UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF TEXAS
HOUSTON DIVISION

ENVIRONMENT TEXAS CITIZEN LOBBY, INC.,
and SIERRA CLUB,

Plaintiffs, C.A. No. 4:10-cv-4969

v.

EXXONMOBIL CORPORATION,
EXXONMOBIL CHEMICAL COMPANY, and
EXXONMOBIL REFINING AND SUPPLY COMPANY,

Defendants.

[PLAINTIFFS' PROPOSED] FINDINGS OF FACT AND CONCLUSIONS OF LAW

Date: June 23, 2014

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INTRODUCTION

I. The Nature Of The Case

This is a case brought by two non-profit citizen groups under the citizen suit provision of the federal Clean Air Act ("CAA" or "the Act"), 42 U.S.C. § 7604. Citizen plaintiffs in such cases "stand in the shoes" of the federal government and seek to effectuate the public interest in clean air, rather than monetary compensation for their own injuries. E.g., Pub. Interest Research Group of New Jersey v. Powell Duffryn Terminals, Inc., 913 F.2d 64, 74 (3d Cir. 1990) (construing similar provision in the federal Clean Water Act).

The case concerns the "Baytown Complex," an industrial complex in Baytown, Texas, comprised of a refinery, olefins plant, and chemical plant owned and operated by the ExxonMobil Defendants (collectively, "Exxon"). Plaintiffs allege that over a roughly eight-year period, stretching from October 2005 to September 2013, Exxon repeatedly violated numerous emission standards and limitations contained in five federal operating permits issued for the Baytown Complex under Title V of the Act ("Title V permits"). Plaintiffs contend that their members in particular, and the public in general, have been adversely affected by Exxon's violations. Plaintiffs seek declaratory relief, injunctive relief, the imposition of civil penalties, and an award of attorneys' fees and costs.

Plaintiffs seek to hold Exxon liable for thousands of violations documented in three types of records that Exxon itself created, as it was required to do by law:

- Reports made by Exxon to the Texas Commission on Environmental Quality ("TCEQ"), between October 14, 2005, and September 3, 2013, of "reportable" emission events at the Baytown Complex – that is, events that resulted in unauthorized emissions of air pollutants in amounts that exceeded a "reportable quantity" established by the TCEQ;

- Records made by Exxon, between October 14, 2005, and September 3, 2013, of "recordable" emission events" at the Baytown Complex – that is, events that resulted in unauthorized emissions of air pollutants in amounts that did not exceeded a reportable quantity;

- "Deviation Reports" submitted by Exxon to the TCEQ, between October 14, 2005, and September 3, 2013, that describe instances of non-compliance with applicable emission standards and limitations contained in Exxon's Title V permits.

B. Prior Proceedings

Prior to trial, the Court granted summary judgment in favor of Exxon with respect to (1) emission events and Title V deviations subject to a 2005 consent decree, styled United States v. Exxon Mobil Corp., No. 1:05-CV-05809 (N.D. Ill. Dec. 13, 2005), and (2) emission events for which Exxon submitted reports to the TCEQ that were later determined not to be reportable events. See Docket Entry 135. This Court also rejected Exxon's argument that this lawsuit be dismissed in favor of the regulatory oversight provided by the Texas Commission on Environmental Quality ("TCEQ"), ruling that "second-

guess[ing] the adequacy of an agency's response to Clean Air Act violations" is the function Congress assigned to citizen enforcement. See Docket Entry 126, pp. 7-10; Docket Entry 135.

The Court conducted a bench trial from February 10 through 28, 2014, with regard to Plaintiffs' remaining claims, which encompass 241 reportable emission events, approximately 3,735 recordable emission events, and approximately 901 Title V permit deviations. During the course of the bench trial proceedings, the Court took evidence in the form of sworn testimony from 25 witnesses and 1,148 exhibits, and heard argument from counsel for both Plaintiffs and Defendants.

Having thoroughly considered the evidence, testimony, and oral argument presented during the trial, post-trial submissions, and applicable law, the Court now enters the findings of fact and conclusions of law set out in this Order. Any finding of fact set forth in this Order that should be construed as a conclusion of law is hereby adopted as such. Any conclusion of law set forth in this Order that should be construed as a finding of fact is hereby adopted as such. The length of these findings and conclusions is required by the breadth and scope of the alleged violations at issue, and the corresponding presentation of evidence by the parties.

Before setting out the facts of this case, the Court will provide context by describing the relevant legal framework.

I. THE PURPOSE OF THE CLEAN AIR ACT.

1. Congress created the Clean Air Act "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." 42 U.S.C. § 7401(b)(1); Public Citizen v. United States Envtl. Prot. Agency, 343 F.3d 449, 452-453 (5th Cir. 2003); Concerned Citizens Around Murphy v. Murphy Oil USA, 686 F. Supp. 2d 663, 667 (E.D. La. 2010).

2. The legislative history of the CAA "shows that Congress intended the statute to be 'technology forcing.'" Whitman v. American Trucking Ass'ns, Inc., 531 U.S. 457, 491 (2001) (Breyer, J., concurring). The Act's provisions were "expressly designed to force regulated sources to develop pollution control devices that *might at the time appear to be economically or technologically infeasible."* Id. (quoting Union Elec. Co. v. United States Envtl. Prot. Agency, 427 U.S. 246, 257 (1976)) (emphasis in original). In construing the Act, courts are cognizant "of both the high cost of attaining acceptable air quality standards *and* of the conscious decision of Congress to impose those costs." Nat'l Steel Corp. v. Gorsuch, 700 F.2d 314, 325 (6th Cir. 1983) (emphasis in original).

II. PERMITS UNDER TITLE V OF THE CLEAN AIR ACT.

3. "In 1990, Congress enacted Title V for the CAA. Title V requires major stationary sources of air pollution, such as factories, to receive operating

permits incorporating CAA requirements and establishes a procedure for federal authorization of state-run Title V permit programs. See 42 U.S.C. §§ 7661-7661f." Public Citizen v. EPA, 343 F.3d at 453.

4. In Texas, the Texas Commission on Environmental Quality ("TCEQ") issues Title V permits. TCEQ regulations governing Title V permits (also called "federal operating permits") are set forth in 30 Tex. Admin. Code Chapter 122.

5. A Title V permit consolidates all applicable requirements in a single document. Id.; 30 Tex. Admin. Code § 122.142(b). "The permit is crucial to the implementation of the Act: it contains, in a single, comprehensive set of documents, all CAA requirements relevant to the particular polluting source. *Clean Air Act Amendments of 1990: Chafee–Baucus Statement of Senate Managers* (Conf. Rep. No. 952, 101st Cong., 2d Sess.) ("*Chafee–Baucus Statement* "), *reprinted in* 136 Cong. Rec. S16933, S16983 (daily ed. Oct. 27, 1990). In a sense, a permit is a source-specific bible for Clean Air Act compliance." Virginia v. Browner, 80 F.3d 869, 873 (4th Cir. 1996). Accord Public Citizen v. EPA, 343 F.3d at 453; Envtl. Integrity Project v. Envtl. Prot. Agency, 425 F.3d 992, 993-994 (D.C. Cir. 2004); Sierra Club v. Energy Future Holdings, Corp., 2013 WL 5354414, at *2 (E.D. Tex. 2013).

6. The CAA provides that Title V permits must contain monitoring and reporting requirements. 42 U.S.C. § 7661c(c). These requirements are

"fundamental" to the permit program. Sierra Club v. Envtl. Prot. Agency, 536 F.3d 673, 677 (D. D.C. 2008). They "provide a record of compliance (or non-compliance) with the CAA's requirements." Hon. Henry A. Waxman, "An Overview of the Clean Air Act Amendments of 1990," 21 Envtl. L. 1721, 1747 (1991).

7. Facilities are required to submit twice annually to TCEQ reports of "deviations" from Title V permit requirements. 30 Tex. Admin. Code §122.145(2). As detailed below, facilities are also required to report and maintain records of unauthorized emissions occurring during upset events.

8. Title V permits incorporate requirements imposed by a number of Clean Air Act programs. Appalachian Power Co. v. Envtl. Prot. Agency, 208 F.3d 1015, 1018, n.3 (D. D.C. 2000). These programs are described below.

A. National Ambient Air Quality Standards And State Implementation Plans.

9. Under the CAA, U.S. EPA establishes minimum air quality levels in the form of "national ambient air quality standards" ("NAAQS") for six pollutants (known as "criteria pollutants"). 42 U.S.C. § 7409; Pub. Citizen v. Whitman, 343 F.3d 449, 453 (5th Cir. 2003); Her Majesty the Queen in Right of the Province of Ontario v City of Detroit, 874 F.2d 332, 335 (6th Cir. 1989). The six criteria pollutants are sulfur dioxide, particulate matter, carbon monoxide, ozone, oxides of nitrogen, and lead. 40 C.F.R. §§ 50.4-17.

10. Areas meeting the national ambient air quality standards are termed "attainment areas;" those not meeting them are termed "nonattainment areas." US Magnesium v. United States Envtl. Prot. Agency, 690 F.3d 1157, 1159 (10th Cir. 2012). In Texas, Harris County, which includes the cities of Baytown and Houston, is a nonattainment area for ozone. 40 C.F.R. § 81.344.

11. Each state is required to adopt a "state implementation plan" ("SIP") to bring nonattainment areas into compliance with the NAAQS and to prevent deterioration of air quality in attainment areas. 42 U.S.C. §§ 7407 & 7410; US Magnesium, 60 F.3d at 1159; City of Detroit, 874 F.2d at 336. In their state implementation plans, states are free to adopt more stringent protections than those in national standards. 42 U.S.C. § 7416; City of Detroit, 874 F.2d at 336; Murphy Oil, 686 F. Supp. at 668.

12. State implementation plans must be approved by U.S. EPA. 42 U.S.C. § 7410(k). Texas has an EPA-approved SIP, the provisions of which are listed at 40 C.F.R. § 52.2270(c).

13. A state implementation plan specifies emissions limitations and other measures to attain and maintain the national ambient air quality standards. Pub. Citizen v. Whitman, 343 F.3d at 453. These are then incorporated into the terms and conditions of Title V permits. Appalachian Power, 208 F.3d at 1018, n.3 & 1019.

14. Congress recognized that compliance with emission standards designed to protect NAAQS is not by itself sufficient to protect public health and welfare, and accordingly created additional air pollution control programs. Hawaiian Elec. Co. v. United States Envtl. Prot. Agency, 723 F.2d 1440, 1446-1447 (9th Cir. 1984). As stated by the Ninth Circuit, in discussing the impetus behind the "Prevention of Significant Deterioration Program" enacted by Congress in the 1977 amendments to the CAA (discussed below):

> Indeed, Congress repeatedly emphasized that NAAQS alone were insufficient to protect public health and welfare. For example, the Senate Report emphasized the "shortcomings and limitations" of the ambient standards – they do not provide an adequate margin of safety on health impacts; they are based on a false assumption that no-effects threshold levels exist; they do not adequately protect against genetic mutations, birth defects, cancer, or diseases caused by long-term chronic exposures or periodic short-term peak concentrations, and hazards due to derivative pollutants and to cumulative or synergistic impacts of various pollutants; and they do not adequately protect against crop damage or acid rain. See H.R. Rep. No. 294, 95th Congress., 1st Sess. 105-132, *reprinted in* 1977 U.S.Code Cong., & Ad.News 1183-1211; see also Statement by Senator Muskie in *A Legislative History of the Clean Act Amendments of 1977*, 95th Cong., 2d Dess. No. 16 (1979), vol. 3, pp. 1032-1035. "The non-degradation amendment is intended to help reduce overall emissions and thus provide protection against these kinds of adverse impacts." *Legislative History*, *supra*, at 728.

Id. "In sum, Congress found that it was important to reduce pollution levels below those mandated by the [National Ambient Air Quality] standards . . .." Id. at 1447.

B. The New Source Review Program.

15. Under the CAA, states that have nonattainment areas must enact state implementation plans that contain a "new source review" ("NSR") program. 42 U.S.C. § 7410(a)(2)(A); Romoland School Dist. v. Inland Empire Energy Ctr., LLC, 548 F.3d 738, 741 (9th Cir. 2008). Texas' SIP contains a New Source Review Program. 50 C.F.R. § 52.2270(c) (referring to 30 Tex. Admin. Code Ch. 116, Subchapter B).

16. Under the NSR program, any new or modified existing facility must obtain an NSR permit if it would emit more than a threshold amount of a pollutant for which the region is in nonattainment. Romoland, 548 F.3d at 741. "The permit specifies what construction is allowed, what emission limits must be met, and often how the emissions source must be operated." EPA, "New Source Review," available at http://www.epa.gov/nsr/.

17. In Texas, each NSR permit contains a Maximum Allowable Emission Rate Table ("MAERT"), which lists each emissions source that is covered by the permit, each contaminant that may be emitted from that source, and the limits on the hourly and annual rates of emissions of that contaminant. Tr. 2-211:17 - 2-214:1 [Kovacs]; PX 114-127, PX 138-142, PX 144, PX 146-152 (Exxon's NSR permits).

18. In Texas, an NSR permit can be issued as a "flexible permit" under the Texas flexible permitting program. 30 Tex. Admin. Code 116.710(a). A

flexible permit can set single, plant-wide emission caps for one or more contaminants (each contaminant is subject to its own limit or cap). As explained by the Fifth Circuit,

> [t]o determine a facility's cap under the Flexible Permit Program, the permit applicant must identify each air contaminant and each source it expects to be covered by the proposed permit. [Cite omitted]. Then, the TCEQ calculates emissions limits for each source and each contaminant . . .. The sum of the emission limits for each of the covered sources comprises the permit's cap on pollution for that contaminant. [Cite omitted]. Thus, a facility remains in compliance so long as the aggregate sum of its emissions for a particular contaminant is less than the total output of all the sources under the permit.

State of Texas v. United States Envtl. Prot. Agency, 690 F.3d 670, 684 (5th Cir. 2012). If a facility exceeds its cap for a contaminant, it can get back into compliance by reducing emissions at *any* of the sources of that contaminant (or even multiple sources). Most of the Baytown Complex, including the entire Refinery and Olefins Plant, is covered by NSR permits that are flexible permits.

C. The Prevention Of Significant Deterioration Program.

19. The Act requires states to adopt a "prevention of significant deterioration" ("PSD") program. 42 U.S.C. §§ 7470-7492. "The program's purpose is to protect the public from any adverse health or welfare effects of air pollution that may occur despite achievement of NAAQS, and to require careful evaluation of all consequences of new industrial development. 42 U.S.C. § 7470(1), (5)." Resisting Envtl. Destruction on Indigenous Lands,

Redoil v. United States Envtl. Prot. Agency, 716 F.3d 1155, 1159-1160 (9th Cir. 2013). Major emitting facilities must obtain a PSD permit before constructing a new facility, or modifying an existing one. 42 U.S.C. § 7474(a)(1).

