Spills in Canadian Waters, Phase I: Oil Spills South of the 60th Parallel, prepared for Transport Canada, WSP: 131-17593-00. http://files.wspdigital.com/risk/oil/english/131-17593-00_ERA_Oil-Spill-South_150116.pdf

¹⁰⁸ Government of Canada, Transport Canada, Tanker safety and spill prevention, accessed May 27, 2015. <http://www.tc.gc.ca/eng/marinesafety/menu-4100.htm>

1 spill of at least 2,800 liters (740 gallons) of heavy bunker-fuel from the grain ship
2 *Marathassa* into outer Burrard Inlet or English Bay. Federal budget cuts had
3 closed the Kitsilano Coast Guard station two years earlier.
4

5 **4.2 The Consequences of a Spill**

- 6 83. Similar to the recent experience with the *Marathassa* oil spill in outer Burrard
7 Inlet, trajectory modeling for blended tar sands oil spill scenarios at different
8 locations in Burrard Inlet show extensive oiling of shorelines and contaminated
9 air plumes moving over densely populated areas.¹⁰⁹
10
- 11 84. These projections may provide a more conservative picture of the spill dispersion
12 risks in the event of a spill. However, in my opinion the projections of spill
13 response capabilities in KM's application and the Genwest Systems report are
14 likely overestimated because they are based on current mechanical recovery
15 techniques, which do not work on oil that submerges and sinks.¹¹⁰ Consequently,
16 I find the projected risks to marine life and shorelines are likely understated
17 because less oil will be recovered than projected.
18
- 19 85. I find the projections of air quality impacts in the report "Air Quality Impacts from
20 Simulated Oil Spills in Burrard Inlet & English Bay, An Air Quality Dispersion
21 Modeling Report", prepared for Metro Vancouver in general likely seriously
22 underestimate the risk to the populace because of the focus on acute, high-level
23 exposures to individual chemicals. People exposed to low levels of oil and oil-
24 based solvents over longer durations of time may experience the same
25 symptoms and illnesses of people exposed to higher levels of shorter durations.
26 Further, complex mixtures of hydrocarbons have synergistic effects at
27 significantly lower levels than established for individual chemicals.
28
- 29 86. In summary, it is my opinion that the science and over 25 years of experience
30 with oil spills supports the conclusion that the Kinder Morgan Trans Mountain
31 Expansion project poses a real and significant risk of harm to public health and
32 the environment if it is approved.
33
34

¹⁰⁹ Genwest Systems, Inc., 2015, Oil spill trajectory model report in Burrard Inlet for the Trans Mountain Expansion Project, prepared for City of Vancouver and others, May. <http://vancouver.ca/green-vancouver/neb-evidence-library.aspx>

Levelton Consultants, Ltd., 2015, Air Quality Impacts from Simulated Oil Spills in Burrard Inlet & English Bay, An Air Quality Dispersion Modeling Report, prepared for Metro Vancouver. <http://twnsacredtrust.ca/wp-content/uploads/2015/05/TWN-Assessment-Appendix-5.pdf>

¹¹⁰ Nuka Research and Planning Group, LLC, 2015, Technical Analysis of Oil Spill Response Capabilities and Limitations for Trans Mountain Expansion Project, prepared for Tsleil-Waututh Nation, City of Vancouver, and Tsawout First Nation, May 1. <http://twnsacredtrust.ca/wp-content/uploads/2015/05/TWN-Assessment-Appendix-4.pdf>

Appendix A — Curriculum vitae of Riki Ott, PhD

Riki Ott, PhD

Marine Toxicologist • Author • Public Speaker • Community Organizer

www.rikiott.com • amend@rikiott.com

Riki Ott, PhD, is a marine toxicologist and former Alaska commercial fisherman who experienced the *Exxon Valdez* oil spill first-hand. Since 1987, she has dedicated her academic training to helping the general public understand the toxic effects of oil and other contaminants on water quality, aquatic ecosystems, and humans. Ott has served on the boards of fishing industry organizations, founded sustainable community organizations, spearheaded ad hoc citizens' coalitions, and served on several state-appointed advisory and working groups. She has testified before Congress, the Alaska State Legislature, and the National Energy Board of Canada, receiving state and international recognition for her work. Ott has written numerous white papers and three books, one of which, *Sound Truth and Corporate Myths: The Legacy of the Exxon Valdez Oil Spill* (Dragonfly Sisters Press, 2004) was translated into Korean. She co-starred in *Black Wave* and *Dirty Energy*, both award-winning feature films. Ott was a runner-up for Huffington Post's Game Changer 2010 Award for her volunteer work in the Gulf, empowering local residents to take action after BP's disaster. Ott currently directs two projects of Earth Island Institute; *Ultimate Civics*, which teaches rights-based community organizing from fifth grade to university, sharing practical skills for sustainable living and ending corporate rule, and the *ALERT Project*, A Locally Empowered Response Team, which exposes the human health risk of our oil dependency and engages people in strengthening oil spill prevention and response planning in their communities.

