

CBE, Sierra Club, Center, ForestEthics et al. Comments on the Revised Draft Environmental Impact Report for the Phillips 66 Company Rail Spur Extension and Crude Unloading Project

ATTACHMENT C4

Attachments to Expert Report of Phyllis Fox on the Revised Draft Environmental Impact Report for the Phillips 66 Rail Spur Extension and Crude Unloading Project, November 2014.

EXHIBIT 2 (cont'd)

Phyllis Fox
Ph.D, PE, BCEE, QEP
Environmental Management
745 White Pine Ave.
Rockledge, FL 32955
321-626-6885
PhyllisFox@gmail.com

Dr. Fox has over 40 years of experience in the field of environmental engineering, including air pollution control (BACT, BART, MACT, LAER, RACT), cost effectiveness analyses, air quality management, water quality and water supply investigations, hazardous waste investigations, environmental permitting, nuisance investigations (odor, noise), environmental impact reports, CEQA/NEPA documentation, risk assessments, and litigation support.

EDUCATION

Ph.D. Environmental/Civil Engineering, University of California, Berkeley, 1980.

M.S. Environmental/Civil Engineering, University of California, Berkeley, 1975.

B.S. Physics (with high honors), University of Florida, Gainesville, 1971.

REGISTRATION

Registered Professional Engineer: Arizona (2001-present; #36701), California (2002-present; CH 6058), Florida (2001-present; #57886), Georgia (2002-present; #PE027643), Washington (2002-present; #38692), Wisconsin (2005-present; #37595-006)

Board Certified Environmental Engineer, American Academy of Environmental Engineers,
Certified in Air Pollution Control (DEE #01-20014), 2002-present

Qualified Environmental Professional (QEP), Institute of Professional Environmental
Practice (QEP #02-010007), 2001-present

PROFESSIONAL HISTORY

Environmental Management, Principal, 1981-present

Lawrence Berkeley National Laboratory, Principal Investigator, 1977-1981

University of California, Berkeley, Program Manager, 1976-1977

Bechtel, Inc., Engineer, 1971-1976, 1964-1966

PROFESSIONAL AFFILIATIONS

American Chemical Society (1981-2010)

Phi Beta Kappa (1970-present)

Sigma Pi Sigma (1970-present)

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Who's Who Environmental Registry, PH Publishing, Fort Collins, CO, 1992.

Who's Who in the World, Marquis Who's Who, Inc., Chicago, IL, 11th Ed., p. 371, 1993-present.

Who's Who of American Women, Marquis Who's Who, Inc., Chicago, IL, 13th Ed., p. 264, 1984-present.

Who's Who in Science and Engineering, Marquis Who's Who, Inc., New Providence, NJ, 5th Ed., p. 414, 1999-present.

Who's Who in America, Marquis Who's Who, Inc., 59th Ed., 2005.

Guide to Specialists on Toxic Substances, World Environment Center, New York, NY, p. 80, 1980.

National Research Council Committee on Irrigation-Induced Water Quality Problems (Selenium), Subcommittee on Quality Control/Quality Assurance (1985-1990).

National Research Council Committee on Surface Mining and Reclamation, Subcommittee on Oil Shale (1978-80)

REPRESENTATIVE EXPERIENCE

Performed environmental and engineering investigations, as outlined below, for a wide range of industrial and commercial facilities including: petroleum refineries and upgrades thereto; reformulated fuels projects; refinery upgrades to process heavy sour crudes, including tar sands and light sweet crudes from the Eagle Ford and Bakken Formations; petroleum distribution terminals; coal export terminals; LNG export, import, and storage terminals; shale oil plants; coal gasification & liquefaction plants; conventional and thermally enhanced oil production; underground storage tanks; pipelines; gasoline stations; landfills; railyards; hazardous waste treatment facilities; nuclear, hydroelectric, geothermal, wood, biomass, waste, tire-derived fuel, gas, oil, coke and coal-fired power plants; transmission lines; airports; hydrogen plants; petroleum coke calcining plants; coke plants; activated carbon manufacturing facilities; asphalt plants; cement plants; incinerators; flares; manufacturing facilities (e.g., semiconductors, electronic assembly, aerospace components, printed circuit boards, amusement park rides); lanthanide processing plants; ammonia plants; nitric acid plants; urea plants; food processing plants; almond hulling facilities; composting facilities; grain processing facilities; grain elevators; ethanol production facilities; soy bean oil extraction plants; biodiesel plants; paint formulation plants; wastewater treatment plants; marine terminals and ports; gas processing plants; steel mills; iron nugget production facilities; pig iron plant, based on blast furnace technology; direct reduced iron plant; acid regeneration facilities; railcar refinishing facility; battery manufacturing plants; pesticide manufacturing and repackaging facilities; pulp and paper mills; olefin plants; methanol plants; ethylene crackers; selective catalytic reduction (SCR) systems; selective noncatalytic reduction (SNCR) systems; halogen acid furnaces; contaminated property redevelopment projects (e.g., Mission Bay, Southern Pacific Railyards, Moscone Center expansion, San Diego Padres Ballpark); residential developments; commercial office parks,

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campuses, and shopping centers; server farms; transportation plans; and a wide range of mines including sand and gravel, hard rock, limestone, nacholite, coal, molybdenum, gold, zinc, and oil shale.

EXPERT WITNESS/LITIGATION SUPPORT

- For plaintiffs, expert witness in civil action relating to alleged violations of the Clean Air Act, Prevention of Significant Deterioration, for historic modifications (1997-2000) at the Cemex cement plant in Lyons, Colorado. Reviewed produced documents, prepared expert and rebuttal reports on PSD applicability based on NOx emission calculations for a collection of changes considered both individually and collectively. Deposed August 2011. *United States v. Cemex, Inc.*, In U.S. District Court for the District of Colorado (Civil Action No. 09-cv-00019-MSK-MEH). Case settled June 13, 2013.
- For plaintiffs, in civil action relating to alleged violations of the Clean Air Act, Prevention of Significant Deterioration, for historic modifications (1988 – 2000) at James De Young Units 3, 4, and 5. Reviewed produced documents, analyzed CEMS and EIA data, and prepared netting and BACT analyses for NOx, SO2, and PM10. Expert report February 24, 2010 and affidavit February 20, 2010. *Sierra Club v. City of Holland, et al.*, U.S. District Court, Western District of Michigan.
- For plaintiffs, in civil action alleging failure to obtain MACT permit, expert on potential to emit hydrogen chloride (HCl) from a new coal-fired boiler. Reviewed record, estimated HCl emissions, wrote expert report June 2010 and March 2013 (Cost to Install a Scrubber at the Lamar Repowering Project Pursuant to Case-by-Case MACT), deposed August 2010 and March 2013. *Wildearth Guardian et al. v. Lamar Utilities Board*, Civil Action No. 09-cv-02974, U.S. District Court, District of Colorado. Case settled August 2013.
- For plaintiffs, expert witness on permitting, emission calculations, and wastewater treatment for coal to gasoline plant. Reviewed produced documents. Assisted in preparation of comments on draft minor source permit. Wrote two affidavits on key issues in case. Presented direct and rebuttal testimony 10/27 - 10/28/10 on permit enforceability and failure to properly calculate potential to emit, including underestimate of flaring emissions and omission of VOC and CO emissions from wastewater treatment, cooling tower, tank roof landings, and malfunctions. *Sierra Club, Ohio Valley Environmental Coalition, Coal River Mountain Watch, West Virginia Highlands Conservancy v. John Benedict, Director, Division of Air Quality, West Virginia Department of Environmental Protection and TransGas Development System, LLC*, Appeal No. 10-01-AQB. Virginia Air Quality Board remanded the permit on March 28, 2011 ordering reconsideration of potential to emit calculations, including: (1) support for assumed flare efficiency; (2) inclusion of startup, shutdown and malfunction emissions; and (3) inclusion of wastewater treatment emissions in potential to emit calculations.

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- For plaintiffs, expert on BACT emission limits for gas-fired combined cycle power plant. Prepared declaration in support of CBE's Opposition to the United States' Motion for Entry of Proposed Amended Consent Decree. Assisted in settlement discussions. *U.S. EPA, Plaintiff, Communities for a Better Environment, Intervenor Plaintiff, v. Pacific Gas & Electric Company, et al.*, U.S. District Court, Northern District of California, San Francisco Division, Case No. C-09-4503 SI.
- Technical expert in confidential settlement discussions with large coal-fired utility on BACT control technology and emission limits for NO_x, SO₂, PM, PM_{2.5}, and CO for new natural gas fired combined cycle and simple cycle turbines with oil backup. (July 2010). Case settled.
- For plaintiffs, expert witness in remedy phase of civil action relating to alleged violations of the Clean Air Act, Prevention of Significant Deterioration, for historic modifications (1998-99) at Gallagher Units 1 and 3. Reviewed produced documents, prepared expert and rebuttal reports on historic and current-day BACT for SO₂, control costs, and excess emissions of SO₂. Deposed 11/18/09. *United States et al. v. Cinergy, et al.*, In U.S. District Court for the Southern District of Indiana, Indianapolis Division, Civil Action No. IP99-1693 C-M/S. Settled 12/22/09.
- For plaintiffs, expert witness on MACT, BACT for NO_x, and enforceability in an administrative appeal of draft state air permit issued for four 300-MW pet-coke-fired CFBs. Reviewed produced documents and prepared prefiled testimony. Deposed 10/8/09 and 11/9/09. Testified 11/10/09. *Application of Las Brisas Energy Center, LLC for State Air Quality Permit*; before the State Office of Administrative Hearings, Texas. Permit remanded 3/29/10 as LBEC failed to meet burden of proof on a number of issues including MACT. Texas Court of Appeals dismissed an appeal to reinstate the permit. The Texas Commission on Environmental Quality and Las Brisas Energy Center, LLC sought to overturn the Court of Appeals decision but moved to have their appeal dismissed in August 2013.
- For defense, expert witness in unlawful detainer case involving a gasoline station, minimart, and residential property with contamination from leaking underground storage tanks. Reviewed agency files and inspected site. Presented expert testimony on July 6, 2009, on causes of, nature and extent of subsurface contamination. *A. Singh v. S. Assaedi*, in Contra Costa County Superior Court, CA. Settled August 2009.
- For plaintiffs, expert witness on netting and enforceability for refinery being upgraded to process tar sands crude. Reviewed produced documents. Prepared expert and rebuttal reports addressing use of emission factors for baseline, omitted sources including coker, flares, tank landings and cleaning, and enforceability. Deposed. *In the Matter of Objection to the Issuance of Significant Source Modification Permit No. 089-25484-00453 to BP Products North America Inc., Whiting Business Unit, Save the Dunes Council, Inc., Sierra*

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Club., Inc., Hoosier Environmental Council et al., Petitioners, B. P. Products North American, Respondents/Permittee, before the Indiana Office of Environmental Adjudication.

- For plaintiffs, expert witness on BACT, MACT, and enforceability in appeal of Title V permit issued to 600 MW coal-fired power plant burning Powder River Basin coal. Prepared technical comments on draft air permit. Reviewed record on appeal, drafted BACT, MACT, and enforceability pre-filed testimony. Drafted MACT and enforceability pre-filed rebuttal testimony. Deposed March 24, 2009. Testified June 10, 2009. *In Re: Southwestern Electric Power Company*, Arkansas Pollution Control and Ecology Commission, Consolidated Docket No. 08-006-P. Recommended Decision issued December 9, 2009 upholding issued permit. Commission adopted Recommended Decision January 22, 2010.
- For plaintiffs, expert witness in remedy phase of civil action relating to alleged violations of the Clean Air Act, Prevention of Significant Deterioration, for historic modifications (1989-1992) at Wabash Units 2, 3 and 5. Reviewed produced documents, prepared expert and rebuttal report on historic and current-day BACT for NOx and SO₂, control costs, and excess emissions of NOx, SO₂, and mercury. Deposed 10/21/08. *United States et al. v. Cinergy, et al.*, In U.S. District Court for the Southern District of Indiana, Indianapolis Division, Civil Action No. IP99-1693 C-M/S. Testified 2/3/09. Memorandum Opinion & Order 5-29-09 requiring shutdown of Wabash River Units 2, 3, 5 by September 30, 2009, run at baseline until shutdown, and permanently surrender SO₂ emission allowances.
- For plaintiffs, expert witness in liability phase of civil action relating to alleged violations of the Clean Air Act, Prevention of Significant Deterioration, for three historic modifications (1997-2001) at two portland cement plants involving three cement kilns. Reviewed produced documents, analyzed CEMS data covering subject period, prepared netting analysis for NOx, SO₂ and CO, and prepared expert and rebuttal reports. *United States v. Cemex California Cement*, In U.S. District Court for the Central District of California, Eastern Division, Case No. ED CV 07-00223-GW (JCRx), Settled 1/15/09.
- For intervenors Clean Wisconsin and Citizens Utility Board, prepared data requests, reviewed discovery and expert report. Prepared prefiled direct, rebuttal and surrebuttal testimony on cost to extend life of existing Oak Creek Units 5-8 and cost to address future regulatory requirements to determine whether to control or shutdown one or more of the units. Oral testimony 2/5/08. Application for a Certificate of Authority to Install Wet Flue Gas Desulfurization and Selective Catalytic Reduction Facilities and Associated Equipment for Control of Sulfur Dioxide and Nitrogen Oxide Emissions at Oak Creek Power Plant Units 5, 6, 7 and 8, WPSC Docket No. 6630-CE-299.
- For plaintiffs, expert witness on alternatives analysis and BACT for NOx, SO₂, total PM₁₀, and sulfuric acid mist in appeal of PSD permit issued to 1200 MW coal fired power plant burning Powder River Basin and/or Central Appalachian coal (Longleaf). Assisted in drafting technical comments on NOx on draft permit. Prepared expert disclosure. Presented 8+ days

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of direct and rebuttal expert testimony. Attended all 21 days of evidentiary hearing from 9/5/07 – 10/30/07 assisting in all aspects of hearing. *Friends of the Chatahooche and Sierra Club v. Dr. Carol Couch, Director, Environmental Protection Division of Natural Resources Department, Respondent, and Longleaf Energy Associates, Intervener*. ALJ Final Decision 1/11/08 denying petition. ALJ Order vacated & remanded for further proceedings, Fulton County Superior Court, 6/30/08. Court of Appeals of GA remanded the case with directions that the ALJ's final decision be vacated to consider the evidence under the correct standard of review, July 9, 2009. The ALJ issued an opinion April 2, 2010 in favor of the applicant. Final permit issued April 2010.

