May 2, 2014

Re: Intent to Approve: Petroleum Processing Plant Project No: N14627-0002

Dear Mr. Bird, Mr. Humpherys, and Mr. DeJulis:

Thank you for the opportunity to comment on the Intent to Approve-N14627-0002 (DAQE-IN146270002-14) issued by the Utah Division of Air Quality (DAQ) to Emery Refining LLC (Emery) dated March 21, 2014. The Grand Canyon Trust submits these comments on behalf of the Grand Canyon Trust, the Southern Utah Wilderness Alliance, Living Rivers, Colorado Riverkeeper, the Center for Biological Diversity, and the Sierra Club (collectively Trust). The Trust hereby incorporates the technical comments submitted by Dr. J. Phyllis Fox on behalf of the Trust, and attached as Exhibit 1.

Before reaching our substantive comments, we would like to express our appreciation of DAQ’s willingness to provide us with documents relevant to the project, to answer our questions concerning the planned facility, and for extending the public comment period. The Trust and DAQ share the goal of ensuring that all emitting facilities are permitted in a way that maximally protects Utah’s public and environmental health.

Identity of Commenting Parties

1. Grand Canyon Trust
Grand Canyon Trust is a non-profit corporation with offices in Flagstaff, Arizona, and Moab and Salt Lake City, Utah. The mission of the Grand Canyon Trust is to protect and restore the Colorado Plateau – its spectacular landscapes, flowing rivers, clean air, diversity of plants and animals, and areas of beauty and solitude. The Colorado Plateau includes the town of Green River, Utah, the site of Emery’s proposed refinery, and the larger area surrounding Green River that will be impacted by decreased air quality resulting from the operation of the Green River Refinery. One of the Trust’s goals is to ensure that the Colorado Plateau is a region characterized by vast open spaces with restored, healthy ecosystems, and habitat for all native fish, animals, and plants. To accomplish this, the Trust works to curb climate change and advocates for sustainable energy policies across the Colorado Plateau. The Trust’s board, staff, and members use the area whose air quality will be impacted by Emery’s proposed refinery for quiet recreation
(including hiking, biking, fishing, rafting and camping), scientific research, aesthetic pursuits, and spiritual renewal. Many of the Trust board, staff, and members live in Utah, and thus air pollution in Utah adversely affects their health, quality of life, recreational pursuits, and aesthetic sense. The Grand Canyon Trust and its members have a protectable legal interest in ensuring that DAQ regulates Emery’s proposed refinery to the maximum extent required by the Utah Air Conservation Act and that emissions from the facility are properly modeled, monitored, reported, quantified, characterized, and minimized as required by law.

2. Southern Utah Wilderness Alliance
The Southern Utah Wilderness Alliance is a non-profit environmental membership organization dedicated to the sensible management of all public lands within the state of Utah, to the preservation and protection of plant and animal species, the protection of air and water quality on public lands, and to the preservation of Utah’s remaining wild lands. The Southern Utah Wilderness Alliance is headquartered in Salt Lake City, Utah and also has offices in Moab, Utah. The Southern Utah Wilderness Alliance has members in all fifty states and several foreign countries. The Southern Utah Wilderness Alliance’s members use and enjoy public lands in and throughout Utah for a variety of purposes, including scientific study, recreation, wildlife viewing, hunting, aesthetic appreciation, and financial livelihood. Members of the Southern Utah Wilderness Alliance frequently visit and recreate (e.g., sightsee, view and appreciate pre-historic and historic cultural sites, bird watch, and enjoy solitude) throughout area that will be impacted by Emery’s proposed refinery. Many of the Southern Utah Wilderness Alliance board, staff, and members live in Utah, and thus air pollution in Utah adversely affects their health, quality of life, recreational pursuits, and aesthetic sense. The Southern Utah Wilderness Alliance and its members have a protectable legal interest in ensuring that DAQ regulates Emery’s proposed refinery to the maximum extent required by the Utah Air Conservation Act and that emissions from the facility are properly modeled, monitored, reported, quantified, characterized, and minimized as required by law.

3. Living Rivers
Living Rivers is a regional nonprofit organization that promotes river restoration through mobilization. By articulating conservation and alternative management strategies to the public, we seek to revive the natural habitat and spirit of rivers by undoing the extensive damage done by dams, diversions and pollution on the Colorado Plateau. Living Rivers’ staff, board and members use the lands whose air quality will be impacted by Emery’s proposed refinery for quiet recreation (including hiking, biking, rafting and camping), scientific research, aesthetic pursuits, and spiritual renewal.

4. Center for Biological Diversity
The Center is a non-profit environmental organization with more than 450,000 members and online activists, including many members who live and recreate in the areas in and affected by actions taken within the planning area in Colorado, Utah and Wyoming. The Center uses science, policy and law to advocate for the conservation and recovery of species on the brink of extinction and the habitats they need to survive. The Center has and continues to actively advocate for increased protections for species and habitats in the area impacted by Emery’s proposed refinery and its associated air emissions. The Center’s board, staff, and members use the area potentially impacted by emissions from Emery’s proposed refinery for quiet recreation
(including hiking, biking and camping), scientific research, aesthetic pursuits, and spiritual renewal.

5. Sierra Club
The Sierra Club is a national nonprofit organization of approximately 2.4 million members and supporters dedicated to exploring, enjoying, and protecting the wild places of the earth; to practicing and promoting the responsible use of the earth’s ecosystems and resources; to educating and enlisting humanity to protect and restore the quality of the natural and human environment; and to using all lawful means to carry out these objectives. The Sierra Club’s Utah Chapter has approximately 3,600 members. The Sierra Club’s staff and members use the lands and waters whose air quality will be impacted by Emery’s proposed refinery for quiet recreation (including hiking, biking and camping), scientific research, aesthetic pursuits, and spiritual renewal.

6. Colorado Riverkeeper
Since 2002, John Weisheit has served the Colorado River basin as the official Colorado Riverkeeper and is in good standing with the overarching Waterkeeper Alliance based in New York City. There are over 200 Waterkeepers on six continents and adhere to the mission of protecting the water resources, which includes the atmosphere’s water cycle, for both human and wildlife communities. Waterkeeper Alliance provides a way for communities to stand up for their right to clean water and for the wise and equitable use of water resources, both locally and globally. The vision of the Waterkeeper movement is for drinkable, swimmable and fishable waterways worldwide. As the Colorado Riverkeeper, John Weisheit uses the land and waters – particularly the Green River – whose quality will be adversely impacted by Emery’s proposed refinery for quiet recreation (including camping, rafting, boating, and swimming), scientific research, and spiritual renewal.

Comments Regarding DAQ’s Permitting Process

1. The Ongoing Construction of the Refinery is Illegal

The construction of this refinery during the public notice and comment period has violated and continues to violate the Utah Air Quality Rules, the Utah Air Conservation Act, and the federal Clean Air Act.

The Utah Air Quality Rules explicitly provide for a pre-construction public comment period and a public hearing, and mandate that “the director will consider all comments received during the public comment period and at the public hearing and, if appropriate, will make changes to the proposal in response to comments before issuing an approval order or disapproval order.” R307-401-7(3). In turn, the Utah Air Quality Rules require new sources of air pollution to obtain an Approval Order “prior to initiation of construction,” which is defined as “any physical change or change in the method of operation (including fabrication, erection, installation, demolition, or modification of an emissions unit) that would result in a change of emissions. R306-401-2

The Utah Air Quality Rules ensure that DAQ will consider and mitigate environmental and public health effects of emissions before the company commits resources to a project. See R307-401-7 (1), (2) – Public Notice (“prior to issuing an approval or disapproval order…the
director’s analysis of the notice of intent proposal, and the proposed approval order conditions will be available for public inspection.”); R307-401-7 (3) (“the director will consider all comments received during the public comment period and at the public hearing and, if appropriate, will make changes to the proposal in response to comments before issuing an approval order or disapproval order”).

DAQ has not yet determined whether Emery’s October 2013 Notice of Intent complies with the federal Clean Air Act, the Utah State Implementation Plan, and the Utah Air Quality Rules. The public, including members of petitioning parties, are – indeed, by writing this very comment – participating in the public hearing and comment procedures that accompany DAQ’s review of Emery’s 2013 Notice. Each of these public participation opportunities is intended to occur prior to the issuance of an approval order, which is in-turn a prerequisite to construction of the facility.

Yet, Emery is currently constructing its refinery in Green River, Utah. The Trust is deeply concerned with DAQ’s failure to ensure that Emery does not construct its refinery prior to receiving an applicable approval order, and its disregard of the plain meaning of the Utah Air Quality Rules, the Utah Air Conservation Act, and the federal Clean Air Act. DAQ should immediately stay refinery construction pending issuance of an applicable approval order.

2. DAQ Failed to Provide for Meaningful Public Participation

DAQ’s refusal to grant the Trust a thirty-day extension to the public comment period hinders full public participation in the permitting process. Given the complexity of commenting on an entirely new petroleum processing plant, a nine-day extension is simply insufficient to allow the public to fully engage in the permitting process. Pursuant to the Utah Air Quality Rules, the public must, arguably, raise any ascertainable issues relating to this project during the public comment period or face the prospect of having those claims dismissed should the public wish to appeal any final AO. Moreover, as DAQ is aware, the agency and the applicant have significant time to revise and finalize the NOI and ITA. Fairness favors an extension of the public comment period for an additional thirty days as expressly allowed by the Utah Air Quality Rules. The Trust hopes and expects that it is DAQ’s goal and desire to allow the public to participate in the permitting process in a meaningful manner and to do all that it can to make that participation well-informed. DAQ’s refusal to grant a thirty-day extension despite the Trust’s timely request hinders public participation in this important air quality issue. Nonetheless, the Trust appreciates the nine-day extension.

Secondly and relatedly, DAQ’s failure to directly communicate the date and time of the public hearing to the Trust risks thwarting full public participation in the permitting process. The Trust timely requested a public hearing as guaranteed by R307-401-7 (2) (b) (iv)-(v) on March 27, 2014, two days after the public announcement of the ITA. DAQ did not even respond to this timely request until a second communication on April 8, 2014, and then did not provide any details about the location or time of the hearing.