D. New Source Performance Standards.

20. "Section 111 of the Act directs the EPA Administrator to list 'categories of stationary sources' that 'in [her] judgment . . . caus[e], or contribut[e] significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare.' § 7411(b)(1)(A). Once EPA lists a category, the agency must establish standards of performance for emission of pollutants from new or modified sources within that category. §7411(b)(1)(B); see also § 7411(a)(2)." Am. Elec. Power Co. ("AEP") v. Connecticut, 131 S.Ct. 2527, 2537 (2011). These standards are known as "New Source Performance Standards," or "NSPS." Murphy Oil, 686 F. Supp. 2d at 667.

21. EPA set New Source Performance Standards for categories of sources relevant to this case: petroleum refineries and chemical manufacturing plants. E.g., 40 C.F.R. §§ Subparts J, Ja, DDD, NNN.

22. Economic costs are considered by EPA in setting NSPS standards. AEP, 131 S.Ct. at 2539.

E. National Emissions Standards For Hazardous Air Pollutants.

23. The Act also directs EPA to set national emissions standards for hazardous air pollutants ("NESHAPs"). 42 U.S.C. § 7412(c)(2). The Act itself contains a list of hazardous air pollutants, 42 U.S.C. § 7412(b)(1), and directs EPA to periodically revise the list, id. at § 7412(b)(2).

24. "The NESHAPs are technology-based standards, based on the Maximum Achievable Control Technology (MACT) for each hazardous air pollutant." US Magnesium, 690 F.3d at 1160.

III. OWNERS AND OPERATORS ARE STRICTLY LIABLE IF THEY VIOLATE THEIR TITLE V PERMIT.

25. The CAA provides, "it shall be unlawful for any person to violate any requirement of a permit issued under" Title V of the Act. 42 U.S.C. § 7661a(a); 40 C.F.R. § 70.12; 30 Tex. Admin. Code § 122.143(4); Sierra Club v. Energy Future Holdings, 2013 WL 5354414, at *2 (E.D. Tex. Sept. 24, 2013); Commonwealth of Pennsylvania v. Allegheny Energy, Inc., 2006 WL 1509061, at *8 (W.D. Penn. 2006).

26. "The Act imposes strict liability upon owners and operators who violate the Act." Pound v. Airosol Co., Inc., 498 F.3d 1089, 1097 (10th Cir. 2007). Accord United Steelworkers of Am. v. Ore. Steel Mills, Inc., 322 F.3d 1222, 1229, n.4 (10th Cir. 2003); United States v. Dell'Aquilla, 150 F.3d 329, 332 (3d Cir. 1998); United States v. B & W Inv. Prop., 38 F.3d 362, 367 (7th

Cir. 1994); Sierra Club v. Pub. Serv. Co. of Colo., Inc., 894 F. Supp. 1455, 1459 (D. Colo. 1995); United States v. Hugo Key & Son, Inc., 731 F. Supp. 1135, 1140 (D. R.I. 1989); United States v. Harford Sands, Inc., 575 F. Supp. 733, 735 (D. Md. 1983).

27. The application of strict liability reflects the importance that Congress has placed upon air quality. United States v. J & D Enter. of Duluth, 955 F. Supp. 1153, 1159 (D. Minn. 1997). "Strict liability is essential to achieve the purpose of the Act and improve the quality of the nation's air." United States v. Ben's Truck & Equip., Inc., 1986 WL 15402, at *3 (E.D. Cal. May 12, 1986).

28. In imposing strict liability under the CAA, Congress reasoned: "[W]here protection of the public health is the root purpose of a regulatory scheme (such as the Clean Air Act), persons who own or operate pollution sources in violation of such health regulations must be held strictly accountable. This rule of law was believed to be the only way to assure due care in the operation of any such source." H.R.Rep. No. 94-1175, 94th Cong., 2d Sess. at 52 (1976) (legislative history of the 1977 amendments to the CAA); J & D Enter. of Duluth, 955 F. Supp. at 1158 (quoting legislative history). Cf. United States v. Marathon Pipe Line Co., 589 F.2d 1305, 1309 (7th Cir. 1978) (in Clean Water Act ("CWA") case, court stated that by imposing strict

liability, Congress determined that "polluters rather than the public should bear the costs of water pollution").

29. "Strict enforcement of applicable permits is in accordance with the legislative history of the Clean Air Act, which 'plainly reflects a congressional intent that claims of technological and economic infeasibility not constitute defense to an adjudication of violation of applicable Clean Air Act requirements.'" St. Bernard Citizens for Envtl. Quality, Inc. v. Chalmette Ref., LLC, 399 F. Supp. 2d 726, 736 (E.D. La. 2005) (quoting Friends of the Earth v. Potomac Elec. Power Co., 419 F. Supp. 528, 535 (D.D.C. 1976)); cf. United States v. Aluminum Co. of America, 824 F. Supp. 640, 652, n.18 (E.D. Tex. 1993) (in a case to enforce a CWA permit, court stated, "[p]ublic policy more likely favors strict enforcement of such permits against the permittee").

A. Impossibility Is Not A Defense.

30. While Exxon claims that it is not possible to achieve total compliance with its permits, as a matter of law, impossibility is not a defense. TCEQ regulations implementing the CAA provide: "It shall not be a defense in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to comply with the permit terms and conditions of the permit." 30 Tex. Admin. Code § 122.143(4). Cf. United States v. City of Hoboken, 675 F. Supp. 189, 198 (D.N.J. 1987) (in a CWA permit

enforcement case, court stated, "impossibility is not, as a matter of law, a valid defense")

31. As a court stated in the analogous context of the Clean Water Act, "[e]xcuses are irrelevant; under the Act the party must either achieve the discharge levels it has been allowed, or pay the consequences of its discharge, or stop discharging." Hoboken, 675 F. Supp. at 198.

B. Hurricane Ike Is Not A Defense.

32. Exxon has also claimed an Act of God defense for alleged violations occurring around the time of Hurricane Ike. While some federal environmental statutes contain an Act of God defense for liability, e.g. 33 U.S.C. § 2703(a)(1) (Oil Pollution Act); 42 U.S.C. § 9607(b)(1) (Comprehensive Environmental Response, Compensation, and Liability Act), the Clean Air Act is not one of them. Congress knew how to draft an Act of God defense when it intended to allow such a defense, and the fact that it did not do so in the CAA indicates it did not want the defense to apply. Cf. Mississippi ex. rel Hood v. AU Optronics, Inc., 134 S.Ct. 736, 737 (2014) (same point in construing the Class Action Fairness Act); Cent. Bank of Denver v. First Interstate Bank, 511 U.S. 164, 166-167 (1994) (same point construing the Securities Exchange Act).

33. Although the State of Texas Water Code contains an Act of God defense (Texas Water Code § 7.251), that provision is not available to Exxon in this case because it is not included in Texas's CAA state implementation

plan. 40 C.F.R. § 52.2270(c). A state law affirmative defense is inapplicable to a federal CAA enforcement suit unless it is part of a SIP. See Sierra Club v. Tennessee Valley Auth., 430 F.3d 1337, 1346-1350 (11th Cir. 2005) (state "de minimis rule" does not bar citizen suit because it was not in SIP); cf. Missouri v. City of Glasgow, 152 F.3d 802, 805 (8th Cir. 1998) (state law defense inapplicable to CWA citizen suit).

34. In any event, to prevail on an act of God defense under Texas law, Exxon must prove (1) its violations were "due directly and exclusively to an act of nature and without human intervention," and (2) "no amount of foresight or care which could have been responsibly required" could have prevented the violations. Sentry Select Ins. Co. v. R&R Marine, Inc., 2011 WL 7102564, at *7 (E. D. Tex. August 19, 2011) (cites omitted), different portion of recommended decision overruled in part, 2012 WL 252840 (E.D. Tex Jan. 26, 2012) (applying principles of common law negligence). "[T]he act of nature must have been so unusual that it could not have been reasonably anticipated or provided against." Id. (declining to find on summary judgment that Hurricane Ike was not reasonably anticipated). Exxon did not actually offer proof in support of an Act of God defense, and this Court thus will not entertain one.[1]

[1] The Court also notes that the Governor's emergency proclamation during Hurricane Ike was not made part of the Texas SIP and that, contrary to Exxon's assertion, the Governor's

C. The State Of Texas "Affirmative Defense" Is Not A Defense To Liability.

35. TCEQ regulations, 30 Tex. Admin. Code § 101.222(b) and (c), do provide a limited affirmative defense *to penalties* in enforcement actions involving unauthorized emissions from upset events, provided that a defendant proves that numerous specified criteria are all met, but this is *not* a defense to liability or to claims for injunctive relief. Luminant Generation Co. LLC v. United States Envtl. Prot. Agency, 714 F.3d 841, 853, 855 (5th Cir. 2013); Env't Texas v. ExxonMobil, Docket Entry 126, p. 17 (parties agree that the affirmative defense is not a defense to liability but is only a defense to imposition of penalties). Here, Plaintiffs seek injunctive relief under all seven counts set forth in the Complaint.

IV. THE CITIZEN SUIT PROVISION OF THE CLEAN AIR ACT.

36. The Clean Air Act provides that citizens may bring a civil action

> against any person . . . who is alleged to have violated (if there is evidence that the alleged violation has been repeated) or to be in violation of (A) an emission standard or limitation under this chapter . . .

42 U.S.C. § 7604(a)(1).

37. The definition of "person" includes "corporation." 42 U.S.C. § 7602(e).

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emergency proclamation did not suspend all Clean Air Act laws regulation. TCEQ informed facilities they must still "apply best engineering practices and good air pollution control practices" at all times, and "[i]n no event shall…create conditions of air pollution or exceed [NAAQS]." PX 578.

38. The definition of "emission standard or limitation" includes standards or limitations in a Title V permit. 42 U.S.C. § 7604(f)(4); St. Bernard Citizens for Envtl. Quality, Inc. v. Chalmette Ref., 399 F. Supp. 2d 726, 736 (E.D. La. 2005) (finding liability for Title V permit violations in citizen suit).

A. The Purpose And Importance Of The Citizen Suit Provision.

39. "Recognizing the importance of attaining the remedial goal of the Clean Air Act and the magnitude of the task at hand, Congress armed citizens with an independent means to require compliance with the Act." Sierra Club v. Pub. Serv. of Colorado, 894 F. Supp. 1455, 1459 (D. Col. 1995)

40. The CAA citizen suit provision "reflected a deliberate choice by Congress to widen citizen access to the courts, as a supplemental and effective assurance that the Act would be implemented and enforced." Natural Resources Defense Council v. Train, 510 F.2d 692, 700 (D.C. Cir. 1974). See also Envt. Conservation Org. ("ECO") v. City of Dallas, 529 F.3d 519, 526 (5th Cir. 2008) (citizen suit provision is "a critical component of the CWA's enforcement scheme, as it permits citizens to abate pollution when the government cannot or will not command compliance") (citation and internal quotations omitted).

41. As noted by the Seventh Circuit: "Congress…chose not to place absolute faith in state and federal agencies. It provided for citizen suits to

enable affected citizens to push for vigorous law enforcement even when government agencies are more inclined to compromise or go slowly." Adkins v. VIM Recycling, Inc., 644 F.3d 483, 501 (7th Cir. 2011) (construing similar citizen enforcement provision of the federal Resource Conservation and Recovery Act ("RCRA")); Conservation Law Found. v. Browner, 840 F. Supp. 171, 175 (D. Mass. 1993) (same, for Clean Air Act).

42. In enacting the citizen suit provision of the CAA, "Congress made clear that citizen groups are not to be treated as nuisances or troublemakers but rather as welcomed participants in the vindication of environmental interests." Friends of the Earth v. Carey, 535 F.2d 165, 172 (2d Cir. 1976); Glazer v. American Ecology Envtl. Serv. Corp., 894 F. Supp. 1029, 1034 (E.D. Tex. 1995) (quoting Carey). "[T]he Act seeks to encourage citizen participation rather than to treat it as a curiosity or a theoretical remedy." Carey, 535 F.2d at 172.

43. As this Court ruled previously on Exxon's summary judgment motion, "citizen suits were *intended* [by Congress] to be a mechanism for the public to second-guess the adequacy of an agency's response to Clean Air Act violations. As an antidote to regulatory capture, a citizen suit is itself an integral part of the regulatory scheme created by Congress." Env't Texas v. ExxonMobil Corp., C.A. No. 4:10-cv-04969, Docket Entry 126, p. 9 (April 3, 2013) (emphasis in original; footnote omitted), adopted, Docket Entry 135

(S.D. Tex. May 2, 2013); accord Citizens for a Better Environment-California v. Union Oil of California, 861 F. Supp. 889, 907 (N.D. Cal. 1994), aff'd, 83 F.3d 1111 (9th Cir. 1996) (same, with respect to Clean Water Act citizen suit provision).

1. Exxon's asserted "public policy considerations" do not override express Congressional authorization and intent with respect to citizen suits.

44. Defendants urge the Court to ignore Congress' intent to encourage citizen enforcement of the Act, and to instead deny relief on the grounds of "public policy considerations," arguing: (1) a citizen suit is not appropriate where an agency has already exercised its enforcement discretion with regard to the violator and (2) a citizen suit cannot be brought unless an agency has wholly "abdicated" its enforcement responsibilities. The Court has already rejected these arguments in its ruling on Exxon's summary judgment motion. Env't Texas v. ExxonMobil Corp., 4:10-cv-04969, Docket Entry 126, at pp. 7-10. The Court will not reverse itself; the reasoning of the summary judgment ruling follows.

45. "The only statutory limits to [CAA] citizen suits are found in subsection b [of 42 U.S.C. § 7604] – plaintiff must give 60-days notice, and the government must not be 'diligently prosecuting' a related civil action in court. 42 U.S.C. 7604(b)(1)." Id. at p. 7.