- For plaintiffs, expert witness on diesel exhaust in inverse condemnation case in which Port expanded maritime operations into residential neighborhoods, subjecting plaintiffs to noise, light, and diesel fumes. Measured real-time diesel particulate concentrations from marine vessels and tug boats on plaintiffs' property. Reviewed documents, depositions, DVDs, and photographs provided by counsel. Deposed. Testified October 24, 2006. *Ann Chargin, Richard Hackett, Carolyn Hackett, et al. v. Stockton Port District*, Superior Court of California, County of San Joaquin, Stockton Branch, No. CV021015. Judge ruled for plaintiffs.
- For plaintiffs, expert witness on NOx emissions and BACT in case alleging failure to obtain necessary permits and install controls on gas-fired combined-cycle turbines. Prepared and reviewed (applicant analyses) of NOx emissions, BACT analyses (water injection, SCR, ultra low NOx burners), and cost-effectiveness analyses based on site visit, plant operating records, stack tests, CEMS data, and turbine and catalyst vendor design information. Participated in negotiations to scope out consent order. *United States v. Nevada Power*. Case settled June 2007, resulting in installation of dry low NOx burners (5 ppm NOx averaged over 1 hr) on four units and a separate solar array at a local business.
- For plaintiffs, expert witness in appeal of PSD permit issued to 850 MW coal fired boiler burning Powder River Basin coal (Iatan Unit 2) on BACT for particulate matter, sulfuric acid mist and opacity and emission calculations for alleged historic violations of PSD. Assisted in drafting technical comments, petition for review, discovery requests, and responses to discovery requests. Reviewed produced documents. Prepared expert report on BACT for particulate matter. Assisted with expert depositions. Deposed February 7, 8, 27, 28, 2007. *In Re PSD Construction Permit Issued to Great Plains Energy, Kansas City Power & Light – Iatan Generating Station, Sierra Club v. Missouri Department of Natural Resources, Great Plains Energy, and Kansas City Power & Light*. Case settled March 27, 2007, providing offsets for over 6 million ton/yr of CO₂ and lower NOx and SO₂ emission limits.
- For plaintiffs, expert witness in remedy phase of civil action relating to alleged violations of the Clean Air Act, Prevention of Significant Deterioration, for historic modifications of coal-fired boilers and associated equipment. Reviewed produced documents, prepared expert report on cost to retrofit 24 coal-fired power plants with scrubbers designed to remove 99%

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of the sulfur dioxide from flue gases. Prepared supplemental and expert report on cost estimates and BACT for SO₂ for these 24 complaint units. Deposed 1/30/07 and 3/14/07. *United States and State of New York et al. v. American Electric Power*, In U.S. District Court for the Southern District of Ohio, Eastern Division, Consolidated Civil Action Nos. C2-99-1182 and C2-99-1250. Settlement announced 10/9/07.

- For plaintiffs, expert witness on BACT, enforceability, and alternatives analysis in appeal of PSD permit issued for a 270-MW pulverized coal fired boiler burning Powder River Basin coal (City Utilities Springfield Unit 2). Reviewed permitting file and assisted counsel draft petition and prepare and respond to interrogatories and document requests. Reviewed interrogatory responses and produced documents. Assisted with expert depositions. Deposed August 2005. Evidentiary hearings October 2005. *In the Matter of Linda Chipperfield and Sierra Club v. Missouri Department of Natural Resources*. Missouri Supreme Court denied review of adverse lower court rulings August 2007.
- For plaintiffs, expert witness in civil action relating to plume touchdowns at AEP's Gavin coal-fired power plant. Assisted counsel draft interrogatories and document requests. Reviewed responses to interrogatories and produced documents. Prepared expert report "Releases of Sulfuric Acid Mist from the Gavin Power Station." The report evaluates sulfuric acid mist releases to determine if AEP complied with the requirements of CERCLA Section 103(a) and EPCRA Section 304. This report also discusses the formation, chemistry, release characteristics, and abatement of sulfuric acid mist in support of the claim that these releases present an imminent and substantial endangerment to public health under Section 7002(a)(1)(B) of the Resource Conservation and Recovery Act ("RCRA"). *Citizens Against Pollution v. Ohio Power Company*, In the U.S. District Court for the Southern District of Ohio, Eastern Division, Civil Action No. 2-04-cv-371. Case settled 12-8-06.
- For petitioners, expert witness in contested case hearing on BACT, enforceability, and emission estimates for an air permit issued to a 500-MW supercritical Power River Basin coal-fired boiler (Weston Unit 4). Assisted counsel prepare comments on draft air permit and respond to and draft discovery. Reviewed produced file, deposed (7/05), and prepared expert report on BACT and enforceability. Evidentiary hearings September 2005. *In the Matter of an Air Pollution Control Construction Permit Issued to Wisconsin Public Service Corporation for the Construction and Operation of a 500 MW Pulverized Coal-fired Power Plant Known as Weston Unit 4 in Marathon County, Wisconsin*, Case No. IH-04-21. The Final Order, issued 2/10/06, lowered the NO_x BACT limit from 0.07 lb/MMBtu to 0.06 lb/MMBtu based on a 30-day average, added a BACT SO₂ control efficiency, and required a 0.0005% high efficiency drift eliminator as BACT for the cooling tower. The modified permit, including these provisions, was issued 3/28/07. Additional appeals in progress.
- For plaintiffs, adviser on technical issues related to Citizen Suit against U.S. EPA regarding failure to update New Source Performance Standards for petroleum refineries, 40 CFR 60,

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Subparts J, VV, and GGG. *Our Children's Earth Foundation and Sierra Club v. U.S. EPA et al.* Case settled July 2005. CD No. C 05-00094 CW, U.S. District Court, Northern District of California – Oakland Division. Proposed revisions to standards of performance for petroleum refineries published 72 FR 27178 (5/14/07).

- For interveners, reviewed proposed Consent Decree settling Clean Air Act violations due to historic modifications of boilers and associated equipment at two coal-fired power plants. In response to stay order, reviewed the record, selected one representative activity at each of seven generating units, and analyzed to identify CAA violations. Identified NSPS and NSR violations for NO_x, SO₂, PM/PM₁₀, and sulfuric acid mist. Summarized results in an expert report. *United States of America, and Michael A. Cox, Attorney General of the State of Michigan, ex rel. Michigan Department of Environmental Quality, Plaintiffs, and Clean Wisconsin, Sierra Club, and Citizens' Utility Board, Intervenors, v. Wisconsin Electric Power Company, Defendant*, U.S. District Court for the Eastern District of Wisconsin, Civil Action No. 2:03-CV-00371-CNC. Order issued 10-1-07 denying petition.
- For a coalition of Nevada labor organizations (ACE), reviewed preliminary determination to issue a Class I Air Quality Operating Permit to Construct and supporting files for a 250-MW pulverized coal-fired boiler (Newmont). Prepared about 100 pages of technical analyses and comments on BACT, MACT, emission calculations, and enforceability. Assisted counsel draft petition and reply brief appealing PSD permit to U.S. EPA Environmental Appeals Board (EAB). Order denying review issued 12/21/05. *In re Newmont Nevada Energy Investment, LLC, TS Power Plant*, PSD Appeal No. 05-04 (EAB 2005).
- For petitioners and plaintiffs, reviewed and prepared comments on air quality and hazardous waste based on negative declaration for refinery ultra low sulfur diesel project located in SCAQMD. Reviewed responses to comments and prepared responses. Prepared declaration and presented oral testimony before SCAQMD Hearing Board on exempt sources (cooling towers) and calculation of potential to emit under NSR. Petition for writ of mandate filed March 2005. Case remanded by Court of Appeals to trial court to direct SCAQMD to re-evaluate the potential environmental significance of NO_x emissions resulting from the project in accordance with court's opinion. California Court of Appeals, Second Appellate Division, on December 18, 2007, affirmed in part (as to baseline) and denied in part. *Communities for a Better Environment v. South Coast Air Quality Management District and ConocoPhillips and Carlos Valdez et al v. South Coast Air Quality Management District and ConocoPhillips*. Certified for partial publication 1/16/08. Appellate Court opinion upheld by CA Supreme Court 3/15/10. (2010) 48 Cal.4th 310.
- For amici seeking to amend a proposed Consent Decree to settle alleged NSR violations at Chevron refineries, reviewed proposed settlement, related files, subject modifications, and emission calculations. Prepared declaration on emission reductions, identification of NSR and NSPS violations, and BACT/LAER for FCCUs, heaters and boilers, flares, and sulfur recovery plants. *U.S. et al. v. Chevron U.S.A.*, Northern District of California, Case No. C

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03-04650. Memorandum and Order Entering Consent Decree issued June 2005. Case No. C 03-4650 CRB.

- For petitioners, prepared declaration on enforceability of periodic monitoring requirements, in response to EPA's revised interpretation of 40 CFR 70.6(c)(1). This revision limited additional monitoring required in Title V permits. 69 FR 3203 (Jan. 22, 2004). *Environmental Integrity Project et al. v. EPA* (U.S. Court of Appeals for the District of Columbia). Court ruled the Act requires all Title V permits to contain monitoring requirements to assure compliance. *Sierra Club v. EPA*, 536 F.3d 673 (D.C. Cir. 2008).
- For interveners in application for authority to construct a 500 MW supercritical coal-fired generating unit before the Wisconsin Public Service Commission, prepared pre-filed written direct and rebuttal testimony with oral cross examination and rebuttal on BACT and MACT (Weston 4). Prepared written comments on BACT, MACT, and enforceability on draft air permit for same facility.
- For property owners in Nevada, evaluated the environmental impacts of a 1,450-MW coal-fired power plant proposed in a rural area adjacent to the Black Rock Desert and Granite Range, including emission calculations, air quality modeling, comments on proposed use permit to collect preconstruction monitoring data, and coordination with agencies and other interested parties. Project cancelled.
- For environmental organizations, reviewed draft PSD permit for a 600-MW coal-fired power plant in West Virginia (Longview). Prepared comments on permit enforceability; coal washing; BACT for SO₂ and PM₁₀; Hg MACT; and MACT for HCl, HF, non-Hg metallic HAPs, and enforceability. Assist plaintiffs draft petition appealing air permit. Retained as expert to develop testimony on MACT, BACT, offsets, enforceability. Participate in settlement discussions. Case settled July 2004.
- For petitioners, reviewed record produced in discovery and prepared affidavit on emissions of carbon monoxide and volatile organic compounds during startup of GE 7FA combustion turbines to successfully establish plaintiff standing. *Sierra Club et al. v. Georgia Power Company* (Northern District of Georgia).
- For building trades, reviewed air quality permitting action for 1500-MW coal-fired power plant before the Kentucky Department for Environmental Protection (Thoroughbred).
- For petitioners, expert witness in administrative appeal of the PSD/Title V permit issued to a 1500-MW coal-fired power plant. Reviewed over 60,000 pages of produced documents, prepared discovery index, identified and assembled plaintiff exhibits. Deposed. Assisted counsel in drafting discovery requests, with over 30 depositions, witness cross examination, and brief drafting. Presented over 20 days of direct testimony, rebuttal and sur-rebuttal, with cross examination on BACT for NO_x, SO₂, and PM/PM₁₀; MACT for Hg and non-Hg metallic HAPs; emission estimates for purposes of Class I and II air modeling; risk assessment; and enforceability of permit limits. Evidentiary hearings from November 2003 to

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June 2004. *Sierra Club et al. v. Natural Resources & Environmental Protection Cabinet, Division of Air Quality and Thoroughbred Generating Company et al.* Hearing Officer Decision issued August 9, 2005 finding in favor of plaintiffs on counts as to risk, BACT (IGCC/CFB, NO_x, SO₂, Hg, Be), single source, enforceability, and errors and omissions. Assist counsel draft exceptions. Cabinet Secretary issued Order April 11, 2006 denying Hearing Offer's report, except as to NO_x BACT, Hg, 99% SO₂ control and certain errors and omissions.