DAQ never directly informed the Trust of its decision of where and when to hold the hearing. Instead, the Trust became aware of the April 30, 2014 hearing in Green River as a result of performing daily internet searches for the notice. Again, DAQ’s failure to directly communicate the details of the public hearing to the Trust hinders meaningful public participation in the permitting process. It is DAQ’s duty to provide the public with opportunities to communicate their many concerns about preserving Utah’s clean air resources, and protecting
public and environmental health in Green River. Despite this, DAQ consistently throws up roadblocks to public participation, which is contrary to the intent and purpose of the Utah Air Quality Rules, the Utah Air Conservation Act, and the Due Process and Open Courts Clauses of the Utah Constitution.

Legal Flaws in the ITA

1. The Proposed Refinery is a Major Source of Greenhouse Gas Emissions and Volatile Organic Compounds

As Dr. Fox’s technical analysis – attached and incorporated here by reference – reveals, when GHGe and VOC emissions are properly accounted for, GHGe emissions from the refinery exceed 100,000 tons per year and VOC emissions exceed 100 tons per year. This renders the refinery a major source. Major sources must comply with numerous requirements including, but not limited to, (1) an impact analysis for Class I visibility areas – including Arches and Canyonlands National Parks– pursuant to R307-406-2 to R307-406-4; and (2) meeting all the requirements of Utah’s Title V Program.

As a major source, Emery is subject to the Class I visibility impact analysis requirements under the Utah Air Quality Rules and the federal Clean Air Act. Specifically the Utah Air Quality Rules provide that:

“the director shall require the use of air pollution control equipment, technologies, methods or work practices deemed necessary to mitigate visibility impacts in Class I areas that would occur as a result of emissions from such source. The director shall take into consideration as a part of the review and control requirements: (a) the costs of compliance; (b) the time necessary for compliance; (c) the energy usage and conservation; (d) the non-air quality environmental impacts of compliance; (e) the useful life of the source; and (f) the degree of visibility improvement, which will be provided as a result of control.” R307-406-2.

Prior to determining whether to issue an approval order, DAQ and Emery must evaluate the impacts on Canyonlands and Arches National Parks, located approximately 50 km and downwind from the proposed refinery. In addition, DAQ must inform the Federal Land Managers for both Arches and Canyonlands of the proposed refinery and provide them with documentation of the NOI and visibility impacts analysis. See R307-406-3. If this analysis reveals an adverse impact on visibility in either Class I area, the director shall not issue the approval order. R307-406-3 (1). Finally, any approval order finally issued must contain any and all requirements deemed necessary to protect these Class I visibility areas. R307-406-2.

Next, as a major source, Emery is also subject to Title V Permitting requirements found at 40 C.F.R. part 70; Utah Admin. Code R307-415-4(1)(a); see also R307-415-4(2). As a result, all of the requirements of Utah’s Title V program apply to the permitting of the facility, including, but not limited to, a permit application that provides: 1) identification and description of all points of emission; 2) descriptions of fuels, fuel use, raw materials, production rates, and operating schedules; 3) citation and description of all applicable requirements; 4) a compliance plan; 5) a compliance schedule; 6) and, a schedule for submission of certified progress reports. Utah Code Ann. R307-415-5c. Yet, the NOI fails to meet these requirements.
In addition, a proper Title V permit must meet all the requirements listed in R307-415-6a, including: 1) emission limitations and standards, including those operational requirements and limitations that assure compliance with all applicable requirements at the time of permit issuance; and 2) monitoring and related recordkeeping and reporting requirements. The permit must also meet the requirements of R307-415-6b and 6c. Yet, the ITA fails to meet these standards. These flaws must be addressed prior to DAQ’s decision of whether to issue an approval order.

2. The ITA Lacks Sufficient Emission Limitations

The Director may issue an Approval Order only if he determines that the pollution control for emissions of criteria pollutants and GHGe is at least best available control technology (BACT). Rule 307-401-8(1)(a) (AO is appropriate only where “[t]he degree of pollution control for emissions, to include fugitive emissions and fugitive dust, is at least best available control technology.”); see also Rule 307-401-8(5) (“If the director determines that a proposed stationary source, modification or relocation does not meet the conditions established in (1) above, the director will not issue an approval order.”). BACT is defined as:

[A]n emissions limitation (including a visible emissions standard) based on the maximum degree of reduction for each air contaminant which would be emitted from any proposed stationary source or modification which the director, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR parts 60 and 61. If the director determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results. R307-401-2(1) (emphasis added).

The purpose of the BACT analysis is for the Director to undertake a thorough analysis and review of permit applications, and issue an Approval Order with emissions limitations based on BACT sufficient to protect public and environmental health as intended by the federal Clean Air Act, the Utah Air Conservation Act, and the Utah Air Quality Rules. Indeed, the Utah Supreme Court has found that Utah’s BACT requirement must be interpreted in keeping with the federal Clean Air Act. See Utah Chapter of the Sierra Club v. Air Quality Board, 2009 UT 76, ¶ 21, 226 P.3d 719 (finding the Director is required to interpret the state’s air quality regulations in a manner that achieves the purpose of the Clean Air Act’s PSD program). Thus, the Utah Supreme Court has held that a sufficient BACT emission limitation must achieve maximum
reduction of air pollution, be enforceable, and protect the nation’s health-based short-term NAAQS. See id. at ¶ 47 (“Further, the EPA has described the goals of BACT emission limitations in three-parts: (1) to achieve the lowest percent reduction; (2) to protect short-term ambient standards; and (2) to be enforceable as a practical matter.”) (citing EPA, New Source Review Workshop Manual: Prevention of Significant Deterioration and Nonattainment Area Permitting B.6 – .9 (1990)).

In Utah Chapter of the Sierra Club, the Utah Supreme Court summarized the requirements of Utah’s BACT rule, and concluded that the ultimate result of BACT analysis is the imposition of an emission limitation on the source. The Court explained:

All PSD programs, whether federal or state, require a new [or modified] source to undergo [BACT] review. This review is often conducted using the five-step “top-down method,” which in essence requires the applicant to adopt the most stringent control technology, unless it can show that the technology is not achievable due to energy, environmental, or fiscal impacts…Once the BACT is selected for a new facility, an emission limitation based on that control technology is also imposed as part of BACT. Id. at ¶ 4.

As Utah Chapter of the Sierra Club, makes clear, properly choosing best technology is only the first step toward satisfying the legal requirements for a BACT analysis. To complete the process, the Director must impose an emissions limitation based on the chosen BACT: “Once the BACT is selected…an emission limitation based on that technology is also imposed as part of BACT.” Id. at ¶ 4.

The Utah Supreme Court’s interpretation of BACT as requiring an emission limitation for each pollutant at its source accords with the EPA’s interpretation of the identical BACT definition in the federal Clean Air Act. See In Re: Indeck-Elwood LLC, 2006 WL 3073109 (EPA PSD Appeal 03-04) at 25 (“BACT ordinarily is expressed in numeric terms or as a combination of numeric limits and design, equipment, work practices and/or operational standards. In limited circumstances, however, the regulations allow the permitting authority to substitute work practices, operational standards, design or equipment limitations for numeric limits to satisfy BACT.”) (footnotes omitted).

The Intent to Approve is legally insufficient evaluated against the standards outlined above because the Director failed to impose emission limits for each pollutant emitted from the emissions sources at the refinery. Indeed, the ITA’s sole emission limitation is found in the SO2 emission limitation for the boilers and heaters. Yet, as Emery’s NOI and DAQ’s engineering review makes clear, each emission source from the refinery emits numerous criteria pollutants. For example, the process boilers and heaters emit PM, SO2, NO2, CO, VOC, CO N2O, CH4, and HAPs. Pursuant to the Utah Air Quality Rules and established EPA guidance, the ITA must include emission limitations for each of these pollutants. Yet, the only pollutant with an emission limitation is SO2. Similarly, DAQ and Emery acknowledge that the flare system emits PM, SOx, NOx, CO, and VOCs. Yet, the ITA lacks emission limitations for each of these pollutants and instead only limits H2S. Finally, the DAQ and Emery acknowledge that the thermal oxidizer emits PM, SO2, NO2, CO, VOC, CO N2O, CH4, and HAPs. Yet the ITA fails to

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1 Indeed, Emery’s own BACT analysis established emission limits to satisfy BACT for fired sources. Dr. Fox’s technical comments suggesting the incorporation of these limits into the ITA are incorporated here.
include emission limitations for these pollutants. The failure to include emission limitations for the pollutants emitted from the process boilers and heaters, thermal oxidizer, and the flare violates the Utah Air Quality Rules and must be remedied in the final AO.

3. **The ITA’s Conditions are Not Enforceable**

   Moreover, the ITA lacks enforceable permit conditions and emission limitations to ensure that the refinery is a minor source. This is particularly problematic because both VOC and GHGe emissions exceed the significance threshold for major sources – indeed, as noted above, the refinery is a major source for both of these pollutants. The ITA does not require any monitoring, recordkeeping, or reporting requirements to ensure that the refinery’s emission units stay under minor source thresholds. Thus, the ITA is unenforceable as a practical matter and cannot be used to support DAQ and Emery’s assertions that the refinery is a minor source. See, e.g., *Weiler v. Chatham Forest Products, Inc.*, 392 F.3d 532, 535 (2d Cir. 2004) (“a proposed facility that is physically capable of emitting major levels of the relevant pollutants is to be considered a major emitting facility under the Act unless there are legally and practicably enforceable mechanisms in place to make certain that the emissions remain below the relevant levels.”) (emphasis added); *United States v. Questar Gas Mgmt. Co.*, 2011 WL 1793172 (D. Utah 2011) (“limitations on a facility’s emissions may only be considered when they are legally and practicably enforceable by a governmental entity”) (emphasis added); *Sierra Club v. Ga. Power Co.*, 365 F. Supp. 2d 1297, 1308 (D. Ga. 2004)(same); *Sierra Club v. Public Serv. Co.*, 894 F.Supp. 1455, 1460 (D. Colo. 1995) (same); *In re Peabody Western Coal Company*, 12 E.A.D. 22, 31 (2005) (“In sum, therefore, [potential to emit] reflects a source’s maximum emissions capacity considering the application of any emission control equipment, or other capacity-limiting restrictions, that effectively and enforceably limit emissions capacity”) (emphasis added).