> Defendants do not assert, and expressly disclaim, reliance on either of the statutory bars of § 7604(b). [Footnote omitted]. Instead, defendants would have this court add another limitation on citizen suits based solely on policy grounds untethered to any statutory language. Stressing the importance of agency discretion and compromise, defendants posit a rule that citizen suits should not be allowed to proceed without a showing that government agencies have "abdicated their CAA enforcement obligations." But the court has found no reported case holding that "agency abdication" is a pre-condition for citizen suits under the Act; indeed, such a holding would be difficult to square with the Fifth Circuit's ruling that an administrative enforcement action by a state agency does not bar a citizen suit under the statutory preclusion section of the Act. *Texans United for a Safe Economy Education Fund v. Crown Central Petroleum Corp.*, 207 F.3d 789, 795 (5th Cir. 2000).
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> Defendants rely upon assembled snippets from *Gwaltney of Smithfield, Ltd. v. Chesapeake Bay Found.*, 484 U.S. 49, 60 (1987) and various appellate opinions describing citizen suits as "interstitial" and "supplemental" to government action.[4]
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> [4] *See* Dkt. 82 at 38-39 (citing *Louisiana Env't Action Network v. City of Baton Rouge*, 677 F.3d 737, 740 (5th Cir. 2012); *E.P.A. v. City of Green Forest*, 921 F.2d 1394, 1402 (8th Cir. 1990); *Karr v. Hefner*, 475 F.3d 1197-98 (10th Cir. 2007); *Supporters to Oppose Pollution, Inc. v. Heritage Group*, 973 F.2d 1320, 1324 (7th Cir. 1992); *Envt'l Conservation Org. v. City of Dallas*, 529 F.3d 519, 528 (5th Cir. 2008)).
>
> But those opinions were addressing express statutory limits on citizen suits, not the novel policy-based bar urged by defendants here. *See, e.g., Karr*, 475 F.3d at 1196-97 (addressing diligent prosecution under 33 U.S.C. § 1365(b)(1)(B)). Moreover, most of the cited cases were construing a different statute (the Clean Water Act) with materially different limits on citizen suits than the Clean Air Act.[5]
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>
> [5] Compare 42 U.S.C. § 7604 with 33 U.S.C. § 1365.

Id. at pp. 7-8. In short, "Congress was aware that unbridled citizen suits might sometimes 'intrude' upon the [agency] enforcement scheme, and accordingly set boundaries it deemed appropriate for such suits. It is not for this court to

move those boundaries, or indeed to erect new ones, merely to satisfy defendants' policy concerns." Id. at p. 10.[2]

2. The Court will not simply defer to TCEQ's enforcement decisions.

46. In a similar vein, Exxon argues that the federal courts lack the necessary expertise to evaluate CAA compliance or fashion appropriate relief, and that this Court should thus defer to TCEQ enforcement decisions and not grant further relief to address Exxon's CAA violations. The Court rejects this argument.

47. Congress clearly believes district courts have the ability to decide CAA enforcement cases; otherwise it would not have provided them with jurisdiction to adjudicate such cases. Ass'n of Irritated Residents v. Fred Schakel Dairy, 2008 WL 850136, at *13 (E.D. Cal. March 28, 2008). Indeed, regarding the CAA citizen suit provision, the Senate Committee on Public Works stated, "[e]nforcement of pollution regulations is not a technical matter beyond the competence of the courts." Carey, 535 F.2d at 174 (quoting Senate report). In adopting the citizen suit provision, § 7604, "Congress specifically

[2] Exxon also cites cases where courts dismissed citizen suits on mootness grounds because agency enforcement action resulted in the defendant coming into compliance with its permit. ECO v. City of Dallas, 529 F.3d 519 (CWA); Black Warrior River Keeper v. Cherokee Mining, LLC, 636 F. Supp. 2d 983 (D. Ala. 2009) (CWA); see also Louisiana Envtl. Action Network v. City of Baton Rouge, 677 F.3d 737 (5th Cir. 2012) (CWA) (denied request to dismiss citizen suit on mootness grounds). Mootness cases are inapposite here. Exxon violated its permits after the Complaint was filed and throughout this litigation, and indeed argues that it cannot attain full compliance. The case is not moot.

considered but rejected arguments advocating the deletion or weakening of the citizen suit section of the Act on the ground that enforcement difficulties would overburden the courts." Id.

48. This Court has already conducted a thirteen-day bench trial and is able to weigh and consider the testimony of the experts and other witnesses who testified and resolve the issues in the case.

49. For Exxon to now argue that the Court should disregard the extensive trial testimony and simply defer to TCEQ is, as another court stated in a different context, "akin to closing the barn door after the horse has escaped; it is a bit late." United States v. Lumumba, 741 F.2d 12, 17 (2d Cir. 1984).

50. Numerous federal courts have expressly ruled that they have the expertise to decide citizen suits under the CAA and other federal environmental statutes. E.g., Maine People's Alliance v. Mallinckrodt, Inc., 471 F.3d 277, 293-294 (1st Cir. 2006) (RCRA); United States Pub. Interest Research Group v. Atl. Salmon of Maine, LLC, 339 F.3d 23, 34 (1st Cir. 2003) (CWA); Ass'n of Irritated Residents, 2008 WL 850136, at *11 (citing L.E.A.D. v. Exide Corp., 1999 WL 124473, at *22 (E.D. Pa. Feb. 19, 1999)) (CAA); Illinois Pub. Interest Group v. PMC, Inc., 835 F. Supp. 1070, 1076 (N.D. Ill. 1993) (CWA); Pub. Interest Group of New Jersey v. Star Enter., 771 F. Supp. 655, 666 (D. N.J. 1991) (CWA).

51. The First Circuit, in rejecting the argument that courts do not have the expertise to interpret and apply a provision of the Resource Conservation and Recovery Act in a citizen suit, held:

> This view sells the federal judiciary short: federal courts have proven, over time, that they are equipped to adjudicate individual cases, regardless of the complexity of the issues involved. Federal courts are often called upon to make evaluative judgments in highly technical areas (patent litigation is an example). [Footnote omitted]. Performing that quintessentially judicial function in the environmental sphere is not tantamount to rewriting environmental policy. To the contrary, what the lower court did here – listening to the testimony of expert witnesses, assessing their credibility, and determining whether or not a litigant has carried the devoir of persuasion – is very much within the core competency of a federal district court.

Mallinckrodt, 471 F.3d at 293-294. See also Carey, 535 F.2d at 173 (in CAA citizen suit, court noted that "the district court in an adversarial setting can expect to derive considerable expert assistance and clarification from experts provided by the parties themselves").

52. Exxon also argues that under Chevron USA, Inc. v. Natural Res. Def. Council, Inc., 467 U.S. 837 (1984) and its progeny, TCEQ's enforcement decisions are entitled to deference and the Court should not substitute its own judgment for the agency's. Exxon misapprehends "Chevron deference."

53. The Supreme Court in Chevron held that a court should give deference to a federal agency's construction of the language of a statute it administers where that language is ambiguous, 467 U.S. at 842-843, or where

Congress has delegated "authority to the agency to elucidate [that language] by regulation," id. at 843-844.

54. In the case at bar, the Court is not asked to construe a CAA provision that is ambiguous or that was "elucidated" by an EPA (or TCEQ) regulation, and Chevron deference thus does not come into play. As the Ninth Circuit stated in a CWA citizen suit, in language applicable here, "[i]n most cases, citizen suits are brought to enforce limitations included in a permit issued by EPA, see e.g., Sierra Club, Lone Star Chapter v. Cedar Point Oil Co., 73 F.3d 546, 566 (5th Cir. 1996), and the suit does not call into question any interpretation of the statute by the agency." S.F. Baykeeper v. Cargill Salt Div., 481 F.3d 700, 706 (9th Cir. 2007); cf. Gonzales v. Oregon, 546 U.S. 243, 264 (2006) (Attorney General's decision whether to prosecute not entitled to Chevron deference in evaluating compliance with federal law); Mallinckrodt, 471 F.3d at 293-294 (rejecting argument that under Chevron the task of determining whether defendant created an "imminent and substantial endangerment" falls to an agency and should not be decided by a court in a citizen suit).

55. Exxon cites Sierra Club v. Energy Future Holdings Corp., 2014 WL 2153913 (W.D. Tex. March 28, 2014), a CAA citizen suit in which the court gave deference to TCEQ's findings on the limited question of whether a power plant satisfied criteria to quality for the affirmative defense to penalties (but

not to liability) applied to violations occurring during certain emission events. 2014 WL 2153913, at *12-13. The court in Energy Future did *not* give any deference to TCEQ enforcement decisions in ruling on liability or on whether an injunction or (where the affirmative defense was not determined to apply) penalties should be ordered.

56. This Court declines to follow Energy Future in giving deference to TCEQ's determinations regarding the availability of the affirmative defense. Nor will it expand the holding of Energy Future to apply Chevron deference to the issues of liability, injunction, or penalty amount.

57. To begin with, deference is especially inappropriate where, as here, TCEQ determinations were not made as part of a formal adjudicatory proceeding. Further, and unlike Energy Future, the Plaintiffs here have offered evidence demonstrating that TCEQ's determinations as to the availability of the affirmative defense were incorrect.

58. Moreover, the cases the Energy Future court cited to support deference involved two situations dissimilar to the one here (and dissimilar to the one before that court).

59. One type of case cited by the court in Energy Future involved construction of statutory provisions that either were ambiguous or were further elucidated by an agency under direction from Congress. Coeur Alaska, Inc. v. Se. Alaska Conservation Council, 557 U.S. 261 (deference to agency

interpretation and application of regulation to resolve ambiguity as to whether the CWA requires new source performance standards to apply to "fill material"); Ford Motor Credit Co. v. Milhollin, 444 U.S. 555 (1980) (deference to Federal Reserve Board interpretation of whether the Truth in Lending Act and Regulation Z require disclosure of an "acceleration clause" in a retail installment contract); Auer v. Robbins, 519 U.S. 452 (1997) (deference to Secretary of Labor's amicus brief setting out position on whether under the Fair Labor Standards Act certain employees are exempt from overtime pay requirements). As noted above, such a situation is not presented here.

60. The other type of case cited by Energy Future involved appeals of agency regulatory decisions under the Administrative Procedure Act ("APA"). In these cases the defendant was an agency (and not a third party charged with violating agency regulations). Texas v. Envt. Prot. Agency, 690 F.3d 670 (5th Cir. 2012) (appeal of EPA disapproval of Texas state implementation plan); Medina County Envtl. Action Ass'n v. Surface Transp. Bd., 602 F.3d 687 (5th Cir. 2010) (appeal of Surface Transportation Board decision to allow rail line); Ctr. for Marine Conservation v. Brown, 917 F. Supp. 1128 (S.D. Tex. 1996) (appeal of decisions by the Secretary of Commerce and the National Marine Fisheries Service regarding sea turtles). See also 3 Charles H. Koch, Jr., Administrative Law and Practice §12.24[3] (2d ed. 1997) (cited by both Energy Future and Exxon) (discussing judicial review of agency action under

the APA); United States v. Alcoa, 2007 WL 5272187 (W.D. Tex. March 14, 2007) (cited in Energy Future) (court requested to invalidate a TCEQ permit issued to defendant). The APA standard of review for these types of cases "is very narrow and very deferential to conclusions and actions of the agency." Ctr. for Marine Conservation, 917 F. Supp. at 1143. The present case was not brought under the APA, and the APA standard of review is inapplicable to this case.[3]

61. Asking this Court to "punt" adjudication of Plaintiffs' claim in favor of TCEQ's previous enforcement decisions is essentially asking this Court to decline jurisdiction over this matter. However, "[t]he federal courts have a 'virtually unflagging obligation…to exercise the jurisdiction given them.'" Colorado River Water Dist. v. United States, 424 U.S. 800, 817 (1976); see Susan B. Anthony List v. Driehaus, __ S. Ct. __, 2014 WL 2675871 (U.S.), at *15 ("a federal court's obligation to hear and decide cases within its jurisdiction is 'virtually unflagging.'") (citations and some internal quotations omitted). Because Congress gave district courts jurisdiction to adjudicate

[3] United States v. BP Prod. North America Inc., 610 F. Supp. 2d 655, 709 (S.D. Tex. 2009), also cited by Exxon, involved judicial review of a plea bargain in a criminal proceeding, not the adjudication of a citizen enforcement suit brought under grant of congressional authority. The citation in that case to Heckler v. Cheney, 470 U.S. 821, 831 (1985), is inapposite here, as Heckler (unlike this case) dealt with an attempt to compel agency action. While it is the general rule that suits to compel the government to take enforcement action are disfavored, Congress has explicitly authorized private citizens to file enforcement suits directly against violators under the CAA when the government does not file a suit.

citizen suits, the courts must do so. E.g., Sierra Club v. Sandy Creek Assoc., L.P., 627 F.3d 134, 144 (5th Cir. 2010) (CAA); Adkins v. Vim Recycling, 644 F.3d at 496 (RCRA); Star Enter., 771 F. Supp. at 666 (CWA).

62. As noted, this Court has previously ruled that "citizen suits were *intended* [by Congress] to be a mechanism for the public to second-guess the adequacy of an agency's response to Clean Air Act violations." Env't Texas v. ExxonMobil, C.A. No. 4:10-cv-04969, Docket Entry 126, at p. 9. Congress' intent would be eviscerated if courts were to defer to enforcement decisions of the very agency they are intended to second-guess. And to the extent that Exxon is arguing that this Court should refrain from addressing violations of the CAA simply because TCEQ or EPA has decided not to address them, this Court notes that the Supreme Court has stated that citizen enforcement suits are appropriate *precisely* "when the government cannot or *will not command compliance*." Gwaltney, 484 U.S. at 62 (emphasis added). Lastly, the Court notes that Congress has specified in the Clean Air Act that agency enforcement precludes citizen enforcement *only* where the state or federal government has already filed suit in a court to address the same violations, which is not the situation here. See 42 U.S.C. § 7604(b)(1)(B).

B. Citizen Plaintiffs Can Sue For "Wholly Past" Or "Ongoing" Violations.

63. As this Court discussed in its summary judgment ruling, citizen plaintiffs are authorized to sue for violations that (1) have occurred wholly in the past (if they were repeated), or (2) are ongoing. Env't Texas v. ExxonMobil, C.A. No. 4:10-cv-04969, Docket Entry 126, at pp. 10-14; 42 U.S.C. § 7604(a)(1). Accord e.g., Patton v. Gen. Signal Corp., 984 F. Supp. 666, 672 (W.D.N.Y. 1997); Glazer, 894 F. Supp. at 1037-1038; Satterfield v. J.M. Huber Corp., 888 F. Supp. 1561, 1564 (N.D. Ga. 1994).

63A. The parties agree that in citizen suits, violations must be proven by a preponderance of the evidence. See Ohio Valley Envtl. Coal. v. Elk Run Coal Co., 2014 WL 2526569, at *23 (S.D. W.Va. June 4, 2014); Cox v. City of Dallas, 1999 WL 33756552, at *5 (W.D.N.Y. December 16, 2008).