- For citizens group in Massachusetts, reviewed, commented on, and participated in permitting of pollution control retrofits of coal-fired power plant (Salem Harbor).
- Assisted citizens group and labor union challenge issuance of conditional use permit for a 317,000 ft² discount store in Honolulu without any environmental review. In support of a motion for preliminary injunction, prepared 7-page declaration addressing public health impacts of diesel exhaust from vehicles serving the Project. In preparation for trial, prepared 20-page preliminary expert report summarizing results of diesel exhaust and noise measurements at two big box retail stores in Honolulu, estimated diesel PM₁₀ concentrations for Project using ISCST, prepared a cancer health risk assessment based on these analyses, and evaluated noise impacts.
- Assisted environmental organizations to challenge the DOE Finding of No Significant Impact (FONSI) for the Baja California Power and Sempra Energy Resources Cross-Border Transmissions Lines in the U.S. and four associated power plants located in Mexico (DOE EA-1391). Prepared 20-page declaration in support of motion for summary judgment addressing emissions, including CO₂ and NH₃, offsets, BACT, cumulative air quality impacts, alternative cooling systems, and water use and water quality impacts. Plaintiff's motion for summary judgment granted in part. U.S. District Court, Southern District decision concluded that the Environmental Assessment and FONSI violated NEPA and the APA due to their inadequate analysis of the potential controversy surrounding the project, water impacts, impacts from NH₃ and CO₂, alternatives, and cumulative impacts. *Border Power Plant Working Group v. Department of Energy and Bureau of Land Management*, Case No. 02-CV-513-IEG (POR) (May 2, 2003).
- For Sacramento school, reviewed draft air permit issued for diesel generator located across from playfield. Prepared comments on emission estimates, enforceability, BACT, and health impacts of diesel exhaust. Case settled. BUG trap installed on the diesel generator.
- Assisted unions in appeal of Title V permit issued by BAAQMD to carbon plant that manufactured coke. Reviewed District files, identified historic modifications that should have triggered PSD review, and prepared technical comments on Title V permit. Reviewed responses to comments and assisted counsel draft appeal to BAAQMD hearing board, opening brief, motion to strike, and rebuttal brief. Case settled.
- Assisted California Central Coast city obtain controls on a proposed new city that would straddle the Ventura-Los Angeles County boundary. Reviewed several environmental impact reports, prepared an air quality analysis, a diesel exhaust health risk assessment, and

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detailed review comments. Governor intervened and State dedicated the land for conservation purposes April 2004.

- Assisted Central California city to obtain controls on large alluvial sand quarry and asphalt plant proposing a modernization. Prepared comments on Negative Declaration on air quality, public health, noise, and traffic. Evaluated process flow diagrams and engineering reports to determine whether proposed changes increased plant capacity or substantially modified plant operations. Prepared comments on application for categorical exemption from CEQA. Presented testimony to County Board of Supervisors. Developed controls to mitigate impacts. Assisted counsel draft Petition for Writ. Case settled June 2002. Substantial improvements in plant operations were obtained including cap on throughput, dust control measures, asphalt plant loadout enclosure, and restrictions on truck routes.
- Assisted oil companies on the California Central Coast in defending class action citizen's lawsuit alleging health effects due to emissions from gas processing plant and leaking underground storage tanks. Reviewed regulatory and other files and advised counsel on merits of case. Case settled November 2001.
- Assisted oil company on the California Central Coast in defending property damage claims arising out of a historic oil spill. Reviewed site investigation reports, pump tests, leachability studies, and health risk assessments, participated in design of additional site characterization studies to assess health impacts, and advised counsel on merits of case. Prepare health risk assessment.
- Assisted unions in appeal of Initial Study/Negative Declaration ("IS/ND") for an MTBE phaseout project at a Bay Area refinery. Reviewed IS/ND and supporting agency permitting files and prepared technical comments on air quality, groundwater, and public health impacts. Reviewed responses to comments and final IS/ND and ATC permits and assisted counsel to draft petitions and briefs appealing decision to Air District Hearing Board. Presented sworn direct and rebuttal testimony with cross examination on groundwater impacts of ethanol spills on hydrocarbon contamination at refinery. Hearing Board ruled 5 to 0 in favor of appellants, remanding ATC to district to prepare an EIR.
- Assisted Florida cities in challenging the use of diesel and proposed BACT determinations in prevention of significant deterioration (PSD) permits issued to two 510-MW simple cycle peaking electric generating facilities and one 1,080-MW simple cycle/combined cycle facility. Reviewed permit applications, draft permits, and FDEP engineering evaluations, assisted counsel in drafting petitions and responding to discovery. Participated in settlement discussions. Cases settled or applications withdrawn.
- Assisted large California city in federal lawsuit alleging peaker power plant was violating its federal permit. Reviewed permit file and applicant's engineering and cost feasibility study to reduce emissions through retrofit controls. Advised counsel on feasible and cost-effective

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NO_x, SO_x, and PM₁₀ controls for several 1960s diesel-fired Pratt and Whitney peaker turbines. Case settled.

- Assisted coalition of Georgia environmental groups in evaluating BACT determinations and permit conditions in PSD permits issued to several large natural gas-fired simple cycle and combined-cycle power plants. Prepared technical comments on draft PSD permits on BACT, enforceability of limits, and toxic emissions. Reviewed responses to comments, advised counsel on merits of cases, participated in settlement discussions, presented oral and written testimony in adjudicatory hearings, and provided technical assistance as required. Cases settled or won at trial.
- Assisted construction unions in review of air quality permitting actions before the Indiana Department of Environmental Management ("IDEM") for several natural gas-fired simple cycle peaker and combined cycle power plants.
- Assisted coalition of towns and environmental groups in challenging air permits issued to 523 MW dual fuel (natural gas and distillate) combined-cycle power plant in Connecticut. Prepared technical comments on draft permits and 60 pages of written testimony addressing emission estimates, startup/shutdown issues, BACT/LAER analyses, and toxic air emissions. Presented testimony in adjudicatory administrative hearings before the Connecticut Department of Environmental Protection in June 2001 and December 2001.
- Assisted various coalitions of unions, citizens groups, cities, public agencies, and developers in licensing and permitting of over 110 coal, gas, oil, biomass, and pet coke-fired power plants generating over 75,000 MW of electricity. These included base-load, combined cycle, simple cycle, and peaker power plants in Alaska, Arizona, Arkansas, California, Colorado, Georgia, Florida, Illinois, Indiana, Kentucky, Michigan, Missouri, Ohio, Oklahoma, Oregon, Texas, West Virginia, Wisconsin, and elsewhere. Prepared analyses of and comments on applications for certification, preliminary and final staff assessments, and various air, water, wastewater, and solid waste permits issued by local agencies. Presented written and oral testimony before various administrative bodies on hazards of ammonia use and transportation, health effects of air emissions, contaminated property issues, BACT/LAER issues related to SCR and SCONO_x, criteria and toxic pollutant emission estimates, MACT analyses, air quality modeling, water supply and water quality issues, and methods to reduce water use, including dry cooling, parallel dry-wet cooling, hybrid cooling, and zero liquid discharge systems.
- Assisted unions, cities, and neighborhood associations in challenging an EIR issued for the proposed expansion of the Oakland Airport. Reviewed two draft EIRs and prepared a health risk assessment and extensive technical comments on air quality and public health impacts. The California Court of Appeals, First Appellate District, ruled in favor of appellants and plaintiffs, concluding that the EIR "2) erred in using outdated information in assessing the emission of toxic air contaminants (TACs) from jet aircraft; 3) failed to support its decision

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not to evaluate the health risks associated with the emission of TACs with meaningful analysis," thus accepting my technical arguments and requiring the Port to prepare a new EIR. See *Berkeley Keep Jets Over the Bay Committee, City of San Leandro, and City of Alameda et al. v. Board of Port Commissioners* (August 30, 2001) 111 Cal.Rptr.2d 598.

- Assisted lessor of former gas station with leaking underground storage tanks and TCE contamination from adjacent property. Lessor held option to purchase, which was forfeited based on misrepresentation by remediation contractor as to nature and extent of contamination. Remediation contractor purchased property. Reviewed regulatory agency files and advised counsel on merits of case. Case not filed.
- Advised counsel on merits of several pending actions, including a Proposition 65 case involving groundwater contamination at an explosives manufacturing firm and two former gas stations with leaking underground storage tanks.
- Assisted defendant foundry in Oakland in a lawsuit brought by neighbors alleging property contamination, nuisance, trespass, smoke, and health effects from foundry operation. Inspected and sampled plaintiff's property. Advised counsel on merits of case. Case settled.
- Assisted business owner facing eminent domain eviction. Prepared technical comments on a negative declaration for soil contamination and public health risks from air emissions from a proposed redevelopment project in San Francisco in support of a CEQA lawsuit. Case settled.
- Assisted neighborhood association representing residents living downwind of a Berkeley asphalt plant in separate nuisance and CEQA lawsuits. Prepared technical comments on air quality, odor, and noise impacts, presented testimony at commission and council meetings, participated in community workshops, and participated in settlement discussions. Cases settled. Asphalt plant was upgraded to include air emission and noise controls, including vapor collection system at truck loading station, enclosures for noisy equipment, and improved housekeeping.
- Assisted a Fortune 500 residential home builder in claims alleging health effects from faulty installation of gas appliances. Conducted indoor air quality study, advised counsel on merits of case, and participated in discussions with plaintiffs. Case settled.
- Assisted property owners in Silicon Valley in lawsuit to recover remediation costs from insurer for large TCE plume originating from a manufacturing facility. Conducted investigations to demonstrate sudden and accidental release of TCE, including groundwater modeling, development of method to date spill, preparation of chemical inventory, investigation of historical waste disposal practices and standards, and on-site sewer and storm drainage inspections and sampling. Prepared declaration in opposition to motion for summary judgment. Case settled.

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- Assisted residents in east Oakland downwind of a former battery plant in class action lawsuit alleging property contamination from lead emissions. Conducted historical research and dry deposition modeling that substantiated claim. Participated in mediation at JAMS. Case settled.
- Assisted property owners in West Oakland who purchased a former gas station that had leaking underground storage tanks and groundwater contamination. Reviewed agency files and advised counsel on merits of case. Prepared declaration in opposition to summary judgment. Prepared cost estimate to remediate site. Participated in settlement discussions. Case settled.
- Consultant to counsel representing plaintiffs in two Clean Water Act lawsuits involving selenium discharges into San Francisco Bay from refineries. Reviewed files and advised counsel on merits of case. Prepared interrogatory and discovery questions, assisted in deposing opposing experts, and reviewed and interpreted treatability and other technical studies. Judge ruled in favor of plaintiffs.
- Assisted oil company in a complaint filed by a resident of a small California beach community alleging that discharges of tank farm rinse water into the sanitary sewer system caused hydrogen sulfide gas to infiltrate residence, sending occupants to hospital. Inspected accident site, interviewed parties to the event, and reviewed extensive agency files related to incident. Used chemical analysis, field simulations, mass balance calculations, sewer hydraulic simulations with SWMM44, atmospheric dispersion modeling with SCREEN3, odor analyses, and risk assessment calculations to demonstrate that the incident was caused by a faulty drain trap and inadequate slope of sewer lateral on resident's property. Prepared a detailed technical report summarizing these studies. Case settled.
- Assisted large West Coast city in suit alleging that leaking underground storage tanks on city property had damaged the waterproofing on downgradient building, causing leaks in an underground parking structure. Reviewed subsurface hydrogeologic investigations and evaluated studies conducted by others documenting leakage from underground diesel and gasoline tanks. Inspected, tested, and evaluated waterproofing on subsurface parking structure. Waterproofing was substandard. Case settled.
- Assisted residents downwind of gravel mine and asphalt plant in Siskiyou County, California, in suit to obtain CEQA review of air permitting action. Prepared two declarations analyzing air quality and public health impacts. Judge ruled in favor of plaintiffs, closing mine and asphalt plant.
- Assisted defendant oil company on the California Central Coast in class action lawsuit alleging property damage and health effects from subsurface petroleum contamination. Reviewed documents, prepared risk calculations, and advised counsel on merits of case. Participated in settlement discussions. Case settled.