Academic Training

- 1985 Doctorate of Philosophy from University of Washington, WA, School of Fisheries with emphasis on effects of heavy metals on benthic invertebrates
- 1980 Masters of Science from University of South Carolina, SC, Baruch Institute in marine biology with emphasis on effects of oil on zooplankton
- 1977 Thomas Watson Fellowship from Colby College for study of marine oil pollution fates and effects in Bermuda, England, and Malta
- 1976 Bachelor of Science from Colby College, Waterville, Maine

Experience

- 1985-94 Co-founded and operated O.C. Inc., a commercial fishing corporation licensed in Alaska
- 1987-94 Cordova District Fishermen United Board of Directors, serving as point person on oil issues including chronic pollution at the Alyeska Marine Tanker Terminal and Exxon Valdez oil spill environmental impacts
- 1987-94 United Fishermen of Alaska Board of Directors; chair of Habitat Committee dealing with statewide oil, forestry, and mining issues as they impacted water quality
- 1988-89 Stakeholder on Alaska Regional Response Team's working group to develop Oil Dispersant Guidelines for Prince William Sound

- 1 1989-92 Co-founder of Oil Reform Alliance, an ad hoc coalition of commercial fishing and
2 environmental organizations that successfully advocated passage of the then
3 strongest oil spill prevention and response laws in the nation
- 4 1990-96 U.S. EPA and Alaska Technical Advisory Group for federal National Pollution
5 Discharge Elimination System ballast water discharge permit for Alyeska Pipeline
6 Services Company in Port Valdez
- 7 1992-96 Member of the (Alaska) Governor's Task Force on Water Quality
- 8 1994-06 Co-founder and board member of Alaska Forum for Environmental Responsibility,
9 dedicated to holding the Alaska oil industry and government accountable to laws
10 designed to protect public and worker health and the environment
- 11 1995-98 Co-founder and founding director of the Copper River Watershed Project, dedicated
12 to value-based economic development in Alaska
- 13 2001-07 Co-founder and vice chair of Oiled Regions of Alaska Foundation to help *Exxon*
14 *Valdez* oil spill claimants with financial management and charitable giving to their
15 communities
- 16 1998 Recognized as an expert witness in the State of Alaska on certain issues relating to
17 effects, fate and transportation of marine oil spills, and environmentally sensitive
18 areas in the Copper River Delta
- 19 2004- Founder and owner of Dragonfly Sisters Press publishing house
- 20 2009- Co-founder and director of Ultimate Civics, a project of Earth Island Institute, to
21 reclaim democratic rule by human persons
- 22 2010-11 Volunteer in Gulf Coast communities impacted by BP Deepwater Horizon, coaching
23 people on what to anticipate and do to minimize environmental, economic, and
24 emotional harm
- 25 2014 Founder and director of ALERT, A Locally Empowered Response Team, a project of
26 Earth Island Institute, to expose human health risks of our oil dependency and
27 engage citizens in strengthening oil spill prevention and response planning

28
29 **Books, Published Essays, Feature Films & Courses**

- 30 2015 *Rethinking Democracy!*, updated course content for high school
- 31 2013 *Rethinking Democracy and Organizing for Change*, community organizer training manual
- 32 2012 *Dirty Energy. The Deepwater Horizon Disaster: First-Hand Stories from the Louisiana*
33 *Bayou*. Producer Bryan Hopkins
- 34 2012 "They have no ears," in *Arctic Voices: A 21st Century Conservation Roadmap*, ed.
35 Subhankar Banerjee (Seven Stories Press)
- 36 2008 *Not One Drop: Betrayal and Courage in the Wake of the Exxon Valdez Oil Spill* (Chelsea
37 Green)
- 38 2008 *Black Wave: The Legacy of the Exxon Valdez Oil Spill*. Produced by Macumaba
39 International and Perception Cinema (Quebec). Feature film, 99 min.
- 40 2005 *Sound Truth and Corporate Myth\$: The Legacy of the Exxon Valdez Oil Spill* (Dragonfly
41 Sisters Press, Cordova, Alaska)
- 42 1998 *Alaska's Copper River Delta*, University of Washington Press (Seattle, Washington)

43

1 Awards and Recognition

- 2 2010 Huffington Post Game Changer Award, runner-up for work documenting human health
3 impacts from BP Deepwater Horizon disaster and other related activities
- 4 2005 *Sound Truth and Corporate Myths* finalist in the 2005 Benjamin Franklin Book Awards in
5 Science/Environment
- 6 1997 "E-chievement" award from E-Town, a National Public Radio program
- 7 1997 U.S. Environmental Protection Agency Region 10 Award for "recognition and
8 appreciation of continued contributions to the ballast water treatment working group
9 and technical advisory group"
- 10 1994 Alaska Conservation Foundation's Celia Hunter Award for exemplary volunteer service
11 to the environmental movement in Alaska
- 12 1993 National Wildlife Federation's "People Who Are Making a Difference" (October 1993
13 issue of *International Wildlife*)