1. Wholly past violations.

64. The CAA citizen suit provision allows for suits over purely historical violations of emission limits that are no longer being violated (citizens may bring suit against any person "alleged to *have violated*" an emission standard or limitation), as long as they were "repeated." E.g., 42 U.S.C. § 7604(a)(1); Env't Texas v. ExxonMobil, C.A. No. 4:10-cv-04969, Docket Entry 126, at pp. 12-13; Patton, 984 F. Supp. at 672; Glazer, 894 F. Supp. at 1037-1038; Satterfield, 888 F. Supp. at 1564. These types of

violations are sometimes referred to as "wholly past violations," because they ceased before the citizen plaintiff's complaint was filed. E.g., Glazer, 894 F. Supp. at 1037.

65. A violation of a limit has been "repeated" for purposes of the CAA if that emission limit has been violated two or more times. E.g., Env't Texas v. ExxonMobil, C.A. No. 4:10-cv-04969, at pp. 12-13; Patton, 984 F. Supp. at 672; Glazer, 894 F. Supp. at 1037-1038; Satterfield, 888 F. Supp. at 1564; "Chafee-Baucus Statement of Senate Managers on the Clean Air Act Amendments of 1990, available on LEXIS at 1990 CAA Leg. Hist. 731, at *946 ("It is the intention of the conferees that citizens should be allowed to seek civil penalties against violators of the act whenever two or more violations have occurred in the past").

66. Some of the violations Plaintiffs allege are wholly past violations.

2. Ongoing violations.

67. The citizen suit provision also allows for suits to enforce standards that the defendant continues to violate (alleged "to be *in violation*"). 42 U.S.C. § 7604(a)(1). These types of violations are often referred to as "ongoing" or "continuing" violations. Env't Texas v. ExxonMobil, C.A. No. 4:10-cv-04969, Docket Entry 126, at pp. 10, 13 ("ongoing"); Fried v. Sungard Recovery Serv., 916 F. Supp. 465, 467 (E.D. Penn. 1996) ("continuing").

68. Like the CAA, the CWA citizen suit provision also authorizes citizens to bring suit against persons alleged "to be in violation." 33 U.S.C. §1365(a)(1). Courts construe the identical "in violation" language in the CAA and CWA citizen suit provisions similarly, and the Court will do so here. See Env't Texas v. ExxonMobil, C.A. No. 4:10-cv-04969, Docket Entry 126, at pp. 10-14 (citing CWA cases to construe "in violation" in the CAA); WildEarth Guardians v. Lamar Util. Bd., 2012 U.S. Dist. LEXIS 43307, at *8, n.1 (D. Colo. March 29, 2012) ("Because the CAA and CWA are similar in mechanism and operation, courts routinely turn to cases decided under one to interpret the other."); see generally Smith v. City of Jackson, 544 U.S. 228, 233 (2005) (same language in two statutes with similar purpose are construed to have same meaning).

69. To establish liability for ongoing violations, the citizen plaintiff must prove the defendant was "in violation" of a particular standard at the time suit was filed. Natural Res. Def. Council v. Texaco Ref. and Mktg., Inc., 2 F.3d 493, 501 (3d Cir. 1993) (CWA case, citing Gwaltney , 484 U.S. at 66 (1987)). A citizen plaintiff can establish the defendant is "in violation" in one of two alternative ways:

> (1) by proving violations that continue on or after the date the complaint is filed, or (2) by adducing evidence from which a reasonable trier of fact could find a continuing likelihood of recurrence in intermittent or sporadic violations.

Carr v. Alta Verde Indus., Inc., 931 F.2d 1055, 1062 (5th Cir. 1991) (citing Chesapeake Found., Inc. v. Gwaltney of Smithfield, Ltd., 890 F.2d 690, 693 (4th Cir. 1989) ("Gwaltney III")); Env't Texas v. ExxonMobil, 4:10-cv-04969, Docket Entry 126, pp. 10-11 (applying Carr to CAA citizen suit).

70. Proof of a single post-complaint violation is "conclusive" proof that a violation is continuing and that a defendant is thus "in violation" within the meaning of the citizen suit provision. Texaco, 2 F.3d at 502 (citing Carr, 931 F.2d at 1065 n. 12).

71. Alternatively, a plaintiff can establish that a defendant is "in violation" "by proving that the same inadequately corrected source of trouble will cause recurring violations" of a standard. Id. at 499.

72. Plaintiffs largely allege ongoing violations.[4]

3. Citizen plaintiffs are not required to prove that violations had the same root cause.

73. Exxon presses the argument that it is not enough for citizen plaintiffs to show multiple violations of the same standard or limitation. According to Exxon, plaintiffs must prove that violations shared the same "root cause" in order to establish that the violations were repeated or ongoing. Much of its trial testimony went to this point.

[4] Once the citizen plaintiff establishes liability for ongoing violations of a particular standard, the court may adjudicate (and award appropriate relief to redress) the defendant's pre- and post-complaint violations of that standard. See, e.g., Atlantic States Legal Foundation, Inc. v. Tyson Foods, Inc., 897 F.2d 1128, 1135 (11th Cir. 1990).

74. This Court rejected this very argument in its summary judgment ruling, and will not reverse its decision now (and will not set it out verbatim here). Env't Texas v. ExxonMobil, 4:10-cv-04969, Docket Entry 126, pp. 10-14.

75. The summary judgment ruling cited Satterfield, 888 F. Supp. at 1564-65; Patton, 984 F. Supp. at 672; and Glazer, 894 F. Supp. at 1038, as cases allowing "citizen suits for [ ] wholly past violations if plaintiffs present evidence of a second violation of the **same** emission standard or limitation." Env't Texas v. ExxonMobil, 4:10-cv-04969, Docket Entry 126, p. 13 (emphasis in original). Those cases required no root cause analysis.

76. The summary judgment ruling also cited Texaco, 2 F.3d at 499, as holding that a citizen plaintiff can establish ongoing violations by proving "a likelihood of recurring violations of the *same parameter*." Env't Texas v. ExxonMobil, 4:10-cv-04969, Docket Entry 126, p. 11 (emphasis added). A "parameter" is the CWA permit equivalent of the emission standards and limitations contained in Exxon's permits. Id. at 11-12. Again, no root cause analysis was required. Rather, the Texaco court held that even a single post-complaint violation of the same parameter establishes an ongoing violation. Texaco, 2 F.3d at 502.

77. The court in Texaco also held that a citizen plaintiff has the *option* to prove ongoing violations by "proving a likelihood that the same

inadequately corrected source of trouble will cause recurring violations of one or more different parameters," but noted that this is just one of "two ways" to prove ongoing violations. Env't Texas v. ExxonMobil, 4:10-cv-04969, Docket Entry 126, p. 11 (citing Texaco, 2 F.3d at 499). "[A] plaintiff need not prove both that a post-complaint violation has occurred and that independent evidence proves a continuing likelihood of recurring violations. Either method will suffice." Texaco, 2 F.3d at 499.[5]

78. There is an additional reason to reject Exxon's argument. Requiring citizens to prove that each violation of a single limit had the same root cause would run directly counter to the Texas Flexible Permit Program under which

[5] In its post-trial submission, Exxon again cites to cases that are either inapposite or directly contradictory to their "same root cause" argument, often excerpting quotes out of context. Yakima v. Surface Transp. Bd., 46 F. Supp. 2d 1092, 1099 (E.D. Wash. 1999), does not hold or even discuss whether the "same root cause" must be established. Rather, it holds that the alleged violation (federal agency's failure to make a "conformity determination" before approving the reopening of a rail line) was a single violation that was never repeated. The court in Anderson v. Farmland Indus., 70 F. Supp. 2d 1218, 1229 (D. Kan. 1999), cited the "either of two ways" language from Texaco, and then found the defendant to be "in violation" of a CAA permit requirement because *that same requirement* had been violated both before and after the complaint was filed, without regard to whether the pre- and post-complaint violations shared a common cause. The court in Chesapeake Bay Found. v. Gwaltney, 890 F.2d 690, 698 (4th Cir. 1989), ruled a defendant was "in violation" of a nitrogen permit limit because it violated that limit both before and after the complaint was filed. The court in Satterfield, 888 F. Supp. 1561, held in a CAA case that a defendant was *not* "in violation" of permit limits where the permit had been modified and plaintiffs did *not* claim post-complaint violations of the modified permit. The court in Allen County Cit. for the Envt. v. BP Oil, Co., 762 F. Supp. 733 (N.D. Ohio 1991), examined each permit limit at issue to determine whether there were any post-complaint violations of that limit (and thus any ongoing violations). The Court also examined, for some of the limits where there were no post-complaint violations, whether the pre-complaint violations were caused by related problems, which could lead to a finding that these violations were ongoing if those problems had not been rectified. Thus, Allen used the "either of two ways" analysis to determine whether violations were ongoing.

many of the Baytown Complex's permits were issued. Under a flexible permit's single, plant-wide emission cap for a contaminants, if a facility exceeds (or is in danger of exceeding) its cap for a contaminant, it can comply with the cap by reducing emissions from *any* of the sources that emit that contaminant (or even multiple sources). The facility can make that choice based on economic considerations if it chooses (as noted below, Exxon personnel testified that the company saw business advantages in having a flexible permit). Thus, if one emission point becomes a source of trouble, emitting too much of a contaminant, a facility could adopt an engineering solution that lowers emissions from one or more *different* sources of that contaminant to comply with the cap. Since violations of a flexible emission cap do not have a single distinct cause or solution (all covered sources contribute to any violation), it would make no logical sense to force a citizen suit plaintiff (but not defendants) to act as if they did.

C. A Defendant's Own Emission Records And Compliance Reports Are Sufficient To Establish CAA Violations.

79. A defendant's own air emission monitoring records and permit compliance reports to the government are sufficient to establish the defendant's CAA violations in an enforcement proceeding. Concerned Citizens v. Murphy Oil, 686 F. Supp. 2d at 680 (summary judgment granted where company's "Unauthorized Discharge Notification Reports"

demonstrated violations of permit limits); Chalmette Ref., 399 F. Supp. 2d at 733 (same); Pub. Serv. of Colo., 894 F. Supp. at 1460-1461 (summary judgment granted based on company's monitoring data and reports to government); Friends of the Earth v. Potomac Elec. Power, 419 F.Supp. 528, 533 (D. D.C. 1976) (summary judgment granted where defendant's own records reflect violations); cf. PennEnvironment v. GenOn Ne. Mgmt. Co., 2011 WL 1085885 (W.D. Pa. March 21, 2011) (in CWA citizen suit, summary judgment granted where defendant's monitoring reports to government indicated permit violations); United States v. Aluminum Co. of Am., 824 F. Supp. 640, 648-649 (E.D. Tex. 1993) (granting summary judgment for federal government in CWA case because monitoring reports submitted to EPA were "conclusive evidence" of violations). Under the Act, these records and reports are publicly available. 42 U.S.C. § 7661b(e) ("[a] copy of each . . . emissions or compliance report [and] certification . . . shall be available to the public").

80. To determine whether a permit holder has violated its permit, the Court need only compare the amount of pollutants permitted to be emitted with the amounts actually emitted. Louisiana Envtl. Action Network v. LWC Mgmt. Co., Inc., 2007 WL 2491360, at *6 (W.D. La. August 14, 2007) (CWA); see e.g., GenOn, 2011 WL 1085885, at *12 (comparison made in CWA citizen suit); Concerned Citizens v. Murphy Oil, 686 F. Supp. 2d at 680-

681 (comparison made in CAA citizen suit); Chalmette Ref., 399 F. Supp. 2d at 732-733 (same); Pub. Serv. of Colorado, 894 F. Supp. 1459 (same).

81. Exxon has throughout this case argued that no relief should be granted because Plaintiffs have largely based their case on publicly available information that Exxon was required to file with TCEQ, which, Exxon argues, renders Plaintiffs' claims an improper game of "gotcha." The Court is unaware of any authority that supports Exxon's argument. To the contrary, the Fifth Circuit has expressly rejected this argument by stating, with respect to the public information and disclosure requirements of the Clean Air Act:

> The public information and disclosure requirements of [the Act] have an important function under the 1970 Amendments. The Amendments embraced the concept of 'citizen enforcement' of antipollution laws. [The Act] permits 'any person' to bring a civil action in the federal district courts to enforce compliance with 'any emission standard or limitation' promulgated under the Clean Air Act. The public information requirements play a crucial role in assuring effective citizen enforcement. They are designed to ensure that 'citizen enforcers' will have access to any and all information they will need in prosecuting enforcement suits or in deciding whether to bring them.

Natural Res. Def. Council v. Envtl. Prot. Agency, 489 F.2d 390, 397 (5th Cir. 1974) (construing statutory provision that was a predecessor to 42 U.S.C. § 7661b(e)), rev'd in part on other grounds sub nom, Train v. Natural Res. Def. Council, 421 U.S. 60 (1975); Pub. Serv. of Col., 894 F. Supp. at 1459 ("[t]o aid citizen enforcement, access to information necessary to prove that an entity is violating the Act is provided"). Cf. Student Pub. Interest Group of New

Jersey, Inc. v. Fritzsche, Dodge & Olcott, Inc., 579 F. Supp. 1528, 1531 (D. N.J. 1984) (parallel self-reporting system under the CWA means "a discharger must report its own permit violations should they occur").

82. In addition, the 1990 amendments to the CAA that created the Title V permit program were intended, among other purposes, to make it easier for citizens to bring enforcement suits based on a facility's own records. Representative Henry A. Waxman (a principal author of the 1990 CAA amendments) noted that previous to the amendments, "even where [a facility's CAA requirements] were known, it was generally not possible – short of hiring engineers and conducting monitoring – for citizens to determine compliance status." Waxman, "An Overview of the Clean Air Act Amendments of 1990," 21 Envtl. L. at 1747. The Title V permit program changed that by requiring facilities to report violations themselves, which "will provide readily accessible information that citizens can use to determine the compliance status of sources." Id. at 1809. These reports were intended to provide "unprecedented opportunities to use the courts to compel full implementation of the CAA's provisions." Id. at 1747-1748.

D. Plaintiffs Need Not Prove That A Violation Has Caused Specific Injury To Establish Liability.

83. Exxon also suggests that to obtain liability, Plaintiffs must prove "causation" by linking specific events to their members' alleged injuries.

However, the CAA does not require proof of such "causation," and Congress did not intend it to be an element of a CAA enforcement action.

84. "[T]he starting point for interpreting a statute is the language of the statute itself." Gwaltney, 484 U.S. at 56. As the Supreme Court stated, the "best evidence" of the intent of Congress is the "statutory text adopted by both Houses of Congress and submitted to the President." W. Virgina Univ. Hosp., Inc. v. Casey, 490 U.S. 83, 98 (1991); Washington Pub. Interest Research Group v. Pendleton Woolen Mills, 11 F.3d 883, 886 (9th Cir. 1993) (same, construing CWA).