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- Assisted defendant oil company in class action lawsuit alleging health impacts from remediation of petroleum contaminated site on California Central Coast. Reviewed documents, designed and conducted monitoring program, and participated in settlement discussions. Case settled.
- Consultant to attorneys representing irrigation districts and municipal water districts to evaluate a potential challenge of USFWS actions under CVPIA section 3406(b)(2). Reviewed agency files and collected and analyzed hydrology, water quality, and fishery data. Advised counsel on merits of case. Case not filed.
- Assisted residents downwind of a Carson refinery in class action lawsuit involving soil and groundwater contamination, nuisance, property damage, and health effects from air emissions. Reviewed files and provided advise on contaminated soil and groundwater, toxic emissions, and health risks. Prepared declaration on refinery fugitive emissions. Prepared deposition questions and reviewed deposition transcripts on air quality, soil contamination, odors, and health impacts. Case settled.
- Assisted residents downwind of a Contra Costa refinery who were affected by an accidental release of naphtha. Characterized spilled naphtha, estimated emissions, and modeled ambient concentrations of hydrocarbons and sulfur compounds. Deposed. Presented testimony in binding arbitration at JAMS. Judge found in favor of plaintiffs.
- Assisted residents downwind of Contra Costa County refinery in class action lawsuit alleging property damage, nuisance, and health effects from several large accidents as well as routine operations. Reviewed files and prepared analyses of environmental impacts. Prepared declarations, deposed, and presented testimony before jury in one trial and judge in second. Case settled.
- Assisted business owner claiming damages from dust, noise, and vibration during a sewer construction project in San Francisco. Reviewed agency files and PM10 monitoring data and advised counsel on merits of case. Case settled.
- Assisted residents downwind of Contra Costa County refinery in class action lawsuit alleging property damage, nuisance, and health effects. Prepared declaration in opposition to summary judgment, deposed, and presented expert testimony on accidental releases, odor, and nuisance before jury. Case thrown out by judge, but reversed on appeal and not retried.
- Presented testimony in small claims court on behalf of residents claiming health effects from hydrogen sulfide from flaring emissions triggered by a power outage at a Contra Costa County refinery. Analyzed meteorological and air quality data and evaluated potential health risks of exposure to low concentrations of hydrogen sulfide. Judge awarded damages to plaintiffs.
- Assisted construction unions in challenging PSD permit for an Indiana steel mill. Prepared technical comments on draft PSD permit, drafted 70-page appeal of agency permit action to

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the Environmental Appeals Board challenging permit based on faulty BACT analysis for electric arc furnace and reheat furnace and faulty permit conditions, among others, and drafted briefs responding to four parties. EPA Region V and the EPA General Counsel intervened as amici, supporting petitioners. EAB ruled in favor of petitioners, remanding permit to IDEM on three key issues, including BACT for the reheat furnace and lead emissions from the EAF. Drafted motion to reconsider three issues. Prepared 69 pages of technical comments on revised draft PSD permit. Drafted second EAB appeal addressing lead emissions from the EAF and BACT for reheat furnace based on European experience with SCR/SNCR. Case settled. Permit was substantially improved. See *In re: Steel Dynamics, Inc.*, PSD Appeal Nos. 99-4 & 99-5 (EAB June 22, 2000).

- Assisted defendant urea manufacturer in Alaska in negotiations with USEPA to seek relief from penalties for alleged violations of the Clean Air Act. Reviewed and evaluated regulatory files and monitoring data, prepared technical analysis demonstrating that permit limits were not violated, and participated in negotiations with EPA to dismiss action. Fines were substantially reduced and case closed.
- Assisted construction unions in challenging PSD permitting action for an Indiana grain mill. Prepared technical comments on draft PSD permit and assisted counsel draft appeal of agency permit action to the Environmental Appeals Board challenging permit based on faulty BACT analyses for heaters and boilers and faulty permit conditions, among others. Case settled.
- As part of a consent decree settling a CEQA lawsuit, assisted neighbors of a large west coast port in negotiations with port authority to secure mitigation for air quality impacts. Prepared technical comments on mobile source air quality impacts and mitigation and negotiated a \$9 million CEQA mitigation package. Represented neighbors on technical advisory committee established by port to implement the air quality mitigation program. Program successfully implemented.
- Assisted construction unions in challenging permitting action for a California hazardous waste incinerator. Prepared technical comments on draft permit, assisted counsel prepare appeal of EPA permit to the Environmental Appeals Board. Participated in settlement discussions on technical issues with applicant and EPA Region 9. Case settled.
- Assisted environmental group in challenging DTSC Negative Declaration on a hazardous waste treatment facility. Prepared technical comments on risk of upset, water, and health risks. Writ of mandamus issued.
- Assisted several neighborhood associations and cities impacted by quarries, asphalt plants, and cement plants in Alameda, Shasta, Sonoma, and Mendocino counties in obtaining mitigations for dust, air quality, public health, traffic, and noise impacts from facility operations and proposed expansions.

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- For over 100 industrial facilities, commercial/campus, and redevelopment projects, developed the record in preparation for CEQA and NEPA lawsuits. Prepared technical comments on hazardous materials, solid wastes, public utilities, noise, worker safety, air quality, public health, water resources, water quality, traffic, and risk of upset sections of EIRs, EISs, FONSI, initial studies, and negative declarations. Assisted counsel in drafting petitions and briefs and prepared declarations.
- For several large commercial development projects and airports, assisted applicant and counsel prepare defensible CEQA documents, respond to comments, and identify and evaluate "all feasible" mitigation to avoid CEQA challenges. This work included developing mitigation programs to reduce traffic-related air quality impacts based on energy conservation programs, solar, low-emission vehicles, alternative fuels, exhaust treatments, and transportation management associations.

SITE INVESTIGATION/REMEDIATION/CLOSURE

- Technical manager and principal engineer for characterization, remediation, and closure of waste management units at former Colorado oil shale plant. Constituents of concern included BTEX, As, 1,1,1-TCA, and TPH. Completed groundwater monitoring programs, site assessments, work plans, and closure plans for seven process water holding ponds, a refinery sewer system, and processed shale disposal area. Managed design and construction of groundwater treatment system and removal actions and obtained clean closure.
- Principal engineer for characterization, remediation, and closure of process water ponds at a former lanthanide processing plant in Colorado. Designed and implemented groundwater monitoring program and site assessments and prepared closure plan.
- Advised the city of Sacramento on redevelopment of two former railyards. Reviewed work plans, site investigations, risk assessment, RAPS, RI/FSs, and CEQA documents. Participated in the development of mitigation strategies to protect construction and utility workers and the public during remediation, redevelopment, and use of the site, including buffer zones, subslab venting, rail berm containment structure, and an environmental oversight plan.
- Provided technical support for the investigation of a former sanitary landfill that was redeveloped as single family homes. Reviewed and/or prepared portions of numerous documents, including health risk assessments, preliminary endangerment assessments, site investigation reports, work plans, and RI/FSs. Historical research to identify historic waste disposal practices to prepare a preliminary endangerment assessment. Acquired, reviewed, and analyzed the files of 18 federal, state, and local agencies, three sets of construction field notes, analyzed 21 aerial photographs and interviewed 14 individuals associated with operation of former landfill. Assisted counsel in defending lawsuit brought by residents

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alleging health impacts and diminution of property value due to residual contamination. Prepared summary reports.

- Technical oversight of characterization and remediation of a nitrate plume at an explosives manufacturing facility in Lincoln, CA. Provided interface between owners and consultants. Reviewed site assessments, work plans, closure plans, and RI/FSs.
- Consultant to owner of large western molybdenum mine proposed for NPL listing. Participated in negotiations to scope out consent order and develop scope of work. Participated in studies to determine premining groundwater background to evaluate applicability of water quality standards. Served on technical committees to develop alternatives to mitigate impacts and close the facility, including resloping and grading, various thickness and types of covers, and reclamation. This work included developing and evaluating methods to control surface runoff and erosion, mitigate impacts of acid rock drainage on surface and ground waters, and stabilize nine waste rock piles containing 328 million tons of pyrite-rich, mixed volcanic waste rock (andesites, rhyolite, tuff). Evaluated stability of waste rock piles. Represented client in hearings and meetings with state and federal oversight agencies.

REGULATORY (PARTIAL LIST)

- In July 2013, prepared technical report on fugitive particulate matter emissions from coal train staging at the proposed Coyote Island Terminal, Oregon, for draft Permit No. 25-0015-ST-01.
- In July 2013, prepared technical comments on air quality impacts of the Finger Lakes LPG Storage Facility as reported in various Environmental Impact Statements.
- In June 2013, prepared technical report on a Mitigated Negative Declaration for a new rail terminal at the Valero Benicia Refinery to import increased amounts of "North American" crudes in. Comments addressed air quality impacts of refining increased amounts of tar sands crudes.
- In May 2013, prepared comments on draft PSD permit for major expansion of midwest refinery to process 100% tar sands crudes, including a complex netting analysis involving debottlenecking and piecemealing and BACT analyses.
- In April 2013, prepared technical report on the Draft Supplemental Environmental Impact Statement (DSEIS) for the Keystone XL Pipeline on air quality impacts from refining increased amount of tar sands crudes at Refineries in PADD 3.
- In October 2012, prepared technical report on the Environmental Review for the Coyote Island Terminal Dock at the Port of Morrow on fugitive particulate matter emissions.

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- Prepared cost analyses and comments on New York's proposed BART determinations for NO_x, SO₂, and PM and EPA's proposed approval of BART determinations for Danskammer Generating Station under New York Regional Haze State Implementation Plan and Federal Implementation Plan, 77 FR 51915 (August 28, 2012).
- Prepared cost analyses and comments on NO_x BART determinations for Regional Haze State Implementation Plan for State of Nevada, 77 FR 23191 (April 18, 2012) and 77 FR 25660 (May 1, 2012).
- Prepared analyses of and comments on New Source Performance Standards for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, 77 FR 22392 (April 13, 2012).
- Prepared comments on CASPR-BART emission equivalency and NO_x and PM BART determinations in EPA proposed approval of State Implementation Plan for Pennsylvania Regional Haze Implementation Plan, 77 FR 3984 (January 26, 2012).
- Prepared comments and statistical analyses on hazardous air pollutants (HAPs) emission controls, monitoring, compliance methods, and the use of surrogates for acid gases, organic HAPs, and metallic HAPs for proposed National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units, 76 FR 24976 (May 3, 2011).
- Prepared cost analyses and comments on NO_x BART determinations and emission reductions for proposed Federal Implementation Plan for Four Corners Power Plant, 75 FR 64221 (October 19, 2010).
- Prepared cost analyses and comments on NO_x BART determinations for Colstrip Units 1- 4 for Montana State Implementation Plan and Regional Haze Federal Implementation Plan, 77 FR 23988 (April 20, 2010).
- For EPA Region 8, prepared report: Revised BART Cost Effectiveness Analysis for Tail-End Selective Catalytic Reduction at the Basin Electric Power Cooperative Leland Olds Station Unit 2 Final Report, March 2011, in support of 76 FR 58570 (Sept. 21, 2011).
- For EPA Region 6, prepared report: Revised BART Cost-Effectiveness Analysis for Selective Catalytic Reduction at the Public Service Company of New Mexico San Juan Generating Station, November 2010, in support of 76 FR 52388 (Aug. 22, 2011).
- For EPA Region 6, prepared report: Revised BART Cost-Effectiveness Analysis for Flue Gas Desulfurization at Coal-Fired Electric Generating Units in Oklahoma: Sooner Units 1 & 2, Muskogee Units 4 & 5, Northeastern Units 3 & 4, October 2010, in support of 76 FR 16168 (March 26, 2011). My work was upheld in: *State of Oklahoma v. EPA*, App. Case 12-9526 (10th Cir. July 19, 2013).

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- Identified errors in N₂O emission factors in the Mandatory Greenhouse Gas Reporting Rule, 40 CFR 98, and prepared technical analysis to support Petition for Rulemaking to Correct Emissions Factors in the Mandatory Greenhouse Gas Reporting Rule, filed with EPA on 10/28/10.
- Assist interested parties develop input for and prepare comments on the Information Collection Request for Petroleum Refinery Sector NSPS and NESHAP Residual Risk and Technology Review, 75 FR 60107 (9/29/10).
- Technical reviewer of EPA's "Emission Estimation Protocol for Petroleum Refineries," posted for public comments on CHIEF on 12/23/09, prepared in response to the City of Houston's petition under the Data Quality Act (March 2010).
- Prepared comments on SCR cost effectiveness for EPA's Advanced Notice of Proposed Rulemaking, Assessment of Anticipated Visibility Improvements at Surrounding Class I Areas and Cost Effectiveness of Best Available Retrofit Technology for Four Corners Power Plant and Navajo Generating Station, 74 FR 44313 (August 28, 2009).
- Prepared comments on Proposed Rule for Standards of Performance for Coal Preparation and Processing Plants, 74 FR 25304 (May 27, 2009).
- Prepared comments on draft PSD permit for major expansion of midwest refinery to process up to 100% tar sands crudes. Participated in development of monitoring and controls to mitigate impacts and in negotiating a Consent Decree to settle claims in 2008.
- Reviewed and assisted interested parties prepare comments on proposed Kentucky air toxic regulations at 401 KAR 64:005, 64:010, 64:020, and 64:030 (June 2007).
- Prepared comments on proposed Standards of Performance for Electric Utility Steam Generating Units and Small Industrial-Commercial-Industrial Steam Generating Units, 70 FR 9706 (February 28, 2005).
- Prepared comments on Louisville Air Pollution Control District proposed Strategic Toxic Air Reduction regulations.
- Prepared comments and analysis of BAAQMD Regulation, Rule 11, Flare Monitoring at Petroleum Refineries.
- Prepared comments on Proposed National Emission Standards for Hazardous Air Pollutants; and, in the Alternative, Proposed Standards of Performance for New and Existing Stationary Sources: Electricity Utility Steam Generating Units (MACT standards for coal-fired power plants).
- Prepared Authority to Construct Permit for remediation of a large petroleum-contaminated site on the California Central Coast. Negotiated conditions with agencies and secured permits.