15 Speaking Engagements (keynote in bold), Research Reports & Articles (examples)

- 16 2015 Wrote and submitted public comments on U.S. EPA rulemaking on National Oil and
17 Hazardous Substances Pollution Contingency Plan (NCP) on behalf of ALERT/EII and the
18 Coalition to Ban Toxic Dispersants
- 19 2014 Wrote and submitted supplement to petition to U.S. EPA for rulemaking on NCP on
20 behalf of Ultimate Civics/EII and the Coalition to Ban Toxic Dispersants
- 21 2012 Wrote and submitted petition to U.S. EPA for rulemaking on NCP policies governing oil
22 spill response organization, structure, authorities, worker and public health, and
23 product use on behalf of Ultimate Civics/EII and the Coalition to Ban Toxic Dispersants
- 24 2007 "Toxicological Paradigm Shifts after the *Exxon Valdez* Oil Spill." **Keynote presentation** at
25 the 20th annual international symposium on 'Man and his Environment in Health and
26 Disease' sponsored by the American Environmental Health Foundation and the
27 American Academy of Environment and Medicine. Dallas, Texas, 7–10 June 2007
- 28 2007 "Sociological Paradigm Shifts after the *Exxon Valdez* Oil Spill." **Keynote presentation** at
29 the 20th annual international symposium on 'Man and his Environment in Health and
30 Disease' sponsored by the American Environmental Health Foundation and the
31 American Academy of Environment and Medicine. Dallas, Texas, 7–10 June 2007
- 32 2005 "Dangerous Cleanup: Lessons Learned from the *Exxon Valdez* Spill." *HazMat*
33 *Management* 17(3): 20–22
- 34 2005 "The Legacy of the *Exxon Valdez* Oil Spill." **Keynote speaker** at the 10th anniversary
35 international symposium on the Sea Prince Oil Spill, sponsored by Korean Federation of
36 the Environmental Movement. University of South Korea, Yeosu, South Korea, July 22,
37 2005
- 38 2005 "Our Toxic Legacy—The *Exxon Valdez* Spill and Beyond." *Ocean* 2(7): 20–29
- 39 2004 "The Legacy of the *Exxon Valdez* Oil Spill." Presented at the National Press Club,
40 Washington DC. 24 March 2004
- 41 2003 "The *Exxon Valdez* Oil Spill and the \$100 Million Reopener Clause." Presentation to the
42 EVOS Trustee Council, Anchorage, AK. 14 August 2003
- 43 2002 "*Exxon Valdez* Oil Spill Legacy: Natural Resources." **Keynote presentation** at the 20th
44 annual international symposium on 'Man and his Environment in Health and Disease'

- 1 sponsored by the American Environmental Health Foundation and the American
2 Academy of Environment and Medicine. Dallas, Texas, 6–9 June 2002
- 3 2002 “*Exxon Valdez* Oil Spill Legacy: Cleanup Workers.” **Keynote presentation** at the 20th
4 annual international symposium on ‘Man and his Environment in Health and Disease’
5 sponsored by the American Environmental Health Foundation and the American
6 Academy of Environment and Medicine. Dallas, Texas, 6–9 June 2002
- 7 1999 “Cultivating Conservation in Our Communities and Our Conscious: Reflections from the
8 Field.” **Keynote address** at Wisconsin Academy for Sciences, Arts and Letters
9 conference, Building on Leopold’s Legacy: A New Century for Conservation. Madison,
10 WI, 6 October 1999
- 11 1999 “Land Ethics, Private Property Owners, ANCSA and Economics: Shaping Alaska’s Forests
12 of the Future Now.” **Presentation** for Alaska Conservation Alliance’s conference on A
13 Sustainable Economy for Alaska. Anchorage, AK, 22 July 1999
- 14 1999 “*Exxon Valdez* Aftermath.” *Defenders*, the conservation magazine of Defenders of
15 Wildlife. Spring 1999, 16–24
- 16 1993 “Lessons from the *Exxon Valdez* Oil Spill.” **Keynote speaker** at the 1st anniversary
17 international symposium on the Aegean Sea Oil Spill. Corunna, Spain, December 1993
- 18 1993 *Status Report on Alaska’s Oil Industry: A Blueprint for Improving Performance*.
19 Distributed to Clinton Administration officials and Congressional delegates on behalf of
20 the Oil Reform Alliance. March 1993
- 21 1989 “Applying Science at Alyeska: The Good, the Bad, and the Ugly.” Presented at the
22 American Fisheries Society National Meeting. Anchorage, AK, 5-8 September 1989
- 23 1989 “Spilled Oil and the Alaska Fishing Industry: Looking Beyond Fouled Nets and Lost
24 Fishing Time.” **Keynote presentaton** at the International Oil Spill Conference on the
25 Open Ocean and Coastal Spill Panel. San Antonio, TX, 12–15 February 1989