85. There is no language in the CAA citizen suit provision, 42 U.S.C. § 7604, that mentions, let alone requires, proof that a violation has caused any injury to a plaintiff; injury causation of this nature is not an element of the cause of action. The elements of a CAA citizen suit claim are: (1) the plaintiff must be a "person," a term which is broadly defined in 42 U.S.C. § 7602(e); (2) the defendant must be a "person;" (3) the defendant must either "have violated (if there is evidence the alleged violation has been repeated," or "be in violation," of (4) "an emission standard or limitation or an order with respect to an emission standard or limitation." 42 U.S.C. § 7604(a)(1).[6]

[6] The citizen suit provision also authorizes suits against the government and persons constructing or modifying certain facilities, but those provisions are not relevant here. 42 U.S.C. § 7604(a)(2) and (3).

86. If Congress had intended to require CAA citizen suit plaintiffs to also prove they were injured by the alleged violation, it could have easily said so, as it has done in other statutes. See Pendleton, 11 F.3d at 886. For instance, the Foreign Sovereign Immunities Act requires a plaintiff to prove that a personal injury or death "*was caused by* an act of torture, extrajudicial killing, aircraft sabotage," or another enumerated circumstance. 28 U.S.C. § 1605A(a) (emphasis added). The Racketeer Influenced and Corrupt Organizations Act requires a civil plaintiff to prove he was "*injured in his business or property by reason of* a violation of section 1962" (RICO predicate acts). 18 U.S.C. § 1964(c) (emphasis added). A veterans' benefits act requires a plaintiff to prove that a disability or death "*was caused by* hospital care, medical or surgical treatment, or examination furnished the veteran under any law administered by the Secretary . . .." 38 U.S.C. § 1151(a)(1) (emphasis added).

87. It is not surprising that citizen suit provisions under federal environmental laws do not require proof of injury causation, because the plaintiffs who bring such actions are effectively government enforcers. As some have courts put it, citizen suit plaintiffs "stand in the shoes of EPA." E.g., Powell Duffryn, 93 F.2d at 74; Sierra Club v. Chevron U.S.A., Inc., 834 F.2d 1517, 1522 (9th Cir. 1987). As other courts put it, citizen suit plaintiffs are "private attorneys general." E.g., Natural Res. Defense Council v. Envt.

Prot. Agency, 484 F.2d 1331, 1337 (1st Cir. 1973). Unlike the plaintiff in a tort suit, where proof of injury causation *is* an element of the cause of action, a citizen suit plaintiff "recovers nothing. Any benefit from the lawsuit, whether injunctive or monetary, inures to the public or to the United States." Chevron, 834 F.2d at 1522; see PennEnvironment v. RRI Energy Ne. Mgmt., 744 F. Supp. 2d 466, 482 (W.D. Penn. 2010) (CWA citizen suit plaintiffs "do not seek individualized damages"); Concerned Citizens v. Murphy Oil, 686 F. Supp. 2d at 678 (in CAA citizen suit, court held that "[a]n injunction is not specific to any of [plaintiff's] members, and an assessment of penalties under 42 US.C. § 7413(e) is paid to the government").

88. Accordingly, the CAA citizen suit provision does not contain "any requirement that the plaintiff be a person aggrieved." NRDC v. EPA, 484 F.2d at 1337. Similarly, courts routinely hold that a citizen suit "does not require individualized proof." E.g., RRI, 744 F. Supp. 2d at 466; Concerned Citizens v. Murphy Oil, 686 F. Supp. 2d at 678.

89. Thus, the only facts relating to injury that must be proven are those necessary to obtain standing under Article III of the Constitution, which of course must be proven for every federal cause of action brought by a plaintiff other than the United States. As discussed fully below, it is settled law that citizen suit plaintiffs are not required to link specific individual violations to specific injuries to establish standing.

90. Crown Petroleum, cited by Exxon, does not hold anything different. In Crown Petroleum the Fifth Circuit stated, without explanation, that while the citizen suit plaintiffs "must ultimately establish causation if they are to prevail on the merits, they need not do so to establish standing." 207 F.3d at 793. This statement is dictum (as the issue of liability was not before the court), and since the case was settled after being remanded to the district court, there was no opportunity for the Fifth Circuit in that case (or any case since) to clarify the statement's meaning.

91. However, the language of Crown Petroleum must be construed in a way that is consistent with the intent of Congress as expressed in the plain language of the CAA. It cannot be construed to require proof of injury causation that was not required by Congress. Rather, the Fifth Circuit's language can only mean that citizen suit plaintiffs must prove that Exxon *caused the violations of its permits* for which it is being sued. As explained above, this form of causation can be established through Exxon's own records.

92. Courts – including district courts in the Fifth Circuit after Crown Petroleum was decided – find CAA liability *without* requiring causation of injury to be proven. E.g., Concerned Citizens v. Murphy Oil, 686 F. Supp. 2d at 679-80; Chalmette Ref., 399 F. Supp. at 679-680; Chalmette Ref., 354 F. Supp. 2d at 707; Pub. Serv. of Colorado, 894 F. Supp. at 1459; Potomac Elec. Power, 419 F. Supp. at 533. Similarly, courts routinely find CWA liability

without requiring injury causation to be proven. E.g., Natural Res. Defense Council v. City of Los Angeles, 725 F.3d 1194 (9th Cir. 2013), cert. denied, 134 S. Ct. 2135 (2014); Cedar Point Oil, 73 F.3d 546; Powell Duffryn, 913 F.2d 64; GenOn 2011 WL 108588; U.S. Pub. Interest Research Group v. Atl. Salmon of Maine, 215 F. Supp. 2d 239 (D. Me. 2002).

93. Exxon also cites Sierra Club v. Energy Future Holdings, 2014 WL 2153913 (W.D. Tex. March 28, 2014), to support its argument that injury causation must be proven. The Court declines to follow that case because its holding is inconsistent with the plain language of the CAA, which does not require injury causation.

94. The court in Energy Future Holdings mistakenly interpreted Crown Petroleum as imposing such a requirement. Id. at *21-22.

95. Further, in imposing an injury causation requirement, the court in Energy Future Holdings cited as supporting authority personal injury cases, in which plaintiffs brought suit for exposure to asbestos and sought compensation for their fear of cancer. Id. at 22. As discussed, a personal injury suit is very different from a private attorney general suit in which the plaintiff "recovers nothing." Chevron, 834 F.2d at 1522.

96. The court in Energy Future Holdings cited Adams v. Johns-Manville Sales Corp., 783 F.2d 589, 591-592 (5th Cir. 1986) and Adams v. Johns-Manville Sales Corp., 727 F.2d 533, 537 (5th Cir. 1984), both of which

construed Louisiana state tort law, and Metro-North Commuter R. Co. v. Buckley, 521 U.S. 424, 432 (1997), which construed the Federal Employer's Liability Act ("FELA"), a form of federal statutory tort law. The Court notes that, unlike the CAA, these laws include injury causation as an element of the cause of action; like state tort law, FELA requires a plaintiff to prove injury "resulting in whole or in part from the negligence of any of the officers, agents, or employees" of the defendant. 45 U.S.C. § 51. These decisions thus are not applicable to a CAA enforcement action.

97. Energy Future Holdings appears to be the only decision in which "injury causation" was applied to determine CAA liability.

E. Administrative Enforcement Actions Do Not Preclude CAA Citizen Suits.

98. As noted earlier and as this Court ruled previously on summary judgment, under the CAA, a government administrative enforcement action does not bar a citizen suit regarding the same violations. Crown Petroleum, 207 F.3d at 795; Env't Texas v. ExxonMobil Corp., 4:10-cv-04969, Docket Entry 126, pp. 8-10; see also Chalmette Ref. 399 F. Supp. 2d at 740 ("ongoing administrative enforcement action does not warrant a denial of summary judgment in plaintiff's favor"). Nor does an agency's decision *not* to take enforcement bar a citizen suit. Env't Texas v. ExxonMobil Corp., 4:10-cv-04969, Docket Entry 126, at 8-10.

F. Relief Available Under The CAA Citizen Suit Provision.

99. A district court has jurisdiction in citizen suits "to enforce . . . an emission standard or limitation…and to apply any appropriate civil penalties . . .." 42 U.S.C. § 7604(a).

100. Contrary to Exxon's assertion at trial that citizen suits may seek only limited forms of relief, courts may invoke the full range of equitable remedies necessary "to provide complete relief in light of the statutory provisions." Mitchell v. DeMario Jewelry, Inc., 361 U.S. 288, 291-292 (1960); Weinberger v. Romero-Barcelo, 456 U.S. 305, 313 (1982) (CWA citizen suit). In citizen suits, courts:

- *Issue declaratory relief.* E.g., Aransas Project v. Shaw, No. 2:10-CV-075, 2013 WL 943780, at *788 (S.D. Tex. Mar. 11, 2013) (Endangered Species Act ["ESA"]); Potomac Electric Power, 419 F. Supp. at 531-532, 535-536 (CAA).

- *Issue injunctions ordering a defendant to stop violating permit terms.* E.g., Idaho Conservation League v. Atlanta Gold Corp., 879 F. Supp. 2d 1148, 1164 (D. Idaho 2012); Humane Soc. of U.S. v. HVFG, LLC, 2010 WL 1837785, at *1, 15 (S.D. N.Y. May 6, 2010) (CWA); PIRG v. Powell Duffryn Terminals, Inc., 720 F. Supp. 1158, 1167-1168 (D. N.J. 1989), aff'd in part and rev'd in part on other grounds, 913 F.2d 64 (3d Cir. 1990) (CWA); see U.S. Pub. Interest Research Group v. Atl. Salmon of Maine, LLC, 257 F. Supp. 2d 407, 435, aff'd, 339 F.3d 23, 27 (1st Cir. 2003) (in CWA case, ordering defendant to operate in "strict compliance" with soon-to-be-issued permit).

- *Order a special master to monitor compliance efforts.* Humane Soc., 2010 WL 1837785, at *1, 15 (CWA); Interfaith Community Organization v. Honeywell Int'l, 263 F. Supp. 2d 796, 834 (D. N.J. 2003), aff'd, 399 F.3d 248 (D. N.J. 2005) (RCRA); cf. U.S. v.

Metropolitan Dist. Com'n, 679 F. Supp. 1154, 1156 (D. Mass. 1988) (CWA).

101. With respect to a penalty, a court must consider the "penalty assessment criteria" set forth in 42 U.S.C. §7413(e) (discussed more fully below). Pound, 498 F.3d at 1097-1098 (the CAA "requires that the district court consider" these criteria).

102. Civil penalties serve the purposes of "retribution and deterrence, in addition to restitution." Tull v. United States, 481 U.S. 412, 422 (1987) (CWA case). "[F]or civil penalties to serve a deterrent function, the amount of the penalty must be high enough to ensure that there is no incentive for violators to simply absorb the penalty as a cost of doing business." United States v. A.A. Mactal Constr. Co., Inc., 1992 WL 245690, at *2 (D. Kan. April 10, 1992) (CAA case).

103. Penalties awarded in a citizen suit are deposited in a special fund in the United States Treasury for licensing and other services and can be used by the U.S. Environmental Protection Agency "to finance air compliance and enforcement activities." 42 U.S.C. § 7604(g)(1). However, a court, in its discretion, can order that up to $100,000 of a penalty "be used in beneficial mitigation projects which are consistent with this chapter and enhance the public health or the environment." Id. at § 7604(g)(2).

104. Courts also award costs of litigation (including reasonable attorney and expert witness fees) to citizen suit plaintiffs pursuant to 42 U.S.C. § 7604(d).[7]

105. Plaintiffs seek all of these forms of relief.

1. Computing "days of violations."

106. Congress authorized the district courts in a citizen suit to impose "any appropriate civil penalties" on a defendant for violating the Act. 42 U.S.C. § 7604(a). The imposition of civil penalties under the CAA is governed by two subsections of section 42 U.S.C. § 7413: subsection 7413(b), which is entitled "civil judicial enforcement" and, among other things, sets the maximum penalty that can be assessed "per day for each violation;" and subsection 7413(e), which is entitled "penalty assessment criteria" and specifies a set of criteria to be applied by the court in assessing the size of the penalty for a particular violation. The CAA citizen suit provision does not reference a particular subsection of § 7413 in authorizing the imposition of penalties, and subsections (b) and (e) must be read in conjunction to determine the appropriate penalty in a citizen suit.

107. Because subsection 7413(b) specifies a maximum penalty "per day for each violation" of the Act, violations of more than one emission standard or

[7] Applications for costs are submitted after final judgment has been entered. Local Rule 54.2.

limitation occurring on the same day are considered separate days of violation. 42 U.S.C. § 7413(b) (setting a maximum fine); Atl. States Legal Found. v. Tyson Foods, Inc., 897 F.2d 1128, 1138-39 (11th Cir. 1990) (construing similar language in CWA, court held violations of multiple limits on the same day are subject to separate daily penalties); Public Interest Research Group of New Jersey, Inc. v. Powell Duffryn Terminals, Inc., 913 F.2d 64, 77–78 (3d Cir. 1990) (also CWA, holding that each type of pollutant limit is "clearly separate" and there is "no reason why [a defendant] should not be penalized separately for violating each limitation").[8]

108. Each "day of violation" is subject to a penalty of up to $37,500 for violations occurring on January 13, 2009, and after, and up to $32,500 for violations occurring before January 13, 2009. 42 U.S.C. § 7413(b); 40 C.F.R. §19.4.[9]

109. Separate instances of violation that occur on different calendar days are counted separately. But for a violation that extends uninterrupted beyond the calendar day on which it begins, a "day" is a 24-hour period, not a calendar day. San Francisco Baykeeper v. West Bay Sanitary Dist., 791 F.

[8] The citizen suit provisions of the CAA and the CWA have long been recognized as being "*in pari materia*, and courts often rely upon interpretations of the Clean Water Act to assist with an analysis under the Clean Air Act." United States v. Dell'Aquilla, 150 F.3d 329, 338 n. 9 (3d Cir.1998) (citations omitted); Pound v. Airosol Co., Inc., 498 F.3d 1089, 1094 n.2 (10th Cir. 2007); ("[T]he penalty provisions of the CAA and the Clean Water Act (CWA) are virtually identical; thus, CWA cases are instructive in analyzing issues arising under the CAA").

[9] This amount was originally $25,000. 42 U.S.C. § 7413(b).

Supp. 2d 719, 762 (N.D. Cal. 2011) (construing identical language in CWA, court held that a two-hour-long sewage overflow that began shortly before midnight and continued into the next calendar day constituted a single "day of violation" for penalty purposes).