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- Prepared Authority to Construct Permit for remediation of a former oil field on the California Central Coast. Participated in negotiations with agencies and secured permits.
- Prepared and/or reviewed hundreds of environmental permits, including NPDES, UIC, Stormwater, Authority to Construct, Prevention of Significant Deterioration, Nonattainment New Source Review, Title V, and RCRA, among others.
- Participated in the development of the CARB document, *Guidance for Power Plant Siting and Best Available Control Technology*, including attending public workshops and filing technical comments.
- Performed data analyses in support of adoption of emergency power restoration standards by the California Public Utilities Commission for “major” power outages, where major is an outage that simultaneously affects 10% of the customer base.
- Drafted portions of the Good Neighbor Ordinance to grant Contra Costa County greater authority over safety of local industry, particularly chemical plants and refineries.
- Participated in drafting BAAQMD Regulation 8, Rule 28, Pressure Relief Devices, including participation in public workshops, review of staff reports, draft rules and other technical materials, preparation of technical comments on staff proposals, research on availability and costs of methods to control PRV releases, and negotiations with staff.
- Participated in amending BAAQMD Regulation 8, Rule 18, Valves and Connectors, including participation in public workshops, review of staff reports, proposed rules and other supporting technical material, preparation of technical comments on staff proposals, research on availability and cost of low-leak technology, and negotiations with staff.
- Participated in amending BAAQMD Regulation 8, Rule 25, Pumps and Compressors, including participation in public workshops, review of staff reports, proposed rules, and other supporting technical material, preparation of technical comments on staff proposals, research on availability and costs of low-leak and seal-less technology, and negotiations with staff.
- Participated in amending BAAQMD Regulation 8, Rule 5, Storage of Organic Liquids, including participation in public workshops, review of staff reports, proposed rules, and other supporting technical material, preparation of technical comments on staff proposals, research on availability and costs of controlling tank emissions, and presentation of testimony before the Board.
- Participated in amending BAAQMD Regulation 8, Rule 18, Valves and Connectors at Petroleum Refinery Complexes, including participation in public workshops, review of staff reports, proposed rules and other supporting technical material, preparation of technical comments on staff proposals, research on availability and costs of low-leak technology, and presentation of testimony before the Board.

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- Participated in amending BAAQMD Regulation 8, Rule 22, Valves and Flanges at Chemical Plants, etc, including participation in public workshops, review of staff reports, proposed rules, and other supporting technical material, preparation of technical comments on staff proposals, research on availability and costs of low-leak technology, and presentation of testimony before the Board.
- Participated in amending BAAQMD Regulation 8, Rule 25, Pump and Compressor Seals, including participation in public workshops, review of staff reports, proposed rules, and other supporting technical material, preparation of technical comments on staff proposals, research on availability of low-leak technology, and presentation of testimony before the Board.
- Participated in the development of the BAAQMD Regulation 2, Rule 5, Toxics, including participation in public workshops, review of staff proposals, and preparation of technical comments.
- Participated in the development of SCAQMD Rule 1402, Control of Toxic Air Contaminants from Existing Sources, and proposed amendments to Rule 1401, New Source Review of Toxic Air Contaminants, in 1993, including review of staff proposals and preparation of technical comments on same.
- Participated in the development of the Sunnyvale Ordinance to Regulate the Storage, Use and Handling of Toxic Gas, which was designed to provide engineering controls for gases that are not otherwise regulated by the Uniform Fire Code.
- Participated in the drafting of the Statewide Water Quality Control Plans for Inland Surface Waters and Enclosed Bays and Estuaries, including participation in workshops, review of draft plans, preparation of technical comments on draft plans, and presentation of testimony before the SWRCB.
- Participated in developing Se permit effluent limitations for the five Bay Area refineries, including review of staff proposals, statistical analyses of Se effluent data, review of literature on aquatic toxicity of Se, preparation of technical comments on several staff proposals, and presentation of testimony before the Bay Area RWQCB.
- Represented the California Department of Water Resources in the 1991 Bay-Delta Hearings before the State Water Resources Control Board, presenting sworn expert testimony with cross examination and rebuttal on a striped bass model developed by the California Department of Fish and Game.
- Represented the State Water Contractors in the 1987 Bay-Delta Hearings before the State Water Resources Control Board, presenting sworn expert testimony with cross examination and rebuttal on natural flows, historical salinity trends in San Francisco Bay, Delta outflow, and hydrodynamics of the South Bay.
- Represented interveners in the licensing of over 20 natural-gas-fired power plants and one coal gasification plant at the California Energy Commission and elsewhere. Reviewed and

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prepared technical comments on applications for certification, preliminary staff assessments, final staff assessments, preliminary determinations of compliance, final determinations of compliance, and prevention of significant deterioration permits in the areas of air quality, water supply, water quality, biology, public health, worker safety, transportation, site contamination, cooling systems, and hazardous materials. Presented written and oral testimony in evidentiary hearings with cross examination and rebuttal. Participated in technical workshops.

- Represented several parties in the proposed merger of San Diego Gas & Electric and Southern California Edison. Prepared independent technical analyses on health risks, air quality, and water quality. Presented written and oral testimony before the Public Utilities Commission administrative law judge with cross examination and rebuttal.
- Represented a PRP in negotiations with local health and other agencies to establish impact of subsurface contamination on overlying residential properties. Reviewed health studies prepared by agency consultants and worked with agencies and their consultants to evaluate health risks.

WATER QUALITY/RESOURCES

- Directed and participated in research on environmental impacts of energy development in the Colorado River Basin, including contamination of surface and subsurface waters and modeling of flow and chemical transport through fractured aquifers.
- Played a major role in Northern California water resource planning studies since the early 1970s. Prepared portions of the Basin Plans for the Sacramento, San Joaquin, and Delta basins including sections on water supply, water quality, beneficial uses, waste load allocation, and agricultural drainage. Developed water quality models for the Sacramento and San Joaquin Rivers.
- Conducted hundreds of studies over the past 40 years on Delta water supplies and the impacts of exports from the Delta on water quality and biological resources of the Central Valley, Sacramento-San Joaquin Delta, and San Francisco Bay. Typical examples include:
 1. Evaluate historical trends in salinity, temperature, and flow in San Francisco Bay and upstream rivers to determine impacts of water exports on the estuary;
 2. Evaluate the role of exports and natural factors on the food web by exploring the relationship between salinity and primary productivity in San Francisco Bay, upstream rivers, and ocean;
 3. Evaluate the effects of exports, other in-Delta, and upstream factors on the abundance of salmon and striped bass;
 4. Review and critique agency fishery models that link water exports with the abundance of striped bass and salmon;

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5. Develop a model based on GLMs to estimate the relative impact of exports, water facility operating variables, tidal phase, salinity, temperature, and other variables on the survival of salmon smolts as they migrate through the Delta;
 6. Reconstruct the natural hydrology of the Central Valley using water balances, vegetation mapping, reservoir operation models to simulate flood basins, precipitation records, tree ring research, and historical research;
 7. Evaluate the relationship between biological indicators of estuary health and down-estuary position of a salinity surrogate (X2);
 8. Use real-time fisheries monitoring data to quantify impact of exports on fish migration;
 9. Refine/develop statistical theory of autocorrelation and use to assess strength of relationships between biological and flow variables;
 10. Collect, compile, and analyze water quality and toxicity data for surface waters in the Central Valley to assess the role of water quality in fishery declines;
 11. Assess mitigation measures, including habitat restoration and changes in water project operation, to minimize fishery impacts;
 12. Evaluate the impact of unscreened agricultural water diversions on abundance of larval fish;
 13. Prepare and present testimony on the impacts of water resources development on Bay hydrodynamics, salinity, and temperature in water rights hearings;
 14. Evaluate the impact of boat wakes on shallow water habitat, including interpretation of historical aerial photographs;
 15. Evaluate the hydrodynamic and water quality impacts of converting Delta islands into reservoirs;
 16. Use a hydrodynamic model to simulate the distribution of larval fish in a tidally influenced estuary;
 17. Identify and evaluate non-export factors that may have contributed to fishery declines, including predation, shifts in oceanic conditions, aquatic toxicity from pesticides and mining wastes, salinity intrusion from channel dredging, loss of riparian and marsh habitat, sedimentation from upstream land alternations, and changes in dissolved oxygen, flow, and temperature below dams.
- Developed, directed, and participated in a broad-based research program on environmental issues and control technology for energy industries including petroleum, oil shale, coal

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mining, and coal slurry transport. Research included evaluation of air and water pollution, development of novel, low-cost technology to treat and dispose of wastes, and development and application of geohydrologic models to evaluate subsurface contamination from in-situ retorting. The program consisted of government and industry contracts and employed 45 technical and administrative personnel.

- Coordinated an industry task force established to investigate the occurrence, causes, and solutions for corrosion/erosion and mechanical/engineering failures in the waterside systems (e.g., condensers, steam generation equipment) of power plants. Corrosion/erosion failures caused by water and steam contamination that were investigated included waterside corrosion caused by poor microbiological treatment of cooling water, steam-side corrosion caused by ammonia-oxygen attack of copper alloys, stress-corrosion cracking of copper alloys in the air cooling sections of condensers, tube sheet leaks, oxygen in-leakage through condensers, volatilization of silica in boilers and carry over and deposition on turbine blades, and iron corrosion on boiler tube walls. Mechanical/engineering failures investigated included: steam impingement attack on the steam side of condenser tubes, tube-to-tube-sheet joint leakage, flow-induced vibration, structural design problems, and mechanical failures due to stresses induced by shutdown, startup and cycling duty, among others. Worked with electric utility plant owners/operators, condenser and boiler vendors, and architect/engineers to collect data to document the occurrence of and causes for these problems, prepared reports summarizing the investigations, and presented the results and participated on a committee of industry experts tasked with identifying solutions to prevent condenser failures.
- Evaluated the cost effectiveness and technical feasibility of using dry cooling and parallel dry-wet cooling to reduce water demands of several large natural-gas fired power plants in California and Arizona.
- Designed and prepared cost estimates for several dry cooling systems (e.g., fin fan heat exchangers) used in chemical plants and refineries.
- Designed, evaluated, and costed several zero liquid discharge systems for power plants.
- Evaluated the impact of agricultural and mining practices on surface water quality of Central Valley streams. Represented municipal water agencies on several federal and state advisory committees tasked with gathering and assessing relevant technical information, developing work plans, and providing oversight of technical work to investigate toxicity issues in the watershed.

AIR QUALITY/PUBLIC HEALTH

- Prepared or reviewed the air quality and public health sections of hundreds of EIRs and EISs on a wide range of industrial, commercial and residential projects.
- Prepared or reviewed hundreds of NSR and PSD permits for a wide range of industrial facilities.

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- Designed, implemented, and directed a 2-year-long community air quality monitoring program to assure that residents downwind of a petroleum-contaminated site were not impacted during remediation of petroleum-contaminated soils. The program included real-time monitoring of particulates, diesel exhaust, and BTEX and time integrated monitoring for over 100 chemicals.
- Designed, implemented, and directed a 5-year long source, industrial hygiene, and ambient monitoring program to characterize air emissions, employee exposure, and downwind environmental impacts of a first-generation shale oil plant. The program included stack monitoring of heaters, boilers, incinerators, sulfur recovery units, rock crushers, API separator vents, and wastewater pond fugitives for arsenic, cadmium, chlorine, chromium, mercury, 15 organic indicators (e.g., quinoline, pyrrole, benzo(a)pyrene, thiophene, benzene), sulfur gases, hydrogen cyanide, and ammonia. In many cases, new methods had to be developed or existing methods modified to accommodate the complex matrices of shale plant gases.
- Conducted investigations on the impact of diesel exhaust from truck traffic from a wide range of facilities including mines, large retail centers, light industrial uses, and sports facilities. Conducted traffic surveys, continuously monitored diesel exhaust using an aethalometer, and prepared health risk assessments using resulting data.
- Conducted indoor air quality investigations to assess exposure to natural gas leaks, pesticides, molds and fungi, soil gas from subsurface contamination, and outgassing of carpets, drapes, furniture and construction materials. Prepared health risk assessments using collected data.
- Prepared health risk assessments, emission inventories, air quality analyses, and assisted in the permitting of over 70 1 to 2 MW emergency diesel generators.
- Prepare over 100 health risk assessments, endangerment assessments, and other health-based studies for a wide range of industrial facilities.
- Developed methods to monitor trace elements in gas streams, including a continuous real-time monitor based on the Zeeman atomic absorption spectrometer, to continuously measure mercury and other elements.
- Performed nuisance investigations (odor, noise, dust, smoke, indoor air quality, soil contamination) for businesses, industrial facilities, and residences located proximate to and downwind of pollution sources.