4. **The ITA Fails to Protect the Short Term National Ambient Air Quality Standards (NAAQS).**

   Moreover, the failure to include emission limitations threatens violations of the short-term NAAQS. The Utah Supreme Court has held that BACT emission limits must protect the short-term NAAQS. *Sierra Club v. Air Quality Board* at ¶ 47. To this end, the *EPA Workshop Manual* further elucidates:

   To complete the BACT process, the reviewing agency must establish an enforceable emission limit for each subject emission unit at the source and for each pollutant subject to review that is emitted from the source. . . . **BACT emission limits** or conditions must be met on a continual basis at all levels of operation (e.g., limits written in pounds/MMbtu or percent reduction achieved), demonstrate protection of short term ambient standards (limits written in pounds/hour), and be enforceable as a practical matter (contain appropriate averaging times, compliance verification procedures and recordkeeping requirements). *EPA Workshop Manual* at B.56.

   Similarly, EPA guidance related to the one-hour SO\textsubscript{2} NAAQS further states:
Because compliance with the new SO₂ NAAQS must be demonstrated on the basis of a 1-hour averaging period, the reviewing authority should ensure that the source’s PSD permit defines a maximum allowable hour emission limitation for SO₂ regardless of whether it is derived from the BACT top-down approach or is the result of an air-quality based emissions rate. Hourly limits are important because they are the foundation of the air quality modeling demonstration relative to the 1-hour SO₂ NAAQS.

U.S. EPA 1-Hour SO₂ NAAQS Guidance Memo at 7. ²

Although EPA’s one-hour NO₂ NAAQS guidance is silent on this issue, significant portions of the one-hour SO₂ NAAQS guidance echo the language in the one-hour NO₂ NAAQS guidance. Based on this analysis, the EAB stated: “Accordingly, the Board believes that it is reasonable to infer that U.S. EPA expects ‘permit[s] [to] define a maximum allowable hour emission limitation’ for NOₓ to protect the one-hour NO₂ NAAQS.” In Re: Mississippi Lime, PSD Appeal No. 11-01 (August 9, 2011); 2011 WL 3557194 at 17. As a result of this analysis, the EAB determined that:

On remand, IEPA must either include maximum allowable hourly emissions limitations for SO₂ and NOₓ and explain how it concluded that the limitations are protective of the respective one-hour NAAQS or provide sufficient rationale for not including such emissions limitations. In either case, IEPA must reopen the public comment period to provide the public with an opportunity to submit comments. Id. at 18.

Here, the ITA lacks short-term emission limits necessary to protect short term NAAQS. There are no hourly emission limits on the flare necessary to protect the one-hour NO₂ and SO₂ NAAQS. Indeed, the ITA entirely fails to limit NOₓ and SO₂ emissions from the flare. Moreover, there are no short-term emission limits for the flare sufficient to protect the secondary, three-hour SO₂ NAAQS or even the 24-hour PM₂.₅ and PM₁₀ NAAQS. There are no limits on PM₂.₅ in the ITA. There are no short-term NO₂ emissions limits anywhere in the ITA. Without such emission limits, the ITA fails to protect short term NAAQS as required by law.

Three-hour averages, such as the three-hour SO₂ limit found at ITA II.B.4.b, are insufficient to protect 1-hour NAAQS. A 3-hour average can mask shorter-term emission spikes that would violate the 1-hour SO₂ NAAQS. A 3-hour average, for example, would allow all of the emissions to occur during one hour, effectively tripling the mass emission rate assumed in the 1-hour modeling. This type of event is hidden by a BACT limit based on a 3-hour average. Thus, the averaging time for the BACT limit must be no longer than the shortest NAAQS averaging time, which is 1 hour for NO₂ and SO₂. The ITA’s conditions governing emissions from the flares, process boilers and heaters, and other emission sources must revised to require a emission limitations on a 1-hour averaging time to protect short-term ambient standards, in particular the 1-hour NO₂ and SO₂ NAAQS.

5. Monitoring and Regulation of Fugitive Emissions is Inadequate

The monitoring and regulation of fugitive emissions in the ITA is inadequate and casts further doubt on the characterization of the refinery as a minor source of VOC emissions. Section II.B purports to limit VOC emissions by requiring that the operator shall develop a

² Available at http://www.epa.gov/region07/air/nsr/nsrmemos/appwso2.pdf.
written leak-detection-and-repair (LDAR) plan that is consistent with certain federal regulations, namely 40 C.F.R. §§ 60.482-2a (g)(2), 60.482-7a (g)(2) & (3), 60.482-10a (j)(2) & (3), and 60.482-11a (e)(2). If a member of the public did not take time to read the referenced regulations, the citations to extensive federal regulations appears to impose substantive requirements on the facility. However, rather than impose federally enforceable limitations, each of the incorporated federal regulations is an exception from monitoring and inspection requirements that would otherwise be imposed by the other sections of 40 C.F.R. § 60.482. For example 40 C.F.R. § 60.482-2(a)(g)(2) provides:

“Any pump that is designated, as described in § 60.486a(f)(1), as an unsafe-to-monitor pump is exempt from the monitoring and inspection requirements of paragraphs (a) and (d)(4) through (6) of this section if:

(2) The owner or operator of the pump has a written plan that requires monitoring of the pump as frequently as practicable during safe-to-monitor times, but not more frequently than the periodic monitoring schedule otherwise applicable, and repair of the equipment according to the procedures in paragraph (c) of this section if a leak is detected.

Similarly, § 60.482-7a (g)(2) provides:

(g) Any valve that is designated, as described in § 60.486a(f)(1), as an unsafe-to-monitor valve is exempt from the requirements of paragraph (a) of this section if:

(2) The owner or operator of the valve adheres to a written plan that requires monitoring of the valve as frequently as practicable during safe-to-monitor times.

40 C.F.R. §§ 60.482-10a (j)(2) & (3), and 60.482-11a (e)(2) are similar exceptions based on adherence to written plans that require monitoring of valves as frequently as practicable during safe-to-monitor times.

The language in these exceptions is not sufficiently precise to allow these provisions to be considered practically enforceable. The EPA has recognized problems with this type of language, and in the 2007 document entitled Leak Detection and Repair: A Best Practices Guide, EPA identifies “improperly identifying components as ‘unsafe’ or ‘difficult’ to monitor” as a typical compliance problem in current LDAR programs.

While Emery is required to carry out an LDAR program, the ITA does not require Emery to use this program to determine whether the facility has more leaks or more components or poorer repair efficiency, and, consequently, more emissions than assumed. The ITA is unenforceable as a practical matter with regard to fugitive emissions.

6. **DAQ Must Correct its BACT Analysis**

The Trust’s technical expert, Dr. J. Phyllis Fox, provided DAQ with comments on its BACT analysis, and failure to consider certain available technology. Dr. Fox provided DAQ with numerous examples of BACT for both fugitive emissions and fired sources. Pursuant to established Utah Supreme Court guidance, DAQ must consider the technology demonstrated as available by Dr. Fox in its BACT analysis before determining whether to issue a final AO. *Utah Chapter of the Sierra Club v. Air Quality Board*, 2009 UT 76 ¶ 46.
7. **Full Compliance with R307-401-5 Must Be Completed Prior to Issuance of the AO**

**A. Emery Must Provide Documentation as Required by R307-4010-5(1)(c)(C)(ii) Prior to the Director’s Determination of Whether to Issue an AO**

Emery’s proposed refinery emits four hazardous air pollutants – benzene, toluene, hexane, and ethylbenzene – in sufficient quantities to trigger the dispersion modeling and impact documentation requirements mandated by the Utah Air Quality Rules. R307-401-5 – Documentation of Ambient Air Impacts for Hazardous Air Pollutants dictates Emery’s modeling and impact documentation obligations. Pursuant to R307-410-5(1)(c), each applicant must submit documentation of the facility’s emission rate, type of release, and emission threshold value for each HAP emitted from the facility. A source whose emissions increase is equal to or greater than the emission threshold value is subject to further documentation requirements.

The first documentation requirement, R307-410-5(1)(c)(C) (ii), requires that the source provide documentation of a comparison of the estimated ambient concentration of the proposed emission with the applicable toxic screening level. Emery’s own documentation found in Appendix D of its October 2013 NOI indicates that the proposed refinery’s benzene, toluene, hexane, and ethylbenzene emissions are equal to or greater than the emission threshold value for each of those HAPS. Thus, Emery must provide further documentation and modeling as required by R307-410-5(1)(c) (ii) & (iii). Emery itself recognizes this obligation; Appendix D notes that modeling is required for each of the above-listed HAPs. However, nothing in the record indicates that Emery has provided that documentation.

The second documentation requirement, R307-410-5(1)(c)(C)(iii), imposes additional requirements on a source whose estimated ambient concentration of the proposed HAP emission exceeds the applicable toxic screening level. Absent Emery completing a comparison as required by R307-410-5(1)(c) (ii), there is no way for DAQ or the public to determine whether Emery must comply with the documentation requirements in R307-410-5(1)(c)(C)(iii).

The Utah Air Quality Rules mandate that Emery conduct dispersion modeling and impact documentation for the four HAPs prior to receiving an approval order. See R307-410-5 (1) (“prior to receiving an approval order under R307-401, a source shall provide documentation of increases in emissions of hazardous air pollutants as required under (c) below…”). Moreover, R307-401 (8) states that the director will not issue an approval order if a party fails to meet the requirements of R307-4010 (Emissions Impact Analysis). This requirement is intended to allow the public and DAQ to consider the impacts of HAPs in the refinery area – including the town of Green River, the endangered fish in the Green River, and the nearby Class I protected areas – when determining whether to issue an approval or disapproval order. Clearly, dispersion modeling and documentation of impacts subsequent to the issuance of an approval order prevents interested parties from a full understanding of the impact of the refinery – an understanding that is meant to inform DAQ’s decision of whether to issue an approval order.

Yet, in condition II.B.1.e. of the ITA, DAQ allows Emery to conduct dispersion modeling prior to commencing operations. This is illegal, contrary to public policy, and should be altered immediately to require Emery to conduct dispersion modeling prior to DAQ’s decision point of whether to issue an approval order.

As discussed above, R307-410-5(1)(c)(C)(iii), imposes additional requirements on a source whose estimated ambient concentration of the proposed HAP emission exceeds the applicable toxic screening level. The commenting parties offer the following suggestions in the event that Emery’s mandatory supplemental documentation – discussed above in Section 7.A – indicates that R307-401-5(1)(c)(C)(ii) analysis triggers further documentation requirements.

The Director should exercise his discretion to require full documentation of each of the factors listed in R307-401-5(1)(c)(C)(iii) (A)-(E). Under, 307-401-5(1)(c)(C)(ii), the Utah Air Quality Rules provide the Director with discretion to require documentation of the following factors as follows:

(A) a description of symptoms and adverse health effects that can be caused by the hazardous air pollutant,
(B) the exposure conditions or dose that is sufficient to cause the adverse health effects,
(C) a description of the human population or other biological species which could be exposed to the estimated concentration,
(D) an evaluation of land use for the impacted areas,
(E) the environmental fate and persistency.