110. Thus, if Exxon were found to have violated an emission limit for sulfur dioxide over a continuous period lasting 24 hours or less, Exxon would be liable for one "day of violation." If, on the other hand, Exxon were found to have violated separate emission limits for sulfur dioxide and carbon monoxide during the same emission event, and unauthorized emissions of both pollutants during that event continued for 36 hours, Exxon would have committed two emission limit violations, each extending into two 24-hour periods, for a total of four "days of violation."

111. Exxon asserts, without citing any authority for the proposition, that subsection 7413(b) applies only to civil enforcement actions brought by EPA, and not to citizen suits, and that citizen suit penalties are governed only by subsection 7413(e). From this starting point, Exxon then takes words out of their statutory context to argue that a violator cannot be subject to multiple fines for violations of multiple limits on the same day. Exxon points to the difference between the wording of subsection 7413(e)(2), which states that "[a] penalty may be assessed for each day of violation," and the wording of

subsection 7413(b), which authorizes a maximum penalty "per day for each violation." Exxon's argument is unpersuasive for many reasons.

112. First, it is self-contradictory. If subsection 7413(b) did not apply to citizen suits there would be no statutory limit on penalties assessed in such suits, and Exxon itself maintains that the $37,500 per day limit – and thus subsection 7413(b) – *does* apply to citizen suits. Congress cannot be presumed to have invested citizen plaintiffs with greater penalty authority than the government, and no case cited to this Court so holds. Rather, as discussed above, citizens serve as private attorneys general under 42 U.S.C. § 7604. Congress authorized citizen plaintiffs to stand in the shoes of the EPA Administrator, to whom subsection 7413(b) is addressed, and to sue for civil penalties, which subsection 7413(b) governs. There thus is every reason to believe that Congress intended federal courts to implement the same set of federal policies when imposing penalties in citizen civil actions as they do when imposing penalties in civil actions brought by the federal government.

113. Second, Exxon's argument is inconsistent with the plain language of subsection 7413(e)(2). That provision does not foreclose, or even address, the imposition of penalties for multiple violations occurring on the same day. Rather, like subsection 7413(e)(1), it sets forth criteria that apply to the assessment of a penalty for any particular "violation." Subpart (e)(1) lists certain factors that the courts are to consider in setting a penalty for the

violation, and subpart (e)(2) clarifies that the penalty "may be assessed for each day of violation" and provides certain rules for determining how many days the violation lasted. 42 U.S.C. § 7413(e)(2). Subsection 7413(e) does not purport to define the "violations" for which penalties may be assessed on any given day; that is left to subsection 7413(b), which limits penalties to a given amount "per day for each violation."

114. Third, Exxon's reading of subsection 7413(e)(2) ignores the fact that this provision also applies to actions brought by the federal government. By its terms, it applies to any "violation for which a penalty may be assessed under subsection [7413](b)." 42 U.S.C. § 7413(e)(2). Thus, if Exxon were correct that the language of 7413(e)(2) foreclosed the imposition of a penalty for more than one violation on a single day, that would create a direct conflict with 7413(b) in government-initiated enforcement cases. Consistent, decades-long interpretation of the CAA by federal courts and the EPA finds no such conflict between the two sections. See, e.g., United States v. Dell'Aquilla, 150 F.3d 329, 337 (3rd Cir.1998) (affirming district court's conclusion that 1990 Amendments clarified congressional intent to allow maximum fine for each violation, for each day the violation existed); United States v. Midwest Suspension & Brake, 824 F. Supp. 713, 733-734 n. 28 (E.D. Mich.1993), aff'd, 49 F.3d 1197 (6th Cir.1995) (civil penalties for

each violation, even if violations occur on the same day, warranted under § 7413(b), citing Tyson Foods, 897 F.2d at 1138–40).

115. Fourth, allowing a violator to commit an unlimited number of different violations each day, while remaining subject only to a single maximum daily penalty, would contravene the Clean Air Act's stated purpose "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare …" 42 U.S.C. § 7401(b)(1). Indeed, rather than creating an economic incentive to keep violations to an absolute minimum, it would create the perverse incentive to commit multiple violations on a single day.

V. THE LAW OF STANDING.

116. "In every federal case, the party bringing the suit must establish standing to prosecute the action. 'In essence the question of standing is whether the litigant is entitled to have the court decide the merits of the dispute or of particular issues.' Warth v. Seldin, 422 U.S. 490, 498 [parallel cites omitted].'" Elk Grove Unified School Dist. v. Newdow, 542 U.S. 1, 11 (2004).

117. "[S]tanding jurisprudence contains two strands: Article III standing, which enforces the Constitution's case-or-controversy requirement, and prudential standing, which embodies 'judicially self-imposed limits on the exercise of federal jurisdiction[.] Elk Grove, [542 U.S. at 11]." Servicios

Azucareros de Venezuela, C.A. v. John Deere Thibodeaux, Inc., 702 F.3d 794, 801 (5th Cir. 2012).

118. At trial, a plaintiff must prove standing by a preponderance of the evidence. Envtl. Conservation Org. v. City of Dallas, 2005 WL 1771289, at *3, n.2 (N.D. Tex. July 26, 2005); Jana-Rock Constr., Inc. v. New York State Dep't of Econ. Dev., 2004 WL 5550699, at *6 (N.D.N.Y. 2004).

119. Standing in a citizen suit can be proven by circumstantial evidence. Crown Petroleum, 207 F.3d at 793; Gaston Copper, 204 F.3d at 163; Murphy Oil, 686 F. Supp. 2d at 672.

120. Utilizing the concept of "associational standing," organizations can sue on behalf of members who have been injured by the challenged action. Hunt v. Washington State Apple Adver. Comm'n, 432 U.S. 333, 342 (1977); Warth v. Seldin, 422 U.S. 490, 511 (1975). An organization establishes associational standing by proving

> (1) its members would otherwise have standing to sue in their own right; (2) the interests it seeks to protect are germane to the organization's purpose; and (3) neither the claim asserted nor the relief requested requires the participation of individual members.

Hunt, 432 U.S. at 343; Crown Petroleum, 207 F.3d at 792; Murphy Oil, 686 F. Supp. 2d at 669.

121. Plaintiffs in citizen suits are typically environmental groups suing on behalf of their members. E.g., Friends of the Earth, Inc. v. Laidlaw Entl.

Serv. (TOC), Inc., 528 U.S. 167 (2000); Crown Petroleum, 207 F.3d 789; Sierra Club, Lone Star Chapter v. Cedar Point Oil Co., 73 F.3d 546 (5th Cir. 1996).

122. To establish associational standing, an organization need have only a single member who would have standing to sue individually. E.g., Warth v. Seldin, 422 U.S. at 511("the association must allege that its members, *or any one of them*, are suffering immediate or threatened injury. . .") (emphasis added); Ecological Rights Found. v. Pac. Lumber Co., 230 F.3d 1141, 1150 n.10 (9th Cir. 2000); Ohio Valley Envtl. Coal. v. Hobet Mining, LLC, 702 F. Supp. 2d 644, 649 (S.D.W. Va. 2010); Huertas v. E. River Hous. Corp., 81 F.R.D. 641, 647 (S.D.N.Y. 1979).

122A. That person's membership status *before* the Complaint is filed is irrelevant to the standing inquiry because "[s]tanding is determined as of the time that suit is filed." Energy Mgmt. v. City of Shreveport, 397 F.3d 297, 302, n.3 (5th Cir. 2005). See Atl. States Legal Found. v. Al Tech Specialty Steel Corp., 635 F. Supp. 284, 288 (S.D.N.Y. 1986) (rejecting defendant's …contention…that it cannot be held liable for any violations that occurred before the plaintiff organization was founded, or before the members of the organization that were allegedly harmed actually joined the organization"). (Here, Plaintiffs' members who testified at trial were all members before this suit was filed. Findings of Fact ["FOF"] ¶¶ 972, 989, 1001, 1020.)

A. Article III Standing.

123. The presence of one party with standing is sufficient to satisfy Article III's case or controversy requirement. Rumsfeld v. Forum for Academic and Inst. Rights, Inc., 547 U.S. 47, 53 n.2 (2006); Janvey v. Democratic Senatorial Campaign Comm, 712 F.3d 188, 193 (5th Cir. 2013).

124. "The [Article III] standing inquiry ensures that a plaintiff has a sufficient personal stake in a dispute to render judicial resolution appropriate." Friends of the Earth, Inc. v. Gaston Copper Recycling Corp., 204 F.3d 149, 153 (4th Cir. 2000); accord Sierra Club v. Morton, 405 U.S. at 732; Baker v. Carr, 369 U.S. 186, 204 (1962); Pub. Interest Research v. Powell Duffryn Terminals, Inc., 913 F.2d 64, 70 (3d Cir. 1990). "The standing requirement also 'tends to assure that the legal questions presented to the court will be resolved, not in the rarefied atmosphere of a debating society, but in a concrete factual context conducive to a realistic appreciation of the consequences of judicial action.'" Gaston Copper, 204 F.3d at 153-154 (quoting Valley Forge Christian College v. Am. United for Separation of Church and State, Inc., 454 U.S. 464, 472, (1982)); see also Gaston Copper 204 F.3d at 154 (standing filters out "the abstractly distressed"). Thus, the plaintiff in an environmental citizen suit must demonstrate more than "a mere '*general* interest in environmental preservation'"; he must have a personal interest in the particular

environmental dispute before the court. Save Our Cmty. v. United States Envtl. Prot. Agency, 971 F.2d 1155, 1161 (5th Cir. 1992) (emphasis added).

125. That requisite personal interest is established when a plaintiff (or, where associational standing is asserted, a plaintiff organization's member) proves:

> (1) they have suffered an actual or threatened injury; (2) the injury is "fairly traceable" to the defendant's actions; and (3) the injury will likely be redressed if the plaintiffs prevails in the lawsuit.

Crown Petroleum, 207 F.3d at 792 (citing Lujan v. Defenders of Wildlife, 504 U.S. 555, 560 (1992)). Put succinctly, "[t]his formula has three elements: (1) injury in fact; (2) traceability; and (3) redressability." Gaston Copper, 204 F.3d at 154.

126. The three prongs of standing apply at each stage of a proceeding, whether a motion to dismiss, summary judgment, or trial. E.g., Comer v. Murphy Oil USA, 585 F.3d 855, 860, 862 (5th Cir. 2009), vacated on other grounds on grant of rehearing en banc, 598 F.3d 208, en banc appeal dismissed for lack of quorum, 607 F.3d 1049 (5th Cir. 2010) (motion to dismiss); St. Bernard Citizens for Envtl. Quality, Inc. v. Chalmette Ref., L.L.C., 354 F. Supp. 2d 697, 699, 701 (E.D. La. 2005) (summary judgment); Natural Resources Def. Council v. Sw. Marine, Inc., 236 F.3d 985, 993-994 (9th Cir. 2000) (trial).

127. "While each of the three prongs of standing should be analyzed distinctly, their proof often overlaps." Gaston Copper, 204 F.3d at 154.

128. As this Court previously ruled, and as discussed further below, a citizen suit plaintiff is not required to prove standing separately for each violation of environmental law alleged. Env't Texas v. ExxonMobil, Docket Entry 126, p. 18 (citing Cedar Point Oil, 73 F.3d at 556-558, this Court stated, "Defendants' violation-by-violation approach to assessing standing is more exacting than what courts have required in citizen environmental suits.").

1. Injury In Fact.

129. The crux of the injury in fact requirement is that "[a] plaintiff must [ ] suffer an invasion of a legally protected interest that is 'concrete and particularized' before he can bring an action.'" Gaston Copper, 204 F.3d at 156 (quoting Lujan, 504 U.S. at 560 (1992). This prevents mere "concerned bystanders" from bringing suits. Cedar Point Oil, 73 F.3d at 556.

130. "[I]njuries need not be large, an identifiable trifle will suffice." Cedar Point Oil, 73 F.3d at 557; accord United States Students Challenging Regulatory Agency Procedures (SCRAP), 412 U.S. 669, 689 n.14 (1973); Abbott v. BP Exploration and Prod., Inc., 781 F. Supp. 2d 453, 470 (S.D. Tex. 2011). The Supreme Court has expressly rejected the argument that the injury in fact requirement is limited to "significant[] injuries." SCRAP, 412 U.S. at 689 n.14. The Fifth Circuit has noted that, in environmental citizen suits, "the

threshold for the injury requirement is fairly low." Cedar Point Oil, 73 F3d at 557 n.23.

131. Exxon suggests, however, that an "identifiable trifle" suffices for a motion to dismiss or a summary judgment motion, but not at trial. As a matter of law, Exxon is wrong. As set out above, the purpose of the standing requirement is to help ensure that the plaintiff has a sufficient stake in the dispute to render judicial resolution appropriate. That requisite "stake" is no different at the motion to dismiss stage, the summary judgment stage, or the trial stage, and the three elements of Article III standing do not have different meanings at different procedural stages of the dispute. As the Fifth Circuit recently noted, "the elements of Article III standing are constant throughout litigation: injury in fact, the injury's traceability to the defendant's conduct, and the potential for the injury to be redressed by the relief requested." In re Deepwater Horizon, 739 F.3d 790, 799 (5th Cir. 2014). Accordingly, the courts have made it clear that where standing is decided at trial, proof of an "identifiable trifle" is all that is required to establish injury in fact. E.g., Common Cause/Georgia v. Billings, 554 F.3d 1340, 1348, 1351 (11th Cir. 2009); Preminger v. Peake, 552 F.3d 757, 762, 763 (9th Cir. 2008); Gen. Instrument Corp. v. Nu-Tek Elec. & Mfg., Inc., 197 F.3d 83, 85, 87 (3d Cir. 1999).

132. Nonetheless, the type of evidence required to establish the three elements of standing *does* differ at the various stages of the litigation, "in the same way as any other matter on which the plaintiff bears the burden of proof." Lujan, 504 U.S. at 561.

> At the pleading stage, general factual allegations of injury resulting from the defendant's conduct may suffice, for on a motion to dismiss we presume that general allegations embrace those specific facts that are necessary to support the claim. In response to a summary judgment motion, however, the plaintiff can no longer rest on such mere allegations, but must set forth by affidavit or other evidence specific facts, which for purposes of the summary judgment motion will be taken to be true. And at the final stage, those facts (if controverted) must be supported adequately by the evidence adduced at trial.

In re Deepwater Horizon, 739 F.3d at 799-80 (citations omitted). Thus, this Court evaluates the record here to determine whether the three elements of Article III standing are "supported adequately by the evidence adduced at trial." (The Court notes that while this is a more exacting standard than would be applied to a plaintiff's proof during a motion to dismiss or a defense motion for summary judgment, it is a lesser burden of proof than would be applied if this case were before the Court on Plaintiffs' motion for summary judgment, because in that procedural posture all factual inferences would be drawn in favor of the Defendants.)