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BEFORE THE
PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION
U.S. DEPARTMENT OF TRANSPORTATION

Advance Notice of Proposed Rulemaking

Hazardous Materials:
Rail Petitions and Recommendations To Improve the
Safety of Railroad Tank Car Transportation

PHMSA-2012-0082 (HM-251)
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Comments of the Natural Resources Defense Council,
Sierra Club and Oil Change International on behalf of

Earthjustice
ForestEthics
Public Citizen
Friends of the Earth
Spokane Riverkeeper
Columbia Riverkeeper
Puget Soundkeeper Alliance
Friends of Grays Harbor
Natural Resources Council of Maine
Benicia Good Neighbor Steering Committee
Community In-power and Development Association
Vermont Chapter of the Sierra Club
Audubon Society of New Hampshire

Submitted December 5, 2013

I. INTRODUCTION

These comments are submitted, in response to the above-captioned Advance Notice of Proposed Rulemaking by the Sierra Club, Oil Change International and the Natural Resources Defense Council on behalf of their millions of members and active supporters, and on behalf of Earthjustice, ForestEthics, Public Citizen, Friends of the Earth, Spokane Riverkeeper, Columbia Riverkeeper, Puget Soundkeeper Alliance, Friends of Grays Harbor, Natural Resources Council of Maine, Benicia Good Neighbor Steering Committee, Community In-power and Development

Analysis of the Potential Costs of Accidents/Spills Related to Crude by Rail

Prepared

by

Ian Goodman
Brigid Rowan

on behalf of
Oil Change International

Before the
Pipeline and Hazardous Materials Safety Administration
in the Context of
Hazardous Materials: Rail Petitions and Recommendations to Improve
the Safety of Railroad Tank Car Transportation
Docket No. PHMSA-2012-0082 (HM-251)



the goodman group, ltd.
<http://www.thegoodman.com/>

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1. Introduction

This analysis was prepared by The Goodman Group, Ltd. (TGG), a consulting firm specializing in energy and regulatory economics,¹ on behalf of Oil Change International. Any findings, conclusions or opinions are those of TGG and the authors and do not necessarily reflect those of Oil Change International.

The costs of crude by rail (CBR) accidents/spills can be very large. This analysis demonstrates that a major crude by rail (CBR) unit train accident/spill could cost \$1 billion or more for a single event.

The following examples provide key support for our findings:

1. The explosion, fire and spill of Bakken crude from a train derailment in Lac-Mégantic, QC (2013): The Lac-Mégantic rail accident/spill will likely have costs in the order of \$500 million to \$1 billion. Costs/damages for a similar incident could have been substantially higher had it occurred in a more populated area. Lac-Mégantic is also relevant in that it shows how an accident involving highly flammable light crude (such as the Bakken crude) can have devastating consequences even in a small town in terms of loss of human life and widespread explosion and fire damage to surrounding property.
2. The spill of tar sands dilbit² from Enbridge's Line 6B in Marshall, MI (2010): This rupture had costs of about \$1 billion for Enbridge. The spill volumes at Marshall were within the range of the amount of spill possible (and, in fact, substantially less than the maximum spill) if a crude by rail unit train released much of its cargo. Costs/damages for similar incident could have also been substantially higher had it occurred in a more populated area. Marshall is also relevant in

¹ www.thegoodman.com This analysis was co-authored by Ian Goodman and Brigid Rowan.

² Diluted bitumen. Raw bitumen (a very heavy asphalt-like crude produced from the Alberta tar sands) is diluted for the purposes of rail and pipeline transport. Bitumen is transported in various forms, including a) SCO (raw bitumen upgraded to light synthetic crude oil), b) raw bitumen mixed with a petroleum-based diluent (such as naphtha or condensate) to make it less viscous, or c) raw bitumen (no diluent). SCO and dilbit (diluted bitumen to pipeline specifications, 25–30% diluent) can be transported in standard (non-coiled and non-insulated) tank cars and pipelines. Railbit (bitumen with 15–20% diluent) and raw bitumen can be transported in coiled and insulated tank cars (which are also sometimes used to transport dilbit). Keystone XL Draft Supplemental EIS, p. 1.4-49. Accessed October 30, 2013. <http://keystonepipeline-xl.state.gov/documents/organization/205654.pdf>

showing the high potential cost of dilbit spills into water (and rail lines are often highly proximate to water).³

The AAR petition for rulemaking states:⁴

AAR surveyed its members for information on derailments involving packing group I and II materials from '2004-2008. The derailments resulted in one fatality and eleven injuries, the release of approximately 925,000 gallons of these hazardous materials, and cleanup costs totaling approximately \$63 million.

The Village of Barrington petition for rulemaking responds:⁵

Furthermore, while AAR claims that derailment costs totaled approximately \$64 million over the past five years, including equipment, lading, response and environmental remediation costs," [footnote 17 in original: March 9, 2011 Petition for Rulemaking letter to Dr. Magdy El-Sibae from Michael Rush of the Association of American Railroads at page 2, footnote 7.] Petitioners question the accuracy of industry's cost-benefit claims. In reviewing the derailment cost chart at Attachment B of AAR's petition, PHMSA should note that there is no apparent accounting for costs associated with civil litigation in the wake of derailments. However, in the Cherry Valley/Rockford derailment, CN paid over \$36 million in October of 2011 to settle a lawsuit brought by the family of only one victim. AAR's chart, however, reflects costs of only \$8 million for that incident. [footnote 18 in original: At the very least, Petitioners believe it would make sense for the PHMSA to ascertain the costs stemming from civil litigation for the entire list of derailments incidents that the AAR provided to your office on March 9, 2011. Even if it doesn't yet completely balance the cost-benefit equation in favor of public safety, Petitioners would guess that the plaintiffs' bar would look forward to securing ever higher awards for future victims of derailments based on the public record demonstrating that industry chose to do nothing meaningful in terms of investing in a retrofit program of tank cars that are known to be dangerous and that are increasingly serving as a rolling pipeline for the ethanol and crude oil industries.]

³ The discussion of the costs of the Lac-Mégantic disaster and the Marshall, MI pipeline rupture is partly based on excerpts from a TGG report filed as written expert testimony at Canada's National Energy Board:

"The Relative Economic Costs and Benefits of the Line 9B Reversal and Line 9 Capacity Expansion," August 8, 2013, pp. 38-41. Accessed October 23, 2013.

<https://www.neb-one.gc.ca/ll-eng/livelink.exe?func=ll&objId=985663&objAction=Open>

⁴ See <http://www.regulations.gov/#!documentDetail;D=PHMSA-2012-0082-0005> p. 2. Accessed October 29, 2013.

⁵ See <http://www.regulations.gov/#!documentDetail;D=PHMSA-2012-0082-0006> p. 8. Accessed October 29, 2013.

In fact, even a single accident relating to a crude by rail unit train can have dramatically higher costs than the costs taken into account in the AAR's cost-benefit claims. As further explained in this briefing, this analysis will demonstrate that a major crude by rail unit train accident/spill, involving either dilbit or a very light crude such as Bakken, could cost \$1 billion or more for a single event.

We have limited our cost analysis to environmental and socio-economic impacts that directly affect economic activity and can be somewhat readily (albeit approximately) quantified using market economics. These costs escalate very quickly in more densely populated urban areas. Moreover, as we have witnessed firsthand in Quebec, in summer 2013, unconventional crudes (such as Bakken and dilbit) have hazardous characteristics (notably flammability), such that their unsafe transport can result in the loss of human life. We have not attempted to assign a cost to potential effects on human health and safety or to broader effects on ecosystems (notably residual effects).⁶

As noted above, two relevant examples to support our findings that a single unit-train accident/spill could result in very large costs are the following:

1. the explosion, fire and spill of Bakken crude from a train derailment in Lac-Mégantic, QC (2013).
2. the spill of tar sands dilbit from Enbridge's Line 6B in Marshall, MI (2010).

For each example, TGG will provide:

1. description of the disaster;
2. the cost and sources of the cost data;
3. the relevance of the example to estimating the potential costs of CBR accidents/spills.

⁶ Residual effects are those effects remaining after implementation of mitigation measures, such as emergency response and decontamination efforts.

2. Estimated Costs of the Crude by Rail Disaster at Lac-Mégantic

2.1. Description of Disaster

According to the Transportation Safety Board of Canada (TSB), “[o]n July 6 2013, a unit train carrying petroleum crude oil operated by Montreal, Maine & Atlantic Railway (MMA) derailed numerous cars in Lac-Mégantic, Quebec, and a fire and explosions ensued.”⁷

The train with five locomotives was pulling 72 DOT-111 tanker cars full of light crude oil from the Bakken shale play in North Dakota to the Irving Oil refinery in Saint John, New Brunswick. The train was operated by Montreal Maine & Atlantic Railway. The train broke away and derailed, unleashing an explosive ball of burning Bakken crude, which incinerated the downtown core of this small Quebec town.⁸

Quebec’s Department of Sustainable Development, Environment and Parks reports that this rail accident released 6.0 million litres⁹ of crude oil into the environment (affecting soil, water and air).¹⁰ Among its other findings (as of October 28, 2013):

- A total of 7.7 million litres¹¹ of crude oil were on the runaway MMA train
- from a total of 72 tankers, 63 spilled and 9 avoided spilling during the accident
- 43 million litres of oily water have been recovered from Lac-Mégantic’s city centre (sewer system, lake, and grounds)
- 52,000 litres of oily water removed from the nearby Chaudière River

⁷ See TSB website, Railway investigation R13D0054. Accessed October 29, 2013.

<http://www.bst-tsb.gc.ca/eng/enquetes-investigations/rail/2013/R13D0054/R13D0054.asp>

⁸ “Lac-Mégantic: What we know, what we don’t,” Montreal Gazette, July 22, 2013. Accessed August 2, 2013.

<http://www.montrealgazette.com/news/M%C3%A9gantic+What+know+what+know/8626661/story.html>

⁹ Equivalent to 1.6 million gallons.

¹⁰ See Quebec Department of Sustainable Development, Environment and Parks website, Train Accident in Lac-Mégantic (content in French: *Ministère du Développement durable, de l’Environnement, de la Faune et des Parcs (MDDEFP), Accident ferroviaire à Lac-Mégantic*), Accessed November 8, 2013

<http://www.mddefp.gouv.qc.ca/lac-megantic/index.htm>; and specifically

Summary Table on quantities of oil estimated as of October 28, 2013 (*Tableau-Synthèse: Estimation au 28 octobre 2013 des quantités de pétrole brut léger impliquées dans l’accident à Lac-Mégantic*)

<http://www.mddefp.gouv.qc.ca/lac-megantic/20131028-tableau-synthese-petrole.pdf>

¹¹ Equivalent to 2.0 million gallons.

the oily water recovered has concentrations of oil ranging from 2% to 50%, and it is not possible to determine the exact amount of oil actually recovered.

“The catastrophe killed 47 residents and levelled more than 40 buildings.”¹²

According to a September 11, 2013 TSB news release, “TSB test results indicate that the level of hazard posed by the petroleum crude oil transported in the tank cars on the accident train was not accurately documented.” The crude was “offered for transport, packaged, and transported as a Class 3, PG III product, which represented it as a lower hazard, less volatile flammable liquid.”¹³

2.2. Costs and Sources of Cost Data

The TSB investigation into the accident is still ongoing.¹⁴ It is still too early to know the final costs for this disaster (including decontamination, town reconstruction, economic recovery, and compensation for victims’ families); but **TGG estimates these costs to be in the hundreds of millions (in the order of \$500 million to \$1 billion).**

Preliminary clean-up bills for damage to the town doubled in the weeks following the accident from \$4 million to almost \$8 million. The MM&A Railway stated at the end of July that it was unable to pay clean-up costs because it was not getting funds from its insurers. At the time, MM&A had outstanding bills for \$7.8 million. MM&A also publicly raised the concern that it could go bankrupt.¹⁵ In response, the Quebec government ordered World Fuel Services Corp. to assist with the clean-up. World Fuel “purchased the oil from producers in North Dakota’s Bakken region, then leased and loaded rail

¹² McNish, Jacquie and Justin Giovanetti, “Oil Company Disputes Lac-Mégantic Cleanup Order,” Globe and Mail. Accessed August 4.

<http://www.theglobeandmail.com/news/national/oil-company-disputes-lac-megantic-cleanup-order/article13518237/>

¹³ “TSB calls on Canadian and U.S. regulators to ensure properties of dangerous goods are accurately determined and documented for safe transportation,” TSB News release, September 11, 2013. Accessed October 29, 2013.

<http://www.bst-tsb.gc.ca/eng/medias-media/communiqués/rail/2013/r13d0054-20130911.asp>

The news release further explains that this misclassification may partly explain why the crude ignited so quickly following the rupture.

¹⁴ See the TSB active investigation page for Lac-Mégantic:

<http://www.bst-tsb.gc.ca/eng/enquetes-investigations/rail/2013/R13D0054/R13D0054.asp>

¹⁵ Blatchford, Andy, “Railway says it can’t pay for Lac-Mégantic disaster cleanup”

<http://www.theglobeandmail.com/news/national/mma-lays-off-nearly-one-third-of-quebec-workforce-union/article13496970/#dashboard/follows/>

cars and arranged for their transport to an Irving Oil refinery in New Brunswick.”¹⁶ World Fuel is disputing the cleanup order.

“In the end, says one expert in civil responsibility, taxpayers could be stuck with a bill in the hundreds of millions of dollars.

Quebec law professor Daniel Gardner says he highly doubts MM&A has enough coverage to absorb the massive, combined financial liabilities of damages like environmental cleanup, emergency-crew salaries and lawsuits.

In fact, he believes the Lac-Mégantic derailment could have more financial consequences than any other land disaster in North American history.

“The whole cost of this will be far closer to \$1 billion than to \$500 million,” said the Université Laval academic, adding he would be surprised if the railway had a total of \$500 million in coverage.

“What will probably happen? ...The company will go bankrupt, insurance coverage won’t be enough.”

Gardner expects governments will wind up covering the difference.¹⁷

On August 7, 2013, MM&A filed for bankruptcy in both Canada (Quebec) and the US (Maine).¹⁸

“It has become apparent that the obligations of both companies now exceed the value of their assets, including prospective insurance recoveries,” MM&A chairman Edward Burkhardt said in a statement Wednesday.