Full documentation of each of these factors is particularly important because the proposed refinery is located within several miles of the town of Green River, Utah and near the Green River, which provides critical habitat for endangered fish species. The public and environmental health effects of benzene, toluene, hexane and ethylbenzene are significant, and the public should be provided with a full analysis of the environmental consequences of the refinery’s HAP emissions prior to DAQ’s decision of whether to issue an approval order.

Once again, we appreciate the opportunity to comment on this ITA. Please inform us directly of any further action you take with regard to the ITA or eventual Approval or Disapproval Order. We hope that you will carefully review our comments and correct the legal deficiencies in the ITA in light of what we say here.

Sincerely,

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/s/  
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Exhibit 1
May 2, 2014

Re: Intent to Approve: Petroleum Processing Plant Project No: N14627-0002

Dear Mr. Bird, Mr. Humpherys, and Mr. DeJulis:

I was asked by the Grand Canyon Trust to review the emission calculations, BACT analyses, and proposed permit limits in the Intent to Approve-N14627-0002 (DAQE-IN146270002-14) dated March 21, 20141 issued by Utah Division of Air Quality to Emery Refining LLC (Emery) and the Notice of Intent (NOI)2 filed by Emery in October 2013, as modified by revised emissions in an Excel spreadsheet, received on May 2, 2014 (Rev. Em.).3 These materials seek to permit a 28,000 barrel per day (BPD) facility, consisting of a 15,000 BPD refinery and a 13,000 BPD petroleum transloading operation. These facilities will be located in Green River, Utah (Project). These comments address the results of my review of the ITA and the supporting analyses contained in the NOI.

3 E-mail from Timothy DeJulis, UDAQ, to Anne Mariah Tapp, May 2, 2014, Attaching: Excel Spreadsheet: Emery Refining Final Calculations_UDAQ_xls_rev Jan 23 2014 (“Rev. Em.”), Received via e-mail.
I support the comments filed by Grand Canyon Trust, the Southern Utah Wilderness Alliance, the Sierra Club, Living Rivers, Colorado Riverkeeper and the Center for Biological Diversity. I submit additional technical comments set out below. My qualifications to evaluate the NOI and ITA are documented in my resume submitted as Appendix A.

I. THE ITA UNDERESTIMATES GREENHOUSE GAS EMISSIONS

The Notice of Intent estimated greenhouse gas emissions, expressed as carbon dioxide equivalents (CO$_2$e or GHGe), of 98,662 ton/yr. Rev. Em. Tab: Summary. These GHGe emissions arise primarily from heaters, boilers, and the thermal oxidizer. If greenhouse gas emissions equal or exceed 100,000 ton/yr, the facility is a major source for GHGe and New Source Review is triggered. The estimated GHGe emissions are 1,778 ton/yr less than the GHGe significance threshold of 100,000 ton/yr.

My review of the supporting emission calculations indicates that GHGe emissions were underestimated due to three errors: (1) failing to include emissions from combusting VOCs in the thermal oxidizer; (2) failing to include emissions from loading the full permitted amount of crude oil; and (3) excluding one of the boilers permitted for the Distillation Plant. Correcting any one of these three errors results in GHGe emissions that exceed the 100,000 ton/yr threshold. Correcting all three results in a substantial exceedance of 100,000 ton/yr. Thus, the Project is a major source and triggers NSR review for GHGe. Each of these issues is discussed below.

1. Thermal Oxidizer Combustion Emissions Were Underestimated

The NOI calculated GHGe emissions from the Project using emission factors reported in 40 CFR 98.33 for natural gas fired sources as follows: 116.89 lb/MMBtu for CO$_2$ (Tables C-1)$^4$ and 0.00022 lb/MMBtu for methane and N2O (Table C-2)$^5$. The GHGe emissions are calculated by multiplying the firing rate of each fired source by these emission factors and summing. Thus, the calculations of GHGe assume that the fuel that will be burned in all sources is natural gas.

However, 100% of the fuel burned in the thermal oxidizer is not natural gas. The thermal oxidizer is used to combust the vapors generated at the loading racks when petroleum products are loaded into rail cars and tank trucks. These vapors originate from the previous cargo that is pushed out during loading plus vapors evaporated from the new liquid being loaded. These vapors are routed to a thermal oxidizer where they are combusted, generating carbon dioxide (CO$_2$) and water. NOI, Appx. C, p. 67.

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$^4$ 40 CFR 98, Subpart C, Table C-1, Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=14be5626471687141acffdd2ea30ead2&node=40:22.0.1.1.3.3.1.10.18&rgn=div9.

$^5$ 40 CFR 98, Subpart C, Table C-2, Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=14be5626471687141acffdd2ea30ead2&node=40:22.0.1.1.3.3.1.10.19&rgn=div9.
The design capacity of the thermal oxidizer is 98 MMBtu/hr. ITA, Condition II.A.15. The thermal oxidizer is limited to operate no more than 2,500 hours per rolling 12-month period. ITA, Condition II.B.2.b. The Notice of Intent estimated GHGe emissions from the thermal oxidizer based on its capacity as limited by hours to operate, using GHGe natural gas emissions factors from 40 CFR 98.33, Tables C-1 and C-2. NOI, pdf 29. However, the thermal oxidizer combuts vapors from transloading naphtha, diesel, atmospheric tower vapors, and crude oil. Rev. Em., Tab: Loading Rack. Combusting these vapors emits more CO\textsubscript{2e} than combusting a comparable amount of natural gas.

The Notice of Intent does not contain adequate information on the thermal oxidizer to precisely estimate its GHGe emissions. It is unknown, for example, whether the design capacity of 98 MMBtu/hr is for supplemental fuel (i.e., 98 MMBtu/hr of natural gas), supplemental fuel plus transloading vapors, or just the transloading vapors (i.e., 98 MMBtu/hr of transloading vapors). Thus, I bound GHGe emissions below using two cases: (I) 100% of the 98 MMBtu/hr is supplemental fuel and (II) 100% of the 98 MMBtu/hr is transloading vapors.

Case I: Thermal Oxidizer Design Capacity Based on Supplemental Fuel

A direct-fired thermal oxidizer is often used to combust vapors from loading and unloading of petroleum products. It introduces the process stream to be combusted into a fire box fueled by natural gas. The BACT analysis suggests this case: “The proposed thermal oxidizers will use natural gas for preheating and to facilitate the combustion of gases in the thermal oxidizer.” NOI, Appx. C, p. 69. In this case, the total GHGe emissions is the sum of GHGe emissions from the supplemental fuel burned in the thermal oxidizer plus the GHG emissions from combusting the transloading vapors.

The GHGe emission calculations for the thermal oxidizer appear to be based only on the natural gas required to fire the combustion chamber, i.e., the firebox, as they are based on the emission factors reported for natural gas in 40 CFR 98.33, Tables C-1 and C-2. The vapors released during transloading that would be routed to the thermal oxidizer are not natural gas and have higher CO\textsubscript{2e} emission factors.

Thus, assuming the thermal oxidizer firing rate of 98 MMBtu/hr is the fuel to the thermal oxidizer and does not include the vapors to be combusted, the additional CO\textsubscript{2e} from combusting transloading vapors must be included in the GHGe emissions total. When the transloading vapors are combusted in the thermal oxidizer, all carbon compounds in these vapors, i.e., reported as volatile organic compounds or VOCs, would be converted to CO\textsubscript{2e}. NOI, Appx. C, p. 68.

The uncontrolled VOC emissions from transloading that are routed to the thermal oxidizer sum to 532 ton/yr.\textsuperscript{6} Rev. Em. Tab: Loading Racks. Assuming that the VOC emissions...
emissions are reported as carbon and that 98% of these VOCs is converted to CO₂, the increase in GHGe emissions from combusting the transloading vapors is 1,912 ton/yr. If this increment from burning the transloading vapors is added to the GHGe estimated in the NOI for natural gas (98,662 ton/yr), GHGe emissions increase to **100,574 ton/yr**. This exceeds the significance threshold of 100,000 ton/yr, classifying the Project as a major source.

**Case II: Thermal Oxidizer Design Capacity Based on Transloading Vapors**

Alternatively, a regenerative thermal oxidizer (RTO) could be used. These use multiple beds of ceramic media to recover heat from waste gases, thus minimizing or eliminating supplemental fuel such as natural gas. The subject transloading gases are not hot so another refinery waste gas stream would have to be used to transfer the required heat and/or heat from combusting the transloading vapors could be recycled to the heat exchanger to provide a portion of the heating demand. The BACT analysis hints at this type of design: “Primary heat recovery is achieved utilizing either a metallic tube and shell or plate-type heat exchanger…” NOI, Appx. C, p. 68. However, the ITA does not require any particular design. Thus, worst case must be assumed in calculating emissions, which would be 100% of the 98 MMBtu/hr capacity is transloading gases.

The transloading gases originate from loading/unloading naphtha, diesel, atmospheric tower bottoms, and crude oil. The major sources of transloading VOCs are crude oil and naphtha. Rev. Em Tab: Loading Racks. The vapors from these materials when combusted emit more GHGe emissions than combusting an equivalent amount of natural gas.

The throughput-weighted CO₂ emission factor for naphtha and crude oil is 72.21 kg CO₂/MMBtu, compared to the CO₂ emission factor for natural gas of 53.06 kg CO₂/MMBtu. Thus, the increase in GHGe emissions from combusting transloading vapors, compared to the Notice of Intent’s calculations assuming natural gas (14,333 ton CO₂/yr), is **5,173 ton/yr**. If this increment from burning the transloading vapors is added to the GHGe estimated in the Notice of Intent (98,477 ton/yr) for natural gas supplemental fuel, GHGe emissions increase to **103,835 ton/yr**. This exceeds the significance threshold of 100,000 ton/yr, classifying the Project as a major source.

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7 GHGe emissions from combusting 531.96 ton/yr of VOCs: (531.96 ton C/yr)(44/12)(.98) = 1,911.51 ton/yr CO₂.