133. Courts have found a variety of adverse effects sufficient to qualify as injury in fact, including, relevant to this case, the following.

a. Adverse physical effects or adverse effects on health.

134. A physical discomfort or adverse health effect constitutes injury in fact for Article III purposes. Crown Petroleum, 207 F.3d at 792 (exposure to air pollution that produces odors that are "overpowering and capable of causing physical discomfort" is an injury in fact); Hall v. Norton, 266 F.3d 969, 976 (9th Cir. 2001) (aggravation of "respiratory discomfort" from air pollution constitutes injury in fact); Tex. Campaign for the Env't v. Lower Colorado River Auth. ("LCRA"), No. 4:11–cv–791, 2012 WL 1067211, at *4 (S.D. Tex. Mar. 28, 2012) (injury in fact established where plaintiff's member's asthma was exacerbated by air pollution); Ass'n of Irritated Residents v. C&R Vanderham Dairy, 2007 WL 2815038, at *15-16 (E.D. Cal. Sept. 25, 2007) (injury in fact established where plaintiff's member "suffers from breathing difficulties exacerbated by ozone pollution").

b. Concern about the health effects of pollution.

135. "[B]eing reasonably concerned about the health effects of air pollution" also establishes an injury in fact for standing purposes. Concerned Citizens Around Murphy Oil v. Murphy Oil USA, Inc., 686 F. Supp. 2d 663, 671 (E.D. La. 2010); see Laidlaw Envtl. Serv., Inc., 528 U.S. at 184 (in CWA case, the Court held that reasonable fear of harm from pollution is an injury in fact); Sierra Club v. Tennessee Valley Auth., 430 F.3d 1337, 1345 (11th Cir.

2005) (plaintiff's member found it "frightening" to breathe air polluted by defendant's power plant).

136. Such concern constitutes injury in fact regardless of whether it is accompanied by physical symptoms of harm. For example, in St. Bernard Citizens v. Chalmette Refining, 354 F. Supp. at 702, members of a plaintiff organization submitted affidavits stating that Chalmette's refinery emissions, which smelled bad, made them concerned for their family's health and their own health. Chalmette argued that, "because plaintiffs do not offer evidence connecting the odors to any health effects, their injury is not sufficiently concrete and particularized to confer standing." Id. The court rejected this argument, holding, "plaintiffs need not show, as Chalmette appears to contend, that they suffer a bodily injury caused by the pollution. Rather, plaintiffs can demonstrate a cognizable injury by showing that they breathe and smell polluted air." Id.

137. In a citizen suit, medical testimony is not required to prove a reasonable concern about the health effects of pollution. E.g., Sierra Club v. TVA, 430 F.3d at 1345; Concerned Citizens v. Murphy Oil, 686 F. Supp. 2d at 671; Chalmette Refining, 354 F. Supp. at 702; Cmtys. for a Better Envt. v. Cenco Ref. Co., 180 F. Supp. 2d 1062, 1075 (C.D. Cal. 2001); see Laidlaw, 528 U.S. at 181-182.

138. In Friends of the Earth v. Laidlaw, 528 U.S. 167, a CWA citizen suit, members of the plaintiff organizations curtailed activities in and around a river because they were concerned about the health effects of the defendant's mercury discharges into the river. Id. at 181-185. Even though the district court had found that the defendant's violations "did not result in any health risk or environmental harm" (id. at 199, Scalia, J., dissenting), the Supreme Court held plaintiffs' concerns constituted an injury in fact. Id. at 184-185. The Court stated, "we see nothing 'improbable' about the proposition that a company's continuous and pervasive illegal discharges of pollutants into a river would cause nearby residents to curtail their recreational use of that waterway…The proposition is entirely reasonable…" Id.

139. In Duke Power Co. v. Carolina Envtl. Study Group, Inc., 438 U.S. 59 (1978), an environmental group sued to strike down a law limiting the liability of nuclear power plant owners. The Supreme Court found Article III standing because, if the environmental group were to prevail, the practical effect would be that Duke Power would not build such a plant, and the group's members would not be exposed to the low-level radiation the plant would emit. Despite the uncertainty about the health effects of exposure to small amounts of radiation, the Court held that the plaintiff had established an injury in fact:

> [T]he emission of non-natural radiation into [plaintiffs'] environment would also seem a direct and present injury, given our generalized concern about exposure to radiation and the apprehension flowing from

> the uncertainty about the health and genetic consequences of even small emissions like those concededly emitted by nuclear power plants.

Id. at 74.

140. Similarly, in a CAA citizen suit, emissions do not need to cause the ambient levels of air pollutants to exceed regulatory limits for a person to suffer an injury-in-fact. Sierra Club v. Franklin County Power of Illinois, 546 F.3d 918, 925 (7th Cir. 2008); LaFleur v. Whitman, 300 F.3d 256, 270-72 (2d Cir. 2002) ("Actual exposure to increased levels of SO_2 at one's workplace [adjacent to the defendant's facility]" is an injury in fact, "even if the ambient level of air pollution does not exceed" national standards).

c. Harm to aesthetic, environmental, or recreational interests.

141. In addition, "harm to aesthetic, environmental, or recreational interests is sufficient to confer standing, provided that the party seeking review is among the injured." E.g., Sierra Club v. Cedar Point Oil, 73 F.3d at 557 (quoting Sierra Club v. Morton, 405 U.S. at 734-735); Save Our Cmty., 971 F.2d at 1161.

142. Aesthetic harm occurs, for example, when one breathes polluted air and finds it unpleasant. The Fifth Circuit has held that "breathing and smelling polluted air is sufficient to demonstrate injury-in-fact and thus confer standing under the CAA." Crown Petroleum, 207 F.3d at 792 (smelling "sulfurous odors while in the home, in the yard, or driving through town"

demonstrates "a cognizable injury" for standing purposes, as these odors diminish the "enjoyment of [one's] surroundings"). Persons who "use and enjoy their yards and neighborhood less because of odors emanating from" a refinery suffer an injury. Concerned Citizens v. Murphy Oil, 686 F. Supp. 2d at 671. See also Laidlaw, 528 U.S. at 181-182 (in CWA case, standing found where group's member "occasionally drove over the" river into which defendant discharged, which "looked and smelled polluted," and member used the river less because of the pollution); Cedar Point Oil, 73 F3d at 557 n.23 (citing Friends of the Earth v. Consol. Rail Corp., 768 F.2d 57, 61 (2d Cir. 1985), in which the court found the requisite injury in fact where an organization's member regularly drove on a bridge over a river and was offended by pollution in the river).

143. Similarly, curtailing recreation or enjoying it less because of pollution also constitutes an injury in fact. E.g., Laidlaw, 528 U.S. at 183 (injury in fact exists where plaintiffs "use the affected area and are persons 'for whom the aesthetic and recreational values of the area will be lessened' by the challenged activity") (quoting Sierra Club v. Morton, 405 U.S. at 735); Ecol. Rights Found., 230 F.3d at 1150 (plaintiff's members fish and swim less because of defendant's pollution); Pub. Interest Res. Group of New Jersey v. Powell Duffryn Terminals, Inc., 913 F.3d 64, 71 (3rd Cir. 1990) (plaintiffs'

members would enjoy hiking, biking, and bird watching more if waterway were not as polluted).

d. Threatened injury and increased risk.

144. "The Supreme Court has consistently recognized that threatened rather than actual injury can satisfy Article III standing requirements." Gaston Copper, 204 F.3d at 160 (citing Valley Forge College, 45 U.S. at 472, and Gladstone Realtors v. Vill. of Bellwood, 441 U.S. 91, 99 (1979)); Crown Petroleum, 207 F.3d at 792 ("an actual *or threatened* injury" suffices) (emphasis added). In other words, "threatened injury . . . is by itself injury in fact," and "increased risk [of harm] thus constitutes cognizable injury" for standing purposes. Gaston Copper, 204 F.3d at 160; accord Ecol. Rights Found., 230 F.3d at 1151 ("Laidlaw recognized that an increased risk of harm can itself be injury in fact sufficient for standing"); Cmtys for a Better Envt. v. Cenco Ref. Co., 180 F. Supp. 2d at 1075 ("breathing even slightly polluted air entails a health risk," and exposure to such a risk is an injury in fact); see also Mountain States Legal Found. v. Glickman, 92 F.3d 1228, 1234-35 (D.C. Cir. 1996) (increased risk of wildfire from certain logging practices constitutes an injury in fact); Village of Elk Grove Village v. Evans, 997 F.2d 328, 329 (7th Cir. 1993) (small increase of flooding risk from construction of a radio tower constitutes injury in fact even though there was only a "small probability" of flooding); Johnson v. Allsteel, Inc., 259 F.3d 885, 888-891 (7th Cir. 2001)

(increased risk that an Employee Retirement Income Security Act beneficiary will not be covered due to the increased amount of discretion given to the ERISA administrator held to be an injury in fact).

145. Violation of reporting and recordkeeping requirements imposed by environmental laws can give rise to this type of injury in fact. As this Court noted in denying Exxon's motion for summary judgment on Plaintiffs' claims for such violations, these requirements are designed to encourage sound operational and maintenance practices, which are important because "[p]oor operation and maintenance practices may lead to future emissions or other dangerous events such as an explosion." Env't Texas v. ExxonMobil, Docket Entry 126, p. 18. See also, Watts Agricultural Aviation, Inc. v. Busey, 977 F.2d 594, *3 (9th Cir. 1992) ("A policy of leniency toward recordkeeping inevitably encourages carelessness in the timely performance of required maintenance, to the derogation of safety") (Federal Aviation Administration case; citation omitted); United States v. Smithfield Foods, Inc., 972 F.Supp. 338, 348 (E.D. Va. 1997), aff'd in part, rev'd in part, 191 F.3d 516 (4th Cir. 1999) ("When a [CWA] permittee…fails to maintain supporting records, … the permittee may be covering up serious violations of effluent limitations … [T]he court cannot assume that violations of monitoring and reporting requirements in a permit are trivial."). Because they are designed to reduce the risk of future air emission events and other forms of air pollution, violation of

such requirements can injure citizen plaintiffs who would be adversely affected by such pollution. "It is not necessary for a plaintiff challenging violations of rules designed to reduce the *risk* of pollution to show the presence of *actual* pollution in order to obtain standing." Ecol. Rights Found., 230 F.3d at 1152 n.12 (emphasis in original).

e. Concern about future adverse effects.

146. Finally, a plaintiff's concern about future adverse effects from a facility's pollution also satisfies the injury in fact requirement. Cedar Point Oil, 73 F.3d at 556 (in CWA citizen suit, fear that waste disposal from oil drilling will impair Galveston Bay recreational activities in the future is injury in fact); Louisiana Envtl. Action Network v. Sun Drilling Prod. Corp., 2010 U.S. Dist. LEXIS 127356, at *12-13 (E.D. La. 2010) (in CWA citizen suit, fear that illegal discharge of toxic pollutant will impair nearby drinking water source in the future is injury in fact).

2. Traceability.

147. The fairly traceable test is whether "the pollutant [released by the defendant] causes or *contributes* to the kinds of injuries alleged by the plaintiffs." Comer v. Murphy Oil, 585 F.3d at 866 (quoting Cedar Point Oil, 73 F.3d at 557) (emphasis in original); Piney Run Pres. Ass'n v. County Comm'rs of Carroll County, 268 F.3d 255, 264 (4th Cir. 2001); Gaston Copper, 204 F.3d at 161; Concerned Citizens v. Murphy Oil, 686 F. Supp. 2d

at 672; PennEnvironment v. RRI Energy Ne. Mgmt., 2010 WL 3883456, at *3 (W.D. Penn. September 28, 2010). "[C]ontribution to the harm is sufficient for traceability purposes…." Comer v. Murphy Oil, 585 F.3d at 866.

148. "The 'fairly traceable' requirement 'is not equivalent to a requirement of tort causation.'" Chalmette Ref., 354 F. Supp. at 704 (quoting Powell Duffryn, 913 F.3d at 72); accord Comer v. Murphy, 585 F.3d at 864; Gaston Copper, 204 F.3d at 161.

149. To prove traceability, citizen suit plaintiffs "need not pinpoint the exact times of violations and link its members' injuries to permit violations at those times." Concerned Citizens v. Murphy Oil, 686 F. Supp. 2d at 671; accord Crown Petroleum, 207 F.3d at 793 (plaintiffs are not required to "connect the exact time of their injuries to the exact time of an alleged violation"); Chalmette Ref., 354 F. Supp. 2d at 704 (finding "meritless" defendant's argument that "plaintiffs have not met the 'fairly traceable' element because plaintiffs have not connected their air pollution samples with the violations they allege"). In Crown Petroleum, the Fifth Circuit expressly rejected the defendant's argument "that the 'fairly traceable' standard cannot be satisfied in this case unless [plaintiff] Texans United's injuries are linked to the exact dates where violations of regulatory standards are known to have occurred." 207 F.3d at 793.

150. "To satisfy the [traceability] requirement, '[r]ather than pinpointing the origins of particular molecules, a plaintiff must merely show that a defendant discharges a pollutant that causes or contributes to the kinds of injuries alleged in the specific geographical area of concern." Sw. Marine, 236 F.3d at 995 (quoting Gaston Copper, 204 F.3d at 161); Hobet Mining, 702 F. Supp. 2d at 651.

151. "[T]o satisfy the 'fairly traceable' element of standing plaintiffs need not 'show to a scientific certainty that defendant's [pollutants], and defendant's [pollutants] alone, caused the precise harm suffered by the plaintiffs." Comer v. Murphy Oil, 585 F.3d at 866; Save our Cmty., 971 F.2d at 1161; Powell Duffryn, 913 F.2d at 72. See also Gaston Copper, 204 F.3d at 163 (in CWA case, no "need to address complex questions of environmental abasement and scientific traceability in enforcement proceedings . . .. Courts would become enmeshed in abstruse scientific discussions as standing questions assumed a complicated life of their own . . . tak[ing] us far afield from the straightforward" issue of whether a permit has been violated).

152. In Powell Duffryn, 913 F.2d 64, an environmental group brought a CWA citizen suit to enforce the terms of a wastewater discharge permit issued to defendant Powell Duffryn Terminals ("PDT"). The court held that a citizen suit plaintiff satisfies the traceability element by showing a defendant has

> 1) discharged some pollutant in concentrations greater than allowed by its permit, 2) into a waterway in which the plaintiffs have an interest that is or may be adversely affected by the pollutant and that 3) this pollutant causes or contributes to the kinds of injuries alleged by the plaintiffs.