Filing for bankruptcy is “the best way to ensure fairness of treatment to all in these tragic circumstances,” he said.

The decision means the company will start a judge-supervised process to determine how much money will be paid to its various creditors. The process, which allows the company to tackle its unmanageable debt load and remain viable, can be lengthy and typically places secured creditors ahead of those seeking compensation through a lawsuit.

¹⁶ See footnote 12.

¹⁷ See footnote 15.

¹⁸ Mackrael, Kim and Tu Thanh Ha, “MM&A files for creditor protection after Lac-Mégantic rail disaster” Globe and Mail. Accessed August 7.

<http://www.theglobeandmail.com/news/national/rail-company-involved-in-megantic-disaster-files-for-bankruptcy/article13644535/#dashboard/follows/>

MM&A's insurance provider, XL Group, has so far declined to cover the cleanup bills, leaving the province to step in and pay more than \$8-million to ensure the work continues.

The court documents indicate that XL has no plans to contribute to continuing environmental recovery costs because it has decided to prioritize claims from victims affected by the disaster. MM&A's insurance policy with XL covers the company for up to \$25-million, according to the court documents.

Because of the number of claims and the amounts being claimed, the insurer "cannot provide for payment of covered environmental cleanup costs to the detriment of the third-party claimants, especially where the amounts of the claims exceed the limit of the coverage," the documents state.

Based on the information provided above, the now bankrupt MM&A has liabilities in excess of assets, minimal insurance coverage (\$25 million); and the insurer has so far refused to pay environmental cleanup costs.

Ongoing squabbling has recently intensified between Quebec and the Canadian federal government over who should pay for the clean-up, economic recovery and town reconstruction. Quebec is insisting that the federal government pitch in more than the \$60M they have committed to. In the October 2013 Throne Speech, the federal government promised to help more with decontamination and reconstruction but have yet to commit to an exact amount.

The Quebec government has still not supplied the federal government with a cost estimate for the cleanup and reconstruction. Federal officials refuse to commit to a fixed amount without a final bill.¹⁹

While MM&A is bankrupt, some **\$25 million** in derailment insurance policy is earmarked by the US bankruptcy trustee for the victim's families. There is a possibility that additional compensation could be obtained for the families from a second insurance policy or from the sale of the company's assets, but these amounts are uncertain.²⁰

¹⁹ The Globe and Mail, "Throne Speech to promise help with Lac-Mégantic cleanup, but not a 'blank cheque,' insiders say," October 15, 2013.
<http://www.theglobeandmail.com/news/politics/throne-speech-to-promise-help-with-lac-megantic-cleanup-but-not-a-blank-cheque-insiders-say/article14883079/#dashboard/follows/>

²⁰ Montreal Gazette, "Quebec rail victims could begin to see compensation in mid-2014: U.S. trustee," October 22, 2013.
<http://www.montrealgazette.com/business/Quebec+rail+victims+could+begin+compensation+mid2014/9066861/story.html>

Certainly, even individual victims of derailment have recently received compensation greater than \$25 million,²¹ therefore higher compensation, if available, would be justifiable.

On the **decontamination costs alone** there are a series of estimates:

- In late July 2013, a Quebec-based Ecotoxicologist, Emilien Pelletier, estimates that the bill just for decontamination would be **\$500 million** and that doesn't include town reconstruction.²²
- In early August 2013, MM&A was reported to have estimated the decontamination costs at **\$200 million** in court documents.²³
- In an October 2013 article, the Quebec government recently estimated the **soil decontamination costs alone at \$150 million.**²⁴

Overall costs estimates vary from several hundred million dollars to \$1 billion:

- As indicated above, Quebec law professor, Daniel Gardner, estimated in August that the costs would far closer to **\$1 billion than \$500 million.**²⁵
- In September 2013, the Toronto Star reported that cleanup costs are pegged as high as **\$500 million by some estimates.**²⁶
- On October 15, 2013, the Globe and Mail (Canada's National paper), indicated that "[e]xperts and government officials expect that **the bill will easily reach \$200-million, and could even end up in the vicinity of \$1-billion.**"²⁷

In light of the above, it would appear that the minimum decontamination costs would be \$200 million and the minimum total costs (decontamination, town reconstruction and

²¹ See footnote 5.

²² See <http://www.ledevoir.com/environnement/actualites-sur-l-environnement/383941/blanchet>

²³ See <http://www.theglobeandmail.com/news/national/quebec-could-still-be-on-hook-for-cleanup-bill/article13680378/#dashboard/follows/> and http://www.thestar.com/news/canada/2013/08/09/lac_megantic_cleanup_to_stretch_into_next_year.html

²⁴ See http://www.thestar.com/news/canada/2013/10/03/lacmegantic_ottawa_to_pitch_in_more_money_for_cleanup_of_train_derailment.html

²⁵ See footnote 15.

²⁶ See http://www.thestar.com/news/canada/2013/09/24/lac_megantic_cleanup_quebec_asks_federal_government_to_share_bill.html#

²⁷ See footnote 19.

economic recovery, and compensation for victims' families) would be approximately \$500 million. The total bill could escalate to \$1 billion and beyond. The updated information is consistent with TGG's August 2013 estimate from the NEB expert report:

“It is far too early to know the final costs for this disaster but they are estimated to be in the hundreds of millions, and possibly exceed \$1 billion.”²⁸

2.3. Relevance of Lac-Mégantic to Estimating the Costs of CBR Accidents/Spills

The Lac-Mégantic tragedy is directly relevant to an estimation of the costs of a major CBR accident/spill for the following reasons:

1. It demonstrates the consequences of a CBR accident in a small town by a lake, thus proximate to people, water and economic activity.
2. The Lac-Mégantic tragedy demonstrates the effect of a rupture of 63 tank cars on a unit train with a total of 72 tankers, all carrying Bakken crude.
3. Bakken crude, which caused the explosion, is very light, and has hazardous characteristics (notably flammability).
4. Rail is now transporting over 600,000 barrels per day (and over 60% of the total) from Bakken production.²⁹
5. More generally, the rapid expansion of CBR results from the rapid expansion in production and transport of unconventional crudes (Bakken and other light crudes from shale/tight oil plays and dilbit and other heavy crudes from Canadian tar sands).³⁰

²⁸ See footnote 3, p. 39.

²⁹ See North Dakota Pipeline Authority website. Accessed October 30, 2013.

<http://northdakotapipelines.com/directors-cut/>.

Monthly Updates for April 2013-October 2013 (February 2013-August 2013 data), reporting transport by rail ranging from 600,000 to 700,000 barrel per day, comprising 61-75% of total Bakken production.

³⁰ To date, a sizable proportion of overall recent CBR activity relates to Bakken production. The Keystone XL Draft Supplemental EIS (KXL DSEIS) assumes that CBR could be rapidly expanded to transport expanded Canadian tar sands production of dilbit and other heavy crudes, so as to provide a viable alternative to expanded pipeline capacity. The KXL DSEIS analysis of tar sands CBR is flawed and potentially misleading because it assumes that CBR can be quickly and vastly scaled up, with no significant operating, logistical, economic or regulatory constraints. Nonetheless, some Western Canadian production is already being transported by rail into the US (including dilbit, railbit, and raw bitumen, from both tar sands and non-tar sands), and there is a potential for further expansion of CBR transport of unconventional Canadian crudes.

See footnote 29; Titterton, Paul, Tank Car Update: Presentation to SWARS, February 28, 2013.

Accessed October 30, 2013.

http://www.swrailshippers.com/swars_pdfs/2013_gatx_presentation.pdf;

(footnote continued on next page)

6. In addition to the devastation of the Lac-Mégantic town center, there has been significant release of crude oil (6.0 million liters or 1.6 million gallons) into the environment (affecting soil, water and air).³¹
7. There are very serious concerns about who will bear the financial responsibility for the disaster.

Although the Lac-Mégantic accident/spill was devastating and will likely have costs in the order of \$500 million to \$1 billion, it is nowhere near a worst-case scenario for a CBR accident.

Costs/damages for a similar incident could have been substantially higher had it occurred in a more populated area. Lac-Mégantic demonstrates how an accident involving highly flammable light crude (such as the Bakken crude) can have devastating consequences even in a small town in terms of loss of human life and widespread explosion and fire damage to surrounding property. In an urban area, the effects of such an accident could be catastrophic and costs could easily escalate to the multi-billion dollar range.³²

(footnote continued from previous page)

Keystone XL Draft Supplemental EIS, pp. 1.4-33 – 1.4-60. Accessed October 30, 2013.

<http://keystonepipeline-xl.state.gov/documents/organization/205654.pdf>;

Goodman, Ian and Brigid Rowan, Report evaluating the adequacy of the Keystone XL (KXL) Draft Supplemental Environmental Impact Statement (DSEIS) Market Analysis, April 22, 2013, pp. 33-50, Adobe pp. 267-284

<http://switchboard.nrdc.org/blogs/aswift/Comments%20of%20Sierra%20Club%2C%20et.%20al.%2C%20on%20the%20Keystone%20XL%20DSEIS.4.22.13.pdf>

³¹ There have been concerns that the spill affected water quality and drinking water in Lac-Mégantic and nearby towns. Authorities continue to monitor water quality.

“Government Examining Lac-Mégantic Health Risks,” The Record, July 31, 2013. Accessed August 2, 2013.

<http://www.sherbrookerecord.com/content/gov%E2%80%99t-examining-lac-megantic-health-risks>;
see also footnote 10.

³² In the context of the PHMSA rulemaking and elsewhere, some may submit that the Lac-Mégantic accident is an exceptional and possibly worst-case scenario that is unlikely to be repeated. And this particular accident certainly has some attributes that may be atypical or even unique. That said, this accident also occurred in a relatively small town. A similar explosion and fire in a more dense urban area could have had even worse consequences and higher costs. In an urban area, the particular factors in Lac-Mégantic (unattended train rolling down steep grades to crash at high speeds) may be far less likely to occur. On the other hand, in an urban area, there are other risk factors, such as increased danger of collisions with other trains (or other vehicles), as well as proximity to large populations and other infrastructure.

It may also be pointed out that the Lac-Mégantic accident occurred in Canada and that the estimated costs are in Canadian dollars. But in fact, the Lac-Mégantic accident is very relevant for the US. First, US and Canadian dollars now have similar value, so the cost estimates for Lac-Mégantic accident would be similar if presented in US dollars. Second, the accident occurred very close to the US border, on a train that had originated in the US (North Dakota), traveled through numerous US states and cities, and would have again passed through the US (Maine) on its intended routing between Quebec and New Brunswick.

3. Estimated Costs of Enbridge's Line 6B Spill in Marshall, MI

3.1. Description of Disaster

According to the NTSB, following its investigation of the Enbridge Line 6B Spill (emphasis added):³³

On Sunday, July 25, 2010, at about 5:58 p.m., a 30 inch-diameter pipeline (Line 6B) owned and operated by Enbridge Incorporated ruptured and spilled crude oil into an ecologically sensitive area near the Kalamazoo River in Marshall, Mich., for 17 hours until a local utility worker discovered the oil and contacted Enbridge to report the rupture.

The NTSB found that the material failure of the pipeline was the result of multiple small corrosion-fatigue cracks that over time grew in size and linked together, creating a gaping breach in the pipe measuring over 80 inches long.

"This investigation identified a complete breakdown of safety at Enbridge. Their employees performed like Keystone Kops and failed to recognize their pipeline had ruptured and continued to pump crude into the environment," said NTSB Chairman Deborah A.P. Hersman. "Despite multiple alarms and a loss of pressure in the pipeline, for more than 17 hours and through three shifts they failed to follow their own shutdown procedures."

[...]

Over 840,000 gallons of crude oil - enough to fill 120 tanker trucks - spilled into hundreds of acres of Michigan wetlands, fouling a creek and a river. A Michigan Department of Community Health study concluded that over 300 individuals suffered adverse health effects related to benzene exposure, a toxic component of crude oil.

Line 6B had been scheduled for a routine shutdown at the time of the rupture to accommodate changing delivery schedules. Following the shutdown, operators in the Enbridge control room in Edmonton, Alberta, received multiple alarms indicating a problem with low pressure in the pipeline, which were dismissed as

³³ NTSB Press Release, "Pipeline Rupture and Oil Spill Accident Caused by Organizational Failures and Weak Regulations," July 10, 2012. Accessed August 3, 2012.
<http://www.nts.gov/news/2012/120710.html>

being caused by factors other than a rupture. "Inadequate training of control center personnel" was cited as contributing to the accident.

The investigation found that Enbridge failed to accurately assess the structural integrity of the pipeline, including correctly analyzing cracks that required repair. The NTSB characterized Enbridge's control room operations, leak detection, and environmental response as deficient, and described the event as an "organizational accident."

Following the first alarm, Enbridge controllers restarted Line 6B twice, pumping an additional 683,000 gallons of crude oil, or 81 percent of the total amount spilled, through the ruptured pipeline. The NTSB determined that if Enbridge's own procedures had been followed during the initial phases of the accident, the magnitude of the spill would have been significantly reduced. Further, the NTSB attributed systemic flaws in operational decision-making to a "culture of deviance," which concluded that personnel had developed an operating culture in which not adhering to approved procedures and protocols was normalized.