8 Revised GHGe emissions: 98,662 + 1,912 = 100,574 ton/yr.

9 The throughput-weighted CO2 emission factor, based on the VOC emissions reported in Rev. Em. Tab: Loading Racks, and the CO₂ emission factors for the transloaded products from 40 CFR 98.33, Table C-1: (21.25 + 168.5 ton VOC/yr)(68.02 kg/MMBtu for naphtha) + (342 ton VOC/yr)(74.54 kg/MMBtu for crude oil)/(21.25 + 168.5 + 342 ton/yr) = 72.21 kg/MMBtu.

10 The increase in thermal oxidizer CO₂ emissions, assuming the design capacity is based only on the transloading vapors that would be combusted: (14,333 ton/yr)(72.21/53.06) – 14,333 = **5,173 ton/yr**. The contribution of methane and N₂O is minor and is ignored in these calculations.
2. **Crude Oil Throughput Underestimated**

The GHGe (and VOC) emissions from transloading crude oil at the loading racks were estimated assuming a crude oil throughput of 141,120,000 gal/yr. Rev. Em. Tab: Loading Racks, Cell B19. However, the ITA, Condition II.B.1.d, limits crude oil receipts to 429,240,000 gallons, or three times more than included in the thermal oxidizer GHGe (and VOC) emission calculations. As crude throughput VOC emissions (342 ton/yr) account for 64% of the total transloading VOCs sent to the thermal oxidizers (531.5 ton/yr), the corresponding increase in GHGe when these VOCs are combusted would be $3 \times 0.64 = 1.92$ times greater than estimated above for Cases I and II using the lower crude throughput.

Thus, for Case I, the increase in GHGe, assuming 100% of the 98 MMBtu/hr thermal oxidizer heat rate is natural gas, is $1,910 \text{ ton/yr} \times 1.92 = 3,667 \text{ ton/yr}$. The revised Project GHGe emissions for Case I are $98,662 \text{ ton/yr} + 3,667 \text{ ton/yr} = 102,329 \text{ ton/yr}$.

For Case II, the increase in GHGe, assuming 100% of the 98 MMBtu/hr thermal oxidizer heat rate is transloading vapors, is $5,173 \text{ ton/yr} \times 1.92 = 9,604 \text{ ton/yr}$. The revised Project GHGe emissions for Case II are $98,662 \text{ ton/yr} + 9,932 \text{ ton/yr} = 108,594 \text{ ton/yr}$. In both cases, the significance threshold of 100,000 ton/yr is exceeded and the Project is a major source subject to Title V Permit requirements and all Utah Air Quality Rules that govern major sources.

3. **Distillation Plant Boiler Omitted**

The Intent to Approve indicates that two 15.7 MMBtu/hr boilers will be included in the Distillation Plant. ITA, Condition II.A.5. However, the GHGe emission calculations only included one 15.7 MMBtu/hr Distillation Plant boiler in its emission calculations for all pollutants. Rev. Em. Tab: Dist. Boilers 15.7 mmbtu/hr. The NOI indicates that only one boiler would be used during normal operation. NOI, p. 10. However, “normal” operation is not defined. Further, the ITA does not restrict the facility to operating only one of the Distillation Plant boilers during normal operation.

The classification of a source as minor, as claimed in the ITA, must be based on the potential to emit (PTE). The PTE must be based on the maximum emissions that can be emitted by the facility. The ITA as drafted allows two 15.7 MMBtu/hr boilers in the Distillation Plant to each operate 8,760 hr/yr. Thus, emissions from both must be included in the Potential to Emit.

The NOI estimated that one 15.7 MMBtu/hr boiler would emit 8,046 ton/yr of GHGe. Adding the GHGe emissions from one additional 15.7 MMBtu/hr boiler to the total GHGe emissions reported in the NOI results in total GHGe emissions of $98,662 \text{ ton/yr} + 8,046 \text{ ton/yr} = 106,708 \text{ ton/yr}$. The significance threshold of 100,000 ton/yr is exceeded and the Project is a major source subject to Title V Permit requirements and all Utah Air Quality Rules that govern major sources.
4. Naphtha Loading Emissions

The NOI estimated the loading emission factor for naphtha assuming a true vapor pressure of 5.88 psia. Rev. Em. Tab: Loading Racks, Cell B41. However, AP-42, EPA’s emission estimating bible,\(^{11}\) indicates that the true vapor pressure of a naphtha at the assumed loading temperature of 50.8 F would be about 14 psia. AP-42, Table 7.1-2 (1.0 psi) and Fig. 7.1-19 (14.8 psia). Thus, the VOC and GHGe emissions from loading naphtha would be about three times higher than disclosed in the NOI. I have not estimated these increases as they do not affect my conclusions. However, they would contribute to the exceedance of the GHGe significance threshold.

5. Total Revised GHGe Emissions

In sum, the NOI underestimated GHGe emissions by: (1) failing to include emissions from combusting the transloading vapors in the thermal oxidizer (5,173 ton/yr); (2) underestimating the crude oil deliveries (9,932 ton/yr); (3) omitting a 15.7 MMBtu/hr boiler (8,046 ton/yr); and (4) underestimating the vapor pressure of naphtha (not estimated). When these errors and omissions are combined, GHGe emissions increase from 98,662 ton/yr to greater than \(121,813 \text{ ton/yr}\).\(^{12}\) This exceeds the significance threshold of 100,000 ton/yr, classifying the Project as a major source for GHGe.

II. THE ITA UNDERESTIMATES VOLATILE ORGANIC COMPOUND (VOC) EMISSIONS

The Notice of Intent reports volatile organic compound (VOC) emissions of 56.40 ton/yr. ITA, p. 2. However, the revised emission spreadsheet, supplied by UDEQ on May 2, 2014, the day these comments were due, reports 57.91 ton/yr. Rev. Em. Tab: Refinery Summary, Cell F13.\(^{13}\) My analysis below is based on the January 23, 2014 Revised Emissions, provided on the day these comments were due, May 2, 2014. The file I reviewed contains no support for the VOC emissions that the ITA reported (56.4 ton/yr). NOI, p. 3.

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\(^{11}\) AP-42, Available at: http://www.epa.gov/ttnchie1/ap42/.

\(^{12}\) Total increase in GHGe emissions = 5,173 + 9,932 + 8,046 = 23,151 ton/yr. The total GHGe emissions are: 98,662 + 23,151 = \(121,813 \text{ ton/yr}\). Actual emissions would be higher as this estimate does not include increases due to the use of a low true vapor pressure for naphtha loading.

\(^{13}\) The ITA, p. 2, reports VOC emissions at 56.4 ton/yr, suggesting either an error, or additional emission revisions that were not produced in response to our public record act requests.
These VOC emissions arise primarily from the tanks, loading racks, and leaking equipment (pumps, valves, connectors). If VOC emissions equal or exceed 100 ton/yr, the facility is a major source for all criteria pollutants and New Source Review is triggered.

My review of the supporting emission calculations indicates that VOC emissions were underestimated due to two major errors: (1) assuming the loading rack collection efficiency is 100% and (2) failing to include emissions from loading the full permitted amount of crude oil.

The VOC emission calculations contain other errors and omissions, including excluding one of the boilers permitted for the Distillation Plant and underestimating the vapor pressure of materials that would be stored in the various tanks and transloaded at the loading racks. However, the change in VOC emissions from these errors were not estimated as the increase in VOC emissions from considering only the collection efficiency and crude throughput errors are sufficient to classify this Project as a major source, subject to NSR review. Each of these issues is discussed below.

1. **Loading Rack Collection Efficiency Assumed to be 100%**

The NOI estimated loading emissions using AP-42, Section 5.2, Equation (1). NOI, pdf 52. The emissions calculated with this equation are the sum of direct loading losses (vapors pushed out by the loaded product) plus losses in the collection system between the tanker truck and rail car and/or tanks. These collection system losses include disconnect losses, drips, open hatches and domes, and leaks around hatches, domes, and hose connections. AP-42, p. 5.2-6.

The loading rack VOC emission calculations in the NOI tacitly assume the collection efficiency is 100% and base loading rack VOC emissions on the control efficiency of the thermal oxidizer only (98%). However, when the collection system efficiency is included, the overall control efficiency for VOCs at the loading racks drops to 69%, significantly increasing VOC emissions.

The emission estimating source relied on by the NOI indicates that the collection efficiency should be assumed to be 99.2% for tanker trucks passing the MACT-level annual leak test; 98.7% for trucks passing the NSPS-level annual test; and 70% for trucks not passing one of these annual tests. AP-42, p. 5.2-6.

The NOI and ITA are silent on tanker truck (and rail car) leak tests. The ITA does not require any specific leaks tests, which are commonly required in permits for loading terminals. Thus, to estimate the potential to emit VOCs from the loading racks, a collection efficiency of 70% must be assumed (or the ITA modified to require annual leak tests). Assuming 70% collection efficiency, the overall control efficiency for the loading racks is 69% (0.98 x 0.70 = 0.69).

The uncontrolled VOC emissions estimated in the NOI from the loading racks that are routed to the thermal oxidizer are 531.5 ton/yr. Rev. Em. Tab: Loading Racks.
Assuming 69% control, the controlled VOC emissions from the loading rack increase from 10.63 ton/yr to 165 ton/yr \((531.5 \times [1-0.69])=164.77\). Thus, VOC emissions from the loading rack, when the collection system efficiency is taken into account, are large enough by themselves to classify this Project as a major source, triggering NSR review. The actual emission increase is even larger when other errors in the NOI’s emission calculations are corrected.

2. Crude Oil Throughput Underestimated

The VOC emissions from transloading crude oil at the loading racks were estimated assuming a crude oil throughput of 141,120,000 gal/yr. Rev. Em. Tab: Loading Racks, Cell B18. However, the ITA, Condition II.B.1.d, limits crude oil receipts to 429,240,000 gallons, or three times more than included in the VOC emission calculations. The VOC emissions from the loading racks increase in direct proportion to the crude throughput.

The revised uncontrolled VOC emissions from loading crude oil is 
\[(492.2/141.1)\times342 \text{ ton/yr} = 1,193 \text{ ton/yr}.\]
Assuming the 69% overall control efficiency for the loading racks that takes into account collection system efficiency, which is the only correct way to calculate loading rack emissions, the revised VOC emissions are 323 ton/yr. These emissions exceed the major source significance threshold of 100 ton/yr by a factor of three, triggering NSR review.

III. PERMIT CONDITIONS ARE INADEQUATE TO CONTROL EMISSIONS

1. The Firing Rates for Heaters and Boilers Are Not Enforceable

The proposed permit, the ITA, is being issued as a minor source permit. However, emissions of GHGe and VOCs are close to significance thresholds that would render the Project a major source. In fact, as discussed above, if errors in the applicant’s calculations are corrected, the Project is major for both VOCs and GHGe. Thus, the final permit must include enforceable emission limits that assure the source remains minor, or the source must go through NSR review. These limits should include limits on fired-source throughput, BACT emission limits, and vapor pressure and design limits on all equipment not otherwise monitored that handles petroleum products.

The emission calculations, used to assert that the source is minor for all pollutants, rely on the design firing rates, in MMBtu/hr, for all fired sources, e.g., boilers, heaters, thermal oxidizer. These firing rates are listed in the Intent to Operate as special provisions. ITA, Condition II.a. However, the Intent to Operate does not require any monitoring, recordkeeping, and reporting to confirm that these units stay within the specified heat input limits. Most fired sources, for example, are designed to operate at

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14 Increase in VOC emissions from underestimating crude throughput and failing to consider collection efficiency = \((429.2/141.12)(342 \text{ ton/yr})(1-0.69) = 322.5 \text{ ton/yr}.\)
5% to 10% above design. Thus, these firing rates are not enforceable as a practical matter and cannot be relied on to support the minor source status of the Project.

2. Tank VOC and HAP Emissions Are Not Enforceable

The tanks are a major source of VOC and HAP emissions, emitting 24.76 ton/yr of VOC. Rev. Em. Tab: Storage Tanks, Cell V70. The emissions from these tanks were calculated based on assumed vapor pressures of the substances to be stored in the tanks. If higher vapor pressure material were stored, for example, if Bakken crude oil were substituted for Canadian tar sands crude, VOC and HAP emissions would increase significantly. As it is not feasible to routinely monitor VOC and HAP emissions from tanks, compliance is normally assured by imposing equipment specifications and vapor pressure limits. It is, for example, standard practice to limit the Reid Vapor Pressure of materials stored in tanks to control their emissions. The ITA does not contain any vapor pressure limits or design criteria for any of the tanks or any conditions at all to demonstrate that the assumed VOC and HAP emissions in fact are met. Thus, the VOC and HAP emissions from these tanks are not enforceable as a practical matter.

This is particularly important, as the HAP emission calculations assume the default crude speciation profile. Rev. Em., Tab HAPs to VOC Ratio. This profile significantly underestimates benzene emissions for tar sands and Bakken crude oils, which are up to 50 times higher than assumed in the NOI emission calculations. Thus, HAP emissions could result in significant public health impacts.

3. The Permit Does Not Establish Any BACT Limits

Best Available Control Technology or BACT is defined to be an “emission limitation” UAC R307-401.2. A specific emission limit must be established where measurement is feasible.

The ITA does not include any BACT emission limits or any other conditions that would assure that the results of the BACT analysis are in fact complied with for GHGe, CO, PM10, PM2.5, NOx, and VOCs. The only BACT limits are set on sulfur compounds.

The BACT analysis established emission limits to satisfy BACT for fired sources, including (NOI, Appx. C, BACT Analysis):

All process heaters:
- CO: 0.08 lb/MMBtu, 1-hr average;
- PM_{10}: 0.0075 lb/MMBtu;
- NO_{x}: 20 ppm or 0.03 lb/MMBtu;
- VOCs: 0.0054 lb/MMBtu.

All boilers:
- NO_{x}: 20 ppm or 0.03 lb/MMBtu;
- CO: 0.08 lb/MMBtu;
• PM$_{10}$/PM$_{2.5}$: 7.6 lb/MMscf.

These limits must be established as permit condition in the ITA and periodic monitoring required to demonstrate compliance. Further, the BACT analysis failed to establish BACT limits for GHGe from all fired sources. GHGe emissions can be and are routinely measured from fired sources. Thus, the ITA must establish GHGe limits and impose monitoring to demonstrate compliance.

IV. THE BACT ANALYSIS IS INADEQUATE

1. BACT Not Required For Fugitive Emissions

The Project includes a number of piping components, including connectors, flanges, valves, and pumps. All of these components leak. They emit 1.39 ton/yr of VOCs. Rev. Em. Tabs: Rev Distill Plant Leaks and Rev Wax Plant Leaks. The leaks are referred to as “fugitive equipment leaks.”

Fugitive emission VOCs were significantly revised downward between the initial NOI submittal in October 2013 and the final emission calculations in January 2014. As the revised emissions were provided the day these comments were due, I was unable to review them in detail. However, the VOC and HAP emissions from these fugitive sources appear to be underestimated and inconsistent with conditions imposed in the ITA. The ITA, Condition II.B.1.b, for example, allows any component that leaks at 500 ppm or less, to leak indefinitely. Thus, under this scenarios, all components could theoretically leak continuously at 500 ppm, which would result in much higher VOC emissions than disclosed. These revised emissions should be reviewed and corrected.

The BACT analysis identified only two methods to control these leaks: (1) leak detection and repair (LDAR) programs and use of cloud imaging cameras. NOI, Appx. C, p. 86. The cloud imaging camera was eliminated and BACT concluded to be a LDAR program that includes a lower leak definition for pumps of 2,000 ppm and valves of 500 ppm. The responsive LDAR plan will be submitted at an undetermined point in the future. ITA, Condition II.B.1.c. This does not satisfy the requirement to perform a top-down BACT analysis for these components.

The critical first step in a BACT analysis is to ensure that all potential control options are identified by casting as wide a net as possible so that a comprehensive list of control options is compiled. This has not been done for fugitive equipment leaks. The NOI concluded LDAR satisfied BACT without considering other viable options. The NOI, for example, did not consider options to further reduce these emissions, including the use of leakless components and a range of LDAR program options. Two of the additional controls that should have been evaluated and found to be feasible and cost effective are discussed below.
A. **Leakless Components**

Emissions from equipment leaks can be controlled by eliminating them at the source with leakless components, such as welded connectors. The BACT analysis did not consider this technically feasible and cost effective option to control these leaks.

B. **More Effective LDAR Program**

A LDAR program is defined by three different criteria: (1) the definition of a leak (expressed as parts per million of the leaked substance); (2) the frequency of monitoring; (3) repair requirements, e.g., the timeline in which leaks are repaired once discovered. The Bay Area Air Quality Management District (“BAAQMD”) has demonstrated that stricter regulation is feasible than contemplated in the BACT analysis and required in the ITA, Condition II.B.1.b.

The BAAQMD supervises LDAR programs at five refineries with over 200,000 regulated components, as well as chemical plants, bulk plants, and bulk terminals under Regulation 8, Rule 18 (Equipment Leaks: Reg. 8-18). This regulation, first adopted in 1998, sets lower leak limits, more frequent inspections, and shorter repair schedules than the LDAR program required in Condition II.B.1.b. It does not, for example, allow components that leak at 500 ppm to continue to leak, without repair. The higher level of control achieved by the BAAQMD regulation should have been considered in the top-down BACT analysis.

The BACT analysis also did not consider requiring that “repeat offenders” be replaced. The South Coast Air Quality Management District and the Ventura County Air Pollution Control District each have rules under which components that have been subject to repair more than, e.g., 5 times within a year be replaced with BACT/BARCT or be vented to an approved air pollution control device.\(^\text{15}\)

Finally, the ITA must ensure the integrity of any LDAR program. As U.S. EPA’s history of enforcement actions demonstrates, this integrity cannot be taken for granted.\(^\text{16}\) The U.S. EPA has encountered significant fraud in the conduct of LDAR inspections and in the reporting of results.\(^\text{17}\) To avoid this, the ITA must include safeguards, including

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\(^{15}\) See, SCAQMD Rule 1173(g)(3) and Ventura County APCD Rule 74.7. Under the Ventura County rule, for example, if a valve is found to have suffered 5 major leaks in a year it shall be replaced by a valve with a bellows seal, or with graphite, PTE or PTFE stack chevron seal rings, or with BACT technology level components.

\(^{16}\) For a more recent example, see U.S. EPA’s recent refinery settlements [http://www.epa.gov/compliance/resources/cases/civil/ssa/index.html](http://www.epa.gov/compliance/resources/cases/civil/ssa/index.html).

\(^{17}\) In the late 1990’s, EPA discovered flagrant, industry-wide violations of several CAA requirements at the nation’s refineries. Among the most significant violations were LDAR rules violations where refiners, and independent contractors hired by refiners, routinely underreported by up to a factor of 10 the number of leaking valves, leading to significant excess emissions. The
requiring a professional engineer to sign off on all LDAR reports. The agency must also explore requiring periodic independent audits of LDAR programs, at least for the largest emitters.

2. BACT Not Required for NO\textsubscript{x} from Fired Sources

The BACT analysis established a BACT NO\textsubscript{x} limit for all heaters and boilers of 20 ppm or 0.03 lb/MMBtu. ITA, Appx. C, pp. 21, 48. An emission limit must include an averaging time, which was not proposed. Thus, the NO\textsubscript{x} BACT analysis for these sources is per se incomplete. Further, the proposed limit is not BACT.

The combination of low-NO\textsubscript{x} burner technology and SCR has been demonstrated to achieve very low emissions of NO\textsubscript{x} in refinery applications. At the TOSCO Refining Company in the SCAQMD, a large refinery heater has been operational since 1995, equipped with low- NO\textsubscript{x} burners and an SCR. Source tests have verified emissions of 7 ppm v or less. Large and small process heaters have also been demonstrated in the SCAQMD to achieve NO\textsubscript{x} emissions in the 5 to 9 ppm range using low- NO\textsubscript{x} burners and SCR.\textsuperscript{18,19}

The lowest permitted NO\textsubscript{x} emission limit is 5 ppmvd at 3% O\textsubscript{2}, corresponding to 6 ppmvd at 0% O\textsubscript{2} permitted by the SCAQMD for a 50-MMBtu/hr heater with SCR firing natural gas at the CENCO refinery in Los Angeles. SCAQMD 3/01\textsuperscript{20}.

These determinations were made for process heaters in refineries in nonattainment areas and thus represent LAER. LAER is the top technology in the top-down BACT process. Thus, the presumptive BACT level for refinery heaters is 6 ppmvd NO\textsubscript{x} at 0% O\textsubscript{2}, corresponding to 0.006 lb NO\textsubscript{x}/MMBtu,\textsuperscript{21} achieved using either natural gas or refinery fuel gas, low NO\textsubscript{x} burners, and an SCR.\textsuperscript{22}

ensuing enforcement actions led to 29 settlements with operators of over 90% of the refining capacity in the country. These settlements required improved LDAR practices, $82 million in fines, and $75 million in Supplemental Environmental Projects. This experience demonstrates a need for detailed independent oversight of LDAR activities, as does the recent Pelican refinery criminal prosecution.