The NTSB also cited the Pipeline and Hazardous Materials Safety Administration's weak regulations regarding pipeline assessment and repair criteria as well as a cursory review of Enbridge's oil spill response plan as contributing to the magnitude of the accident.

The investigation revealed that the cracks in Line 6B that ultimately ruptured were detected by Enbridge in 2005 but were not repaired. A further examination of records revealed that Enbridge's crack assessment process was inadequate, increasing the risk of a rupture.

"This accident is a wake-up call to the industry, the regulator, and the public. Enbridge knew for years that this section of the pipeline was vulnerable yet they didn't act on that information," said Chairman Hersman. "Likewise, for the regulator to delegate too much authority to the regulated to assess their own system risks and correct them is tantamount to the fox guarding the hen house. Regulators need regulations and practices with teeth, and the resources to enable them to take corrective action before a spill. Not just after."

As a result of the investigation, the NTSB reiterated one recommendation to PHMSA and issued 19 new safety recommendations to the Department of the Transportation, PHMSA, Enbridge Incorporated, the American Petroleum Institute, the International Association of Fire Chiefs, and the National Emergency Number Association.

3.2. Costs and Sources of Cost Data

As of March 31, 2013, Enbridge indicated in its First Quarter Interim Report to Shareholders that the total clean-up for the spill is now estimated to cost approximately \$1 billion. Enbridge's civil penalty for the spill was only \$3.7 million.³⁴ Enbridge also points out that there is a possibility that the clean-up bill will continue to increase as the clean-up is still ongoing.

No lives were lost, but as the NTSB citation above indicates: "over 300 individuals suffered adverse health effects related to benzene exposure, a toxic component of crude oil." Furthermore, "[o]ver 840,000 gallons of crude oil - enough to fill 120 tanker trucks - spilled into hundreds of acres of Michigan wetlands, fouling a creek and a river."

3.3. Relevance of Marshall, MI to Estimating the Costs of CBR Accidents/Spills

The Marshall, MI pipeline disaster is also highly relevant to an estimation of the costs of a major CBR accident/spill for the following reasons:

1. It demonstrates the costs of a dilbit spill in an environmentally sensitive area (with wetlands and proximity to waterways and human population) in a non-urban area.³⁵ Marshall, MI is not dissimilar to the many areas through which trains are also routed (along waterways in order to minimize elevation and through population centers throughout the US).
2. The spill volumes at Marshall were within the range of the amount of spill possible (and, in fact, substantially less than the maximum spill) if a crude by rail unit train released much of its cargo. 840,000 gallons (or 3.3 million liters) were spilled at Marshall, the equivalent of the full cargo release of 27 tank cars (carrying 31,000 gallons) or 34 tank cars (carrying 25,000 gallons).³⁶ With

³⁴ Enbridge First Quarter Interim Report to Shareholders for the Three Months Ended March 31, 2013, Section 11 Contingencies, Adobe p. 67. Accessed August 3, 2013.

See <http://www.enbridge.com/InvestorRelations/FinancialInformation/InvestorDocumentsandFilings.aspx> and then click on FIRST QUARTER REPORT under 2013.

³⁵ The population of Marshall is approximately 7,000.

³⁶ Maximum capacity per tank car typically varies between 25,000 and 31,800 gallons of crude, based on factors including maximum weight limits, tank car design, and type of crude. Capacity will generally be lower for heavy crudes (such as the dilbit spilled at Marshall), which weigh more per gallon than light crudes (such as the Bakken crude spilled at Lac-Mégantic). Likewise, capacity will be lower for tank cars (footnote continued on next page)

transport by unit trains on the rise, and unit trains carrying up to 100+ tank cars, it would be possible for a unit train to spill significantly higher volumes than the 840,000 gallons (or 3.3 million liters) released at Marshall. The 6.0 million liters released at Lac-Mégantic (almost twice the amount released at Marshall) provide support for this finding.

3. In light of recent findings regarding the Line 6B spill, the EPA has recently expressed concerns regarding the additional impacts of tar sands crude spills (versus conventional oil), with a particular concern about spills on waterways.³⁷

Regarding the need for improved safety regulation for CBR, there are a number of regulatory lessons from the Marshall, MI rupture that should be considered:

1. The NTSB investigation also clearly indicates that in the case of Enbridge, and with respect to the regulation of pipeline operators, “trust us” isn’t good enough. Chair Hersman has insightfully pointed out that “for the regulator to delegate too much authority to the regulated to assess their own system risks and correct them is tantamount to the fox guarding the hen house.”³⁸ Chair Hersman’s words are even more relevant for the regulation of transport of hazardous materials by rail, which is in many ways both weaker and more fragmented than the regulation of liquid pipelines.³⁹
2. The NTSB investigation pointed out that the Marshall rupture was “a wake-up call” to industry, the regulator, and the public.” Enbridge knew for years that the

(footnote continued from previous page)

which have higher tare (unloaded) weights (such as those with heater coils and insulation, which are also sometimes used to transport dilbit).

³⁷ Comments of EPA on the Department of State’s Keystone XL Draft Supplement Environmental Impact Statement (DSEIS). Accessed October 30, 2013.

<http://epa.gov/compliance/nepa/keystone-xl-project-epa-comment-letter-20130056.pdf>

³⁸ See footnote 33.

³⁹ As described in various other documents in the current proceeding, there is a long history of problems in regard to transport of hazardous materials (notably flammable liquids) by rail, with only a very slow and partial response to tighten standards to insure public safety. See Village of Barrington, Illinois and The Regional Answer to Canadian National (TRAC) - Petition for Rulemaking (P-1587); National Transportation Safety Board - Accident Report - Derailment of CN Freight Train U70691-18 With Subsequent Hazardous Materials Release and Fire Cherry Valley, Illinois June 19, 2009; and National Transportation Safety Board - Safety Recommendation - R-12-5 through -8, R-07-4 (Reiteration)

In the case of liquid pipelines, the pipeline owner/operator is typically responsible for construction and operation of all facilities within its transport system that are handling hazardous materials (notably flammable liquids), including pipes, valves, and pumping stations. By contrast, in the case of rail, the railroads provide motive power and crews to move hazardous materials (notably flammable liquids) in tank cars which are typically owned, loaded, and unloaded by shippers and other entities besides the railroads.

pipeline was vulnerable; much as the rail industry knows that another CBR spill is only a matter of time.

Although the Line 6B rupture caused widespread devastation to the Kalamazoo and surrounding wetlands and, at \$1 billion in clean-up costs, holds the record for the single most expensive onshore spill in US history,⁴⁰ it is nowhere near the worst-case scenario for a CBR disaster. Similar to the Lac-Mégantic tragedy involving a CBR release of Bakken, the costs/damages for a CBR dilbit spill could be substantially higher in a more populated area, and costs could easily escalate to the multi-billion dollar range. The clean-up of dilbit, especially in waterways is particularly problematic and expensive. Moreover, the condensate can be highly flammable when spilled and this flammability could have catastrophic consequences in a more densely populated area.

⁴⁰ See footnote 33.

4. Conclusion

As the examples of the Lac-Mégantic CBR tragedy and the Marshall, MI pipeline rupture have demonstrated, a major CBR unit train accidents/spill could cost \$1 billion or more for a single event.

Unit trains now transport unconventional crude, including both dilbit and Bakken, through densely populated urban areas, and this form of transport is rapidly growing. An accident/spill in an urban area could damage and disrupt major infrastructure, result in serious and widespread water and soil contamination, and possibly cause loss of life. The costs of a major unit train derailment in an urban centre could easily escalate into the multi-billion dollar range.

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CANADA NEWS

Officials Tighten Crude-Shipping Standards

By BETSY MORRIS and RUSSELL GOLD

Updated Aug. 7, 2013 10:09 p.m. ET

The Federal Railroad Administration plans to start asking shipping companies to supply testing data they use to classify their crude-oil shipments, saying it is concerned that some shipments are being transported in tank cars that aren't safe enough.

In a letter to American Petroleum Institute CEO Jack Gerard last week, the FRA said it is investigating whether some crude shipments contain chemicals—possibly from the hydraulic-fracturing process used to extract it—that make them more hazardous than their classification indicates.



Oil containers sit at a train depot outside Williston, N.D., last month. Oil producers and refiners are increasingly using rail in North Dakota and Texas, where there aren't enough pipelines. *Getty Images*

The agency told the API it also suspects that mixes of crude and other chemicals might be the cause of an increase in damage to tank cars caused by "severe corrosion." If shippers can't supply their testing data, the FRA said in the letter, it will work with the Pipeline and Hazardous Materials Safety Administration to test the shipments independently.

Companies routinely add highly corrosive hydrochloric acid to fracking fluid to break down rock formations. They also add certain chemicals to kill microorganisms and reduce friction in oil. Frack fluids are exempt from federal disclosure laws, but some companies voluntarily provide details, and some states require a thorough ingredient list.

The action is the latest by the agency to toughen regulation of the transport by rail of crude oil after a runaway train hauling 72 tank cars with crude oil derailed and exploded last month, killing 47 people and ravaging the Quebec town of Lac-Mégantic.

The latest FRA action "looks like a shot over the bow," said Grady Cothen, a former FRA safety official who is now a transportation-policy consultant. "They seem to be saying, 'Get your house in order or we'll do it for you.' "

The Quebec disaster follows a number of serious accidents involving hazardous materials and tank cars in recent years that have raised federal regulators' concern. More than 34 million barrels of crude were delivered to U.S. refineries by train in 2012, a fivefold increase compared with a year earlier, according to the Energy Information Administration, the statistical arm of the U.S. Energy Department. The volume is

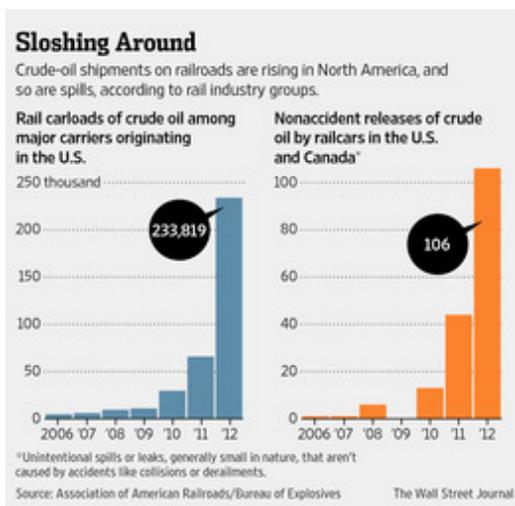
expected to increase again in 2013.

The Canadian Transportation Safety Board said it would analyze and compare numerous fluid samples taken from the Lac-Mégantic accident "to verify the properties of the petroleum product in these tank cars" and to help figure out "why the oil created such a fierce fire that night." It is also analyzing metallurgical samples, damage records and photographs to determine how well the tank cars involved in the derailment were prepared to withstand a crash.

The company that operated that train, Montreal, Maine & Atlantic Railway Ltd., filed for bankruptcy protection Wednesday in U.S. Bankruptcy Court in Bangor, Maine. Its Canadian counterpart filed for protection from creditors.

The FRA moves will likely pose difficulties for some shippers. Oil producers and refiners are increasingly using rail in Texas and North Dakota, where there aren't enough pipelines to get the crude to markets that will command the highest price.

Prentiss Searles, marketing-issues manager for the American Petroleum Institute, said the institute was reviewing the letter to see what, if anything, needed to be done to respond to the FRA's concerns. "Ultimately, we're going to follow the rules and requirements that currently exist. If somebody made a mistake and put the wrong type of crude in the wrong type of tank care, that should not happen," he said.



EOG Resources Inc., a Houston-based energy producer that ships crude from rail yards in Texas and North Dakota, said it was "in close communication with our railroad carriers and is currently reviewing the topics raised by the Federal Railroad Administration." Jeff Hume of Continental Resources Inc., an Oklahoma City-based crude producer, said: "We meet all [Department of Transportation] specifications. If the DOT deems it necessary to change those specifications, we will support what safety experts recommend."

In the detailed letter to the Petroleum Institute, Thomas J. Herrmann, acting director of FRA's office of safety assurance and compliance, spelled out numerous reasons for the agency's concern. In one example, the FRA said a company was shipping crude that should have been classified as flammable in a tank car that hadn't been designed for that material. The agency could "only speculate as to the number of potential crude-oil shipments that are being made in violation of Hazardous Material Regulations," he wrote.

Shippers need to know the chemical makeup of substances they are shipping, the letter said. But FRA said its audits indicate the oil is often classified based on outdated testing and testing that doesn't reflect all the batches of oil from different sources and wells that are being mixed. Crude is frequently shipped in unit trains made up of scores of tank cars, containing oil from different shippers and many wells, some of which has been blended together.

The FRA also noted recurring problems with what it said appeared to be overloaded tank cars. Proper tank-car loading is based on a calculation that involves relative temperatures and gravity to determine the quantity to load without overloading that will result in leaks.

George King, an engineer and technology consultant for Apache Corp., said hydrochloric acid used in fracking typically doesn't return to the surface. "I have never seen anything stronger than a very, very weak vinegar come back in terms of acid," he said.

However, Mr. King said the acid won't mix with crude oil and if stored in a tanker, will settle to the bottom. "Could it be corrosive on steel? Yes," he said.

—Daniel Gilbert contributed to this article.

Write to Betsy Morris at betsy.morris@wsj.com

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