\textsuperscript{18} SCAQMD BACT Determinations, 50 MMBtu/hr Tulsa Heaters Inc. process heater, John Zink low-NO\textsubscript{x} burners with SCR, January 2001.

\textsuperscript{19} SCAQMD BACT Determinations, 764 MMBtu/hr Kinetics Technology International process heater, John Zink low-NO\textsubscript{x} burners and SCR, June 1999.


\textsuperscript{21} NO\textsubscript{x} emission rate (lb/MMBtu) = \left[\text{NO\textsubscript{x} concentration in exhaust gas (ppmvd)} \times 10^{-6} \times \text{NO\textsubscript{x} molecular weight (lb/lb mole)} \times F \text{ factor in dscf/MMBtu} / \text{specific molar volume of exhaust gas at standard reference temperature (scf/lb mole)} \right] \times [\text{oxygen correction}] = \left[\left(6 \times 10^{-6} \times 46.01 \times 8710\right) / 385.3\right] \left(\frac{20.9\%}{(20.9\% - 0\%)}\right) = 0.0062 \text{ lb/MMBtu}.

\textsuperscript{22} The emission rates in lb/MMBtu calculated from ppmvd is based on firing natural gas. Many of the units fire refinery fuel gas and/or natural gas. Refinery fuel gas generally has a higher heating value and F factor than natural gas. Thus, the emission limits derived by converting ppmvd to lb/MMBtu would be somewhat
Boilers, regardless of the specific service and design, should be able to meet comparable emission limits as process heaters, using a combination of ultra low NO\textsubscript{x} burners and post combustion controls. The heat-transfer method used in boilers, for example, fire tube versus water tube, does not affect the burners or performance of post-combustion controls. Emissions associated with these two heat transfer methods are indistinguishable. See, for example, AP-42, Sec. 1.4. Thus, refinery boilers, regardless of the specific service should be able to meet the same low NO\textsubscript{x} levels as refinery heaters.

Ultra low NO\textsubscript{x} burners have been installed and successfully used on many boilers. These burners can achieve NO\textsubscript{x} limits of 7 ppm to 9 ppm at 3% O\textsubscript{2}, as demonstrated by source test and CEMs data. While the BACT analysis concluded that ultra low NO\textsubscript{x} burners satisfy BACT for heaters and boilers, it failed to set a NO\textsubscript{x} emission limit consistent with this control method. Much lower NO\textsubscript{x} emissions can be achieved than proposed as NO\textsubscript{x} BACT.

Three 40,000 lb/hr Foster-Wheeler auxiliary boilers at the Crockett Cogeneration Facility in California were permitted at 8.2 ppm NO\textsubscript{x} at 3% O\textsubscript{2} in 1996, achieved using SCR. The June 1997 source test measured 5.47 ppm NO\textsubscript{x} and 4.92 ppm NH\textsubscript{3} from Boiler B and the June 1998 source test measured 5.39 ppm NO\textsubscript{x} and 5.84 ppm NH\textsubscript{3} from Boiler C, all reported at 3% O\textsubscript{2}. Thus, these boilers have achieved 0.0065 to 0.0066 lb/MMBtu.\textsuperscript{23}

A 31.5-MMBtu/hr Scotch Marine fire tube boiler was permitted by the SCAQMD in December 1999 at 7 ppm NO\textsubscript{x} at 3% O\textsubscript{2}, achieved using low-NO\textsubscript{x} burners and SCR. A second similar 21-MMBtu/hr Cleaver Brooks fire tube boiler was permitted by the SCAQMD in August 2000 at 7 ppm NO\textsubscript{x} at 3% O\textsubscript{2} averaged over 15-minutes, achieved using SCR. Source tests for a similarly equipped 100-MMBtu/hr boiler at Darling Delaware in Los Angeles achieved NO\textsubscript{x} emissions of 6-7 ppm. These concentrations correspond to 0.0073 to 0.0085 lb/MMBtu.\textsuperscript{24}

\begin{equation}
\text{NOx emission rate (lb/MMBtu) = \left[ \frac{\text{NOx concentration in exhaust gas (ppmvd) \times 10E-6 \times NOx molecular weight (lb/lb mole) \times F factor in dscf/MMBtu/[specific molar volume of exhaust gas at standard reference temperature (scf/lb mole)] \times [oxygen correction]}{385.3[(20.9\% / (20.9\% - 3\%))]} \right] = 0.0065 lb/MMBtu;}
\end{equation}

\begin{equation}
\text{NOx emission rate (lb/MMBtu) = \left[ \frac{\text{NOx concentration in exhaust gas (ppmvd) \times 10E-6 \times NOx molecular weight (lb/lb mole) \times F factor in dscf/MMBtu/[specific molar volume of exhaust gas at standard reference temperature (scf/lb mole)] \times [oxygen correction]}{385.3[(20.9\% / (20.9\% - 3\%))]} \right] = 0.0066 lb/MMBtu.}
\end{equation}

\begin{equation}
\text{NOx emission rate (lb/MMBtu) = \left[ \frac{\text{NOx concentration in exhaust gas (ppmvd) \times 10E-6 \times NOx molecular weight (lb/lb mole) \times F factor in dscf/MMBtu/[specific molar volume of exhaust gas at standard reference temperature (scf/lb mole)] \times [oxygen correction]}{385.3[(20.9\% / (20.9\% - 3\%))]} \right] = 0.0073 lb/MMBtu;}
\end{equation}

\begin{equation}
\text{NOx emission rate (lb/MMBtu) = \left[ \frac{\text{NOx concentration in exhaust gas (ppmvd) \times 10E-6 \times NOx molecular weight (lb/lb mole) \times F factor in dscf/MMBtu/[specific molar volume of exhaust gas at standard reference temperature (scf/lb mole)] \times [oxygen correction]}{385.3[(20.9\% / (20.9\% - 3\%))]} \right] = 0.0085 lb/MMBtu.}
\end{equation}

higher for refinery fuel gas-fired units, depending upon the composition of the fuel burned in each subject unit.

\textsuperscript{23} NOx emission rate (lb/MMBtu) = \left[ \frac{\text{NOx concentration in exhaust gas (ppmvd) \times 10E-6 \times NOx molecular weight (lb/lb mole) \times F factor in dscf/MMBtu/[specific molar volume of exhaust gas at standard reference temperature (scf/lb mole)] \times [oxygen correction]}{385.3[(20.9\% / (20.9\% - 3\%))]} \right] = 0.0065 lb/MMBtu;

\textsuperscript{24} NOx emission rate (lb/MMBtu) = \left[ \frac{\text{NOx concentration in exhaust gas (ppmvd) \times 10E-6 \times NOx molecular weight (lb/lb mole) \times F factor in dscf/MMBtu/[specific molar volume of exhaust gas at standard reference temperature (scf/lb mole)] \times [oxygen correction]}{385.3[(20.9\% / (20.9\% - 3\%))]} \right] = 0.0066 lb/MMBtu.
A 56-MMBtu/hr auxiliary boiler at a cogeneration facility in the Equilon Refinery, Martinez, California was permitted by the BAAQMD in December 1993 at 5 ppm NO\textsubscript{x} at 3% O\textsubscript{2}, achieved using SCR. The unit has been successfully source tested. This corresponds to 0.0061 lb/MMBtu.\textsuperscript{25}

A 16.4-MMBtu/hr Cleaver Brooks CB700 fire-tube boiler was permitted in February 1992 at 40 ppm NO\textsubscript{x} at 3% O\textsubscript{2}. The boiler was subsequently equipped with low temperature oxidation ("LTO") in October 1996 as a demonstration project. Source tests demonstrated that LTO achieved a NO\textsubscript{x} limit of 5 ppm at 3% O\textsubscript{2}.\textsuperscript{26} The LTO system has been operated continuously since December 1996, at more than 50% of its capacity. The SCAQMD’s Mobile Source Test Vehicle (MSTV 1) was used to collect and continuously analyze flue gases at the exhaust stack of the LTO system. NO\textsubscript{x} and CO concentrations were recorded every minute. The analysis of these data shows that NO\textsubscript{x} concentrations were consistently below 5 ppmvd at 3% O\textsubscript{2},\textsuperscript{27} which corresponds to 0.0061 lb/MMBtu.\textsuperscript{28}

All of these permitting decisions were made in nonattainment areas and thus represent LAER. LAER is the top technology in the top-down BACT process. Thus, the presumptive BACT level for boilers at all refineries is a NO\textsubscript{x} limit of 5 ppm at 3% O\textsubscript{2}, which corresponds to 0.0061 lb/MMBtu, achieved using ultra low NO\textsubscript{x} burners, SCR or LTO.

Very Truly Yours,

Phyllis Fox, Ph.D., PE

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\textsuperscript{25} NO\textsubscript{x} emission rate (lb/MMBtu) = [(NO\textsubscript{x} concentration in exhaust gas (ppmvd) \times 10E-6 \times NO\textsubscript{x} molecular weight (lb/mole) \times F factor in dscf/MMBtu)/(specific molar volume of exhaust gas at standard reference temperature (scf/lb mole))] \times [oxygen correction] = [(7 \times 10E-6 \times 46.01 \times 8710) / 385.3][(20.9\% (20.9\% - 3\%)] = 0.0085 lb/MMBtu.

\textsuperscript{26} See http://www.arb.ca.gov/bactdb/search.exe (Alta Dena Dairy).


\textsuperscript{28} NO\textsubscript{x} emission rate (lb/MMBtu) = [(NO\textsubscript{x} concentration in exhaust gas (ppmvd) \times 10E-6 \times NO\textsubscript{x} molecular weight (lb/mole) \times F factor in dscf/MMBtu)/(specific molar volume of exhaust gas at standard reference temperature (scf/lb mole))] \times [oxygen correction] = [(5 \times 10E-6 \times 46.01 \times 8710) / 385.3][(20.9\% (20.9\% - 3\%)] = 0.0061 lb/MMBtu.
Appendix A
Phyllis Fox  
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Environmental Management  
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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  

PROFESSIONAL AFFILIATIONS

American Chemical Society (1981-2010)  
Phi Beta Kappa (1970-present)  
Sigma Pi Sigma (1970-present)

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, coke, and ore/mineral export terminals; LNG export, import, and storage terminals; crude-by-rail projects; shale oil plants; crude oil rail terminals; 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; soybean 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, 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 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.

Technical expert in confidential settlement discussions with large coal-fired utility on BACT control technology and emission limits for NOx, SO2, PM, PM2.5, and CO for new natural gas fired combined cycle and simple cycle turbines with oil backup. (July 2010). Case settled.


For plaintiffs, expert witness on MACT, BACT for NOx, 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 prefilled 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 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 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 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 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 a 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 NOx 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 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

- 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 NOx 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 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 NOₓ, 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 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, NOₓ, 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 NOₓ 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 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 NOx, SOx, 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 SCONOx, 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 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.

• 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.

• 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 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 reheating 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.

- 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, FONSIs, 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/REMEDICATION/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 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 March and April 2014, prepared declarations on permit issues for two crude-by-rail terminals, modified to import Bakken crude oils.
- In March 2014, prepared technical comments on Negative Declaration for a proposed modification of the air permit for a bulk petroleum and storage terminal to allow the import of tar sands and Bakken crude oil by rail and its export by barge, under the New York State Environmental Quality Review Act (SEQRA).
- In February 2014, prepared technical comments on proposed modification of air permit for midwest refinery upgrade/expansion to process tar sands crudes.
- In November 2013, prepared technical report on Environmental Impact Report for the Phillips 66 Propane Recovery Project, Rodeo, CA. Comments addressed project description (piecemealing, crude slate) and air quality impacts.
- In July 2013, prepared technical report on Initial Study/Mitigated Negative Declaration for the Valero Crude by Rail Project, Benicia, California, Use Permit Application 12PLN-00063.
- 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. 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, 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.

Prepared cost analyses and comments on New York’s proposed BART determinations for NOx, 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 NOx 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 comments on CASPR-BART emission equivalency and NOx 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 NOx 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 NOx 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 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).


- 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).


- 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 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.
- 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.

• 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 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;

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 alterations, 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 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.

- 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.

**PUBLICATIONS AND PRESENTATIONS (Partial List - Representative Publications)**


C.E. Lambert, E.D. Winegar, and Phyllis Fox, Ambient and Human Sources of Hydrogen Sulfide: An Explosive Topic, Air & Waste Management Association, June 2000, Salt Lake City, UT.

San Luis Obispo County Air Pollution Control District and San Luis Obispo County Public Health Department, *Community Monitoring Program*, February 8, 1999.

The Bay Institute, *From the Sierra to the Sea. The Ecological History of the San Francisco Bay-Delta Watershed*, 1998.


Levine-Fricke-Recon (Phyllis Fox and others), *Preliminary Endangerment Assessment Work Plan for the Study Area Operable Unit, Former Solano County Sanitary Landfill, Benicia, California*, Prepared for Granite Management Co. for submittal to DTSC, September 26, 1997.


Jud Monroe, Phyllis Fox, Karen Levy, Robert Nuzum, Randy Bailey, Rod Fujita, and Charles Hanson, *Habitat Restoration in Aquatic Ecosystems. A Review of the Scientific Literature*


Ambiente," ONERN-CONCYTEC, Lima, Peru, April 25-27, 1984. (Also presented at Instituto Tecnologico Pesquero and Instituto del Mar del Peru.)


P. Persoff and J. P. Fox, Control Technology for In-Situ Oil Shale Retorts, Lawrence Berkeley Laboratory Report LBL-14468, 118 pp., Dec. 1982.


National Academy of Sciences (J. P. Fox and others), *Surface Mining of Non-Coal Minerals, Appendix II: Mining and Processing of Oil Shale and Tar Sands*, 222 pp., 1980.


P. Persoff and J. P. Fox, Control Strategies for Abandoned In-Situ Oil Shale Retorts, Lawrence Berkeley Laboratory Report LBL-8780, 106 pp., October 1979.


J. P. Fox, Water Quality Effects of Leachates from an In-Situ Oil Shale Industry, Lawrence Berkeley Laboratory Report LBL-8997, 37 pp., April 1979.


POST GRADUATE COURSES
(Partial)

S-Plus Data Analysis, MathSoft, 6/94.
Air Pollutant Emission Calculations, UC Berkeley Extension, 6-7/94
Assessment, Control and Remediation of LNAPL Contaminated Sites, API and USEPA, 9/94
Pesticides in the TIE Process, SETAC, 6/96
Sulfate Minerals: Geochemistry, Crystallography, and Environmental Significance,
    Mineralogical Society of America/Geochemical Society, 11/00.
Design of Gas Turbine Combined Cycle and Cogeneration Systems, Thermoflow, 12/00
Air-Cooled Steam Condensers and Dry- and Hybrid-Cooling Towers, Power-Gen, 12/01
Combustion Turbine Power Augmentation with Inlet Cooling and Wet Compression,
    Power-Gen, 12/01
CEQA Update, UC Berkeley Extension, 3/02
The Health Effects of Chemicals, Drugs, and Pollutants, UC Berkeley Extension, 4-5/02
Noise Exposure Assessment: Sampling Strategy and Data Acquisition, AIHA PDC 205, 6/02
Noise Exposure Measurement Instruments and Techniques, AIHA PDC 302, 6/02
Noise Control Engineering, AIHA PDC 432, 6/02
Optimizing Generation and Air Emissions, Power-Gen, 12/02
Utility Industry Issues, Power-Gen, 12/02
Multipollutant Emission Control, Coal-Gen, 8/03
Community Noise, AIHA PDC 104, 5/04
Cutting-Edge Topics in Noise and Hearing Conservation, AIHA 5/04
Selective Catalytic Reduction: From Planning to Operation, Power-Gen, 12/05
Improving the FGD Decision Process, Power-Gen, 12/05
E-Discovery, CEB, 6/06
McIlvaine Hot Topic Hour, FGD Project Delay Factors, 8/10/06
McIlvaine Hot Topic Hour, What Mercury Technologies Are Available, 9/14/06
McIlvaine Hot Topic Hour, SCR Catalyst Choices, 10/12/06
McIlvaine Hot Topic Hour, Particulate Choices for Low Sulfur Coal, 10/19/06
McIlvaine Hot Topic Hour, Impact of PM2.5 on Power Plant Choices, 11/2/06
McIlvaine Hot Topic Hour, Dry Scrubbers, 11/9/06
Cost Estimating and Tricks of the Trade – A Practical Approach, PDH P159, 11/19/06
Process Equipment Cost Estimating by Ratio & Proportion, PDH G127 11/19/06
Power Plant Air Quality Decisions, Power-Gen 11/06
McIlvaine Hot Topic Hour, WE Energies Hg Control Update, 1/12/07
Negotiating Permit Conditions, EEUC, 1/21/07
BACT for Utilities, EEUC, 1/21/07
McIlvaine Hot Topic Hour, Chinese FGD/SCR Program & Impact on World, 2/1/07
McIlvaine Hot Topic Hour, Mercury Control Cost & Performance, 2/15/07
McIlvaine Hot Topic Hour, Mercury CEMS, 4/12/07
Coal-to-Liquids – A Timely Revival, 9th Electric Power, 4/30/07
Advances in Multi-Pollutant and CO₂ Control Technologies, 9th Electric Power, 4/30/07
McIlvaine Hot Topic Hour, Measurement & Control of PM2.5, 5/17/07
McIlvaine Hot Topic Hour, Co-firing and Gasifying Biomass, 5/31/07
McIlvaine Hot Topic Hour, Mercury Cost and Performance, 6/14/07
Ethanol 101: Points to Consider When Building an Ethanol Plant, BBI International, 6/26/07
McIlvaine Hot Topic Hour, CEMS for Measurement of NH3, SO3, Low NOx, 7/12/07
McIlvaine Hot Topic Hour, Mercury Removal Status & Cost, 8/9/07
McIlvaine Hot Topic Hour, Filter Media Selection for Coal-Fired Boilers, 9/13/07
McIlvaine Hot Topic Hour, Catalyst Performance on NOx, SO3, Mercury, 10/11/07
PRB Coal Users Group, PRB 101, 12/4/07
McIlvaine Hot Topic Hour, Mercury Control Update, 10/25/07
Circulating Fluidized Bed Boilers, Their Operation, Control and Optimization, Power-Gen, 12/8/07
Renewable Energy Credits & Greenhouse Gas Offsets, Power-Gen, 12/9/07
Petroleum Engineering & Petroleum Downstream Marketing, PDH K117, 1/5/08
Estimating Greenhouse Gas Emissions from Manufacturing, PDH C191, 1/6/08
McIlvaine Hot Topic Hour, NOx Reagents, 1/17/08
McIlvaine Hot Topic Hour, Mercury Control, 1/31/08
McIlvaine Hot Topic Hour, Mercury Monitoring, 3/6/08
McIlvaine Hot Topic Hour, SCR Catalysts, 3/13/08
Argus 2008 Climate Policy Outlook, 3/26/08
Argus Pet Coke Supply and Demand 2008, 3/27/08
McIlvaine Hot Topic Hour, SO3 Issues and Answers, 3/27/08
McIlvaine Hot Topic Hour, Mercury Control, 4/24/08
McIlvaine Hot Topic Hour, Co-Firing Biomass, 5/1/08
McIlvaine Hot Topic Hour, Coal Gasification, 6/5/08
McIlvaine Hot Topic Hour, Spray Driers vs. CFBs, 7/3/08
McIlvaine Hot Topic Hour, Air Pollution Control Cost Escalation, 9/25/08
McIlvaine Hot Topic Hour, Greenhouse Gas Strategies for Coal Fired Power Plant Operators, 10/2/08
McIlvaine Hot Topic Hour, Mercury and Toxics Monitoring, 2/5/09
McIlvaine Hot Topic Hour, Dry Precipitator Efficiency Improvements, 2/12/09
McIlvaine Hot Topic Hour, Coal Selection & Impact on Emissions, 2/26/09
McIlvaine Hot Topic Hour, 98% Limestone Scrubber Efficiency, 7/9/09
McIlvaine Hot Topic Hour, Carbon Management Strategies and Technologies, 6/24/10
McIlvaine Hot Topic Hour, Gas Turbine O&M, 7/22/10
McIlvaine Hot Topic Hour, Industrial Boiler MACT – Impact and Control Options, March 10, 2011
Interest Rates, PDH P204, 3/9/12
Understanding Concerns with Dry Sorbent Injection as a Coal Plant Pollution Control, Webinar #874-567-839 by Cleanenergy.Org, March 4, 2013