Id. at 72. The Third Circuit applied this analysis to the facts of the case as follows:

> In this case, several affiants stated that the water had an oily or greasy sheen they found offensive. PDT's permit contained limits on the oil and grease PDT could discharge in its effluent. PDT's reports to the EPA indicate that PDT has discharged oil and grease in excess of these limits. Thus the aesthetic injury suffered by the plaintiffs may be fairly traced to PDT's effluent.

Id. at 73.

153. Numerous courts, including the Fifth Circuit and district courts in the Fifth Circuit, have adopted this analytical framework for assessing traceability, e.g., Am. Canoe Assoc., Inc. v. City of Louisa Water and Sewer Comm'n, 389 F.3d 536, 543 (6th Cir. 2010) (CWA); Piney Run Pres. Ass'n v. County Comm'rs of Carroll County, 268 F.3d 255, 263-264 (4th Cir. 2001) (CWA); Crown Petroleum, 207 F.3d at 793 (CAA); Cedar Point Oil, 73 F.3d at 557-558 (CWA); Concerned Citizens v. Murphy Oil, 686 F. Supp. 2d at 671-673 (CAA); Davis v. Jackson, 2010 WL 2978047, at *3 (M.D. Fla. July 19, 2010) (CWA). And this Court adopts it here.

154. Exxon appears to suggest that, at trial, a citizen plaintiff must go further, and must explicitly link each violation to a specific injury to one of the plaintiff's members. This is not the law. As discussed, the standing

requirements "are constant throughout [the] litigation." In re Deepwater Horizon, 739 F.3d at 799. Moreover, it is not the case that plaintiffs face a higher evidentiary burden at trial than when they move for summary judgment; rather, as also discussed above, plaintiffs face a higher burden on their own motion for summary judgment, because at that stage of the proceeding, unlike at trial, all factual inferences will be drawn against them. And, on a plaintiff's motion for summary judgment, numerous courts have ruled that citizen suit plaintiffs have standing, *and have then gone on to find liability*, without requiring plaintiffs to pinpoint the exact times of violations and link their members' injuries to permit violations at those times. E.g., PennEnvironment v. GenOn Ne. Mgmt. Co., 2011 WL 1085885, at *10 (W.D. Penn. March 21, 2011) (expressly rejecting need to "pinpoint"); Concerned Citizens v. Murphy Oil, 686 F. Supp. 2d at 671-672 (expressly rejecting need to "pinpoint" or "link" injuries to dates of violations); Chalmette, 354 F. Supp. 2d at 704 (expressly rejecting need to "link" injuries to dates of violations).

155. The cases cited by Exxon do not require a different result. See Crown Petroleum, 207 F.3d at 793 ("No relevant case law supports Crown's argument that Texans United must connect the exact time of their injuries with the exact time of an alleged violation by Crown."); Sierra Club v. Energy Future Holdings Corp., 2014 WL 2153913, at *21 (W.D. Tex. March 28, 2014) (noting that it is not necessary to "explicitly link" a plaintiff's injury to a

particular violation to make "the minimal showing of 'traceability' needed to demonstrate Article III standing"); and Texas Campaign for the Envt. v. LCRA, 2012 WL 1067211, at *5 (S.D. Tex. March 28, 2012) (noting that "the Fifth Circuit has found it sufficient for the 'fairly traceable' standard that the alleged 'pollutant causes or contributes to the kinds of injuries alleged by the plaintiffs.'") (citing Cedar Point Oil, 73 F.3d at 557).

3. Redressability.

156. The "redressability" element of standing requires that the relief sought by the plaintiff will, in whole or in part, "redress" the injuries of which the plaintiffs complain; this element must be satisfied for each form of relief sought by the plaintiff. Laidlaw, 528 U.S. at 185. The fact that an agency has taken administrative enforcement action against a citizen suit defendant does not defeat redressability where the defendant continues to violate. Crown Petroleum, 207 F.3d at 793-794. Relief that "encourage[s] defendants to discontinue current violations" or "deter[s] them from committing future ones" will "afford redress to citizen plaintiffs." Laidlaw, 528 U.S. at 186.

157. Declaratory relief – here, determining whether, and to what extent, Exxon has violated its permits – can help redress a plaintiff's injuries. See generally Franklin v. Massachusetts, 505 U.S. 788, 801-803 (1992) (holding redressability prong satisfied by request for declaratory relief even though any actual change would require discretionary determination by President); Steffel

v. Thompson, 415 U.S. 452, 466 (1974) (recognizing that declaratory relief can provide an incentive to change behavior, and that "Congress plainly intended declaratory relief to act as an alternative to the strong medicine of the injunction."). The Court notes that an Agreed Order negotiated by Exxon and TCEQ and entered in 2012 provides that violations of the Complex's permits will be deemed "non-violations" as long as Exxon pays money to TCEQ. This highlights the importance of a court order declaring Exxon to be in violation of its permits.

158. An injunction requiring Exxon to cease violating its permits would redress Plaintiffs' members' injuries by ensuring that that they will not be exposed to Exxon's illegal emissions in the future. Crown Petroleum, 207 F.3d at 793; Chalmette Ref., 354 F. Supp. 2d at 705-706.

159. An injunction requiring Exxon to cease violating its permits is also "likely to alleviate some of the distress, anger, and fear Plaintiffs experience in relation to their knowledge of" the air pollution in Baytown and surrounding areas, which is itself a measure of redress. Hobet Mining, 702 F. Supp. 2d at 653.

160. Appointment of a special master to monitor Exxon's efforts to comply with its permits would strengthen the likelihood that the principal injunction would be carried out, and thus would redress Plaintiffs' members' injuries as above.

161. Plaintiffs need not show that an injunction would return the air in Baytown to a "pristine state." Hobet Mining, 702 F. Supp. 2d at 652; Student Pub. Interest Research Group of New Jersey, Inc. v. Georgia-Pacific Corp., 615 F. Supp. 1419, 1424 (D. N.J. 1985). Similarly, an injunction need not reduce air pollution from all sources in the area to provide redress to Plaintiffs. Crown Petroleum, 207 F.3d at 702.

162. Penalties redress a citizen suit plaintiff's injuries by deterring future violations. Laidlaw, 528 U.S. at 167; Crown Petroleum, 207 F.3d at 793; Chalmette Ref., 354 F. Supp. 2d at 705-706; Pub. Citizen v. Am. Elec. Power, 2006 WL 3813766, at *5 (E.D. Tex. 2006). Penalties encourage compliance and deter future violations both by punishing illegal conduct and by helping to remove any economic incentive to violate the law. Laidlaw, 528 U.S. at 167 (citing Tull v. United States, 481 U.S. at 423); Hobet, 723 F. Supp. at 912.

163. Exxon cites to Steel Co. v. Citizens for a Better Envt., 523 U.S. 83, (1998), asserting the Supreme Court specifically held in that case that penalties paid to the government cannot satisfy constitutional requirements of redressability. This is a misstatement of the law. Unlike the present case, Steel Co. dealt with a situation in which there was no longer a potential for future violation. Subsequently, the Court held in Laidlaw that penalties levied against a violator *do* satisfy constitutional requirements of redressability when

a potential for future violation remains, since future violations can be deterred by the assessment of penalties for past violations. 525 U.S. at 185-188.

4. Standing is not determined on a violation-by-violation basis.

164. Exxon suggests that Plaintiffs have standing for, at most, the specific emission events about which their members testified at trial. This argument is unavailing. In essence, Exxon would have the Court assess the three elements of standing *separately* for each of the thousands of alleged violations before it. As this Court ruled prior to trial, however, a violation-by-violation approach of this nature is inconsistent with the longstanding principles of standing routinely applied by the federal courts in citizen environmental suits. The Court is unaware of any authority holding otherwise. The Article III standing principles discussed above show why this is the case.

165. Requiring a plaintiff to prove specific injury from each alleged past violation would serve no legitimate purpose in the standing inquiry, because the focus of the citizen enforcement suit (unlike that of a tort suit for compensation) is "primarily forward-looking." Gwaltney, 484 U.S. at 59. The Plaintiffs here ask the Court to impose penalties and injunctive relief to reduce the likelihood that Exxon will violate the Clean Air Act at these facilities in the future. That this will benefit Plaintiffs' members by reducing future air pollution from these facilities (and thus will *redress* their injuries) is obvious

regardless of how many times any particular member of one of the Plaintiff groups has been injured (by inhaling polluted air, by being bothered by foul smells, by declining to recreate near the Baytown Complex, by experiencing fear of explosions or adverse health effects, etc.) by Exxon's past violations.

166. Indeed, as discussed above, proof of injury from past violations is *not* necessary to establish standing to seek penalties for those violations in citizen enforcement cases. Although the Plaintiffs here have presented evidence both of injury from past violations and threatened injury from future violations, it is well-established that "'threatened [future] injury'" *alone* "will satisfy the 'injury in fact' requirement for standing." Cedar Point Oil, 73 F.3d at 556 (quoting Valley Forge 454 U.S. at 472); see also Laidlaw, 528 U.S. at 186 (civil penalties for past violations "afford redress to citizen plaintiffs who are…threatened with injury"). This plainly contradicts Exxon's contention that Plaintiffs must "match up" their injuries with each of the past violations at the Exxon Complex in order to seek the imposition of penalties for those violations. As discussed, a plaintiff in a Clean Air Act suit "need not pinpoint the exact times of violations and link its members' injuries to permit violations at those times" in order to seek relief for those violations. Murphy Oil, 686 F. Supp. 2d 663, 671 (E.D. La. 2010).

B. Prudential Standing.

167. Prudential standing requirements need not be considered where Congress explicitly confers standing. Warth v. Seldin, 422 U.S. at 501. Since the CAA explicitly confers standing to "any person" to sue a violator of an emission limit, 42 U.S.C. § 7604, there are no prudential limitations on a CAA citizen suit. Covington v. Jefferson County, 358 F.3d 626, 638 n.3 (9th Cir. 2004); cf. Powell Duffryn, 913 F.2d at 70 n.3 (CWA); Animal Welfare Inst. v. Beech Ridge Energy LLC, 675 F. Supp. 540, 559 (D. Md. 2009) (Endangered Species Act); Puerto Rico Campers' Ass'n v. Puerto Rico Aqueduct and Sewer Auth., 219 F. Supp. 2d 201, 214 (CWA). Rather, the citizen suit provision "extends standing to the outer boundaries of . . . Article III." Natural Res. Defense Council v. United States Envt. Prot. Agency, 542 F.3d 1235 (9th Cir. 2008) (CWA).

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XV. TCEQ's Enforcement of Exxon's Permits Has Been Ineffective.
- A. TCEQ has too few inspectors for too many facilities.
- B. TCEQ enforcement policies are inconsistent.
- C. The Baytown Complex violated its Title V permits many times, year after year, despite TCEQ oversight.
- D. A February 2012 Agreed Order between Exxon and TCEQ is an agreement not to enforce Exxon's permits.

E. Former TCEQ upper management now works for Exxon via the regulatory "revolving door."
F. TCEQ was aware of Plaintiffs' dissatisfaction with the agency's enforcement efforts, but did nothing to address it.

XVI. Exxon Did Not Meet Its Burden Of Proving That The Criteria For The Affirmative Defense To Penalties Were Satisfied For Reportable Emission Events.
A. Exxon did not demonstrate that all of the affirmative defense criteria were met for each of the emission events.
B. The Court does not find persuasive the opinion of Defendants' expert Dr. Christopher Buehler that Exxon satisfied the affirmative defense criteria in all cases.
C. Exxon automatically claims the affirmative defense for every reportable emission event.
D. Exxon presented no evidence to prove that violations that occurred during and after Hurricane Ike satisfied the affirmative defense.

I. Background On The Baytown Complex.

A. Basic information about the Complex.

1. The Baytown Complex ("Complex") comprises the Baytown Refinery, the Baytown Chemical Plant, and the Baytown Olefins Plant. DX 1012F-H; Answer, Introduction (Docket Entry 37); Tr. 2-199:1-8 [Kovacs].

2. The Refinery, Chemical Plant, and Olefins Plant are often referred to as the three "plants" within the Complex. DX 1012F-H; Tr. 2-199:1-8 [Kovacs].

3. The Refinery, Chemical Plant, and Olefins Plant are integrated in their design and operation. Tr. 3-80:12-16 [Kovacs].

4. The Complex is located in Baytown, Texas, approximately 25 miles east of Houston. Tr. 3-68:8-16 [Kovacs].

5. The Complex covers approximately 3,400 acres, or 5 square miles, and borders the Houston Ship Channel. DX 1012D; Tr. 3-71:14-25 [Kovacs]. The perimeter of the Complex extends for approximately 13.6 miles. Tr. 3-72:2-4 [Kovacs].

6. Portions of the Chemical Plant date to World War II. Tr. 3-63:11-22 [Kovacs]. The Refinery dates to shortly after World War I. Tr. 3-69:5-7 [Kovacs].

7. The Baytown Complex is designed to operate 24 hours a day, 7 days a week, 365 days a year. Tr. 10-10:19-20 [Fraiser].

8. The Baytown Complex is the largest manufacturing complex and the largest integrated petroleum and petrochemical complex in the United States. Answer, Introduction, ¶ 1 (Docket Entry 37); Tr. 3-74:21-25 [Kovacs].

9. The Complex has fixed equipment, such as pipes, vessels, and tanks, and rotating equipment, such as pumps and compressors. Tr. 7-212:18-20 [Ranna]; 4-109:22-25 [Bowers].

10. There are hundreds of vessels and thousands of pieces of rotating equipment at the Complex. Tr. 12-8:12-16 [Buehler]; 3-73:13-14 [Kovacs].

11. The Baytown Complex has thousands of miles of piping. DX 1012E.

12. There are approximately one million valves, 2,500 pumps, and 146 compressors in the Baytown Complex. DX 1012E; Tr. 3-72:21 – 3-73:20 [Kovacs].

13. The Complex's tanks have a total storage capacity for raw and finished products of approximately 1.25 billion gallons. Tr. 3-74:5-12 [Kovacs]. Much of that material is flammable. Tr. 3-257:12-14 [Kovacs].

B. The Complex is owned and operated by Defendants.

14. Defendant ExxonMobil Corporation is a multinational oil and gas corporation that owns and operates the Baytown Complex. Answer ¶ 11 (Docket Entry 37); PX 556, pp. 24-25.

15. Defendant ExxonMobil Chemical Company is a wholly owned subsidiary of ExxonMobil Corporation and operates the Baytown Chemical Plant and Olefins Plant. Answer ¶ 12 (Docket Entry 37); PX 556, p. 25.

16. Defendant ExxonMobil Refining and Supply Company is a wholly owned subsidiary of ExxonMobil Corporation and operates the Baytown Refinery. Answer ¶ 13 (Docket Entry 37); PX 556, p. 25.

C. Products made at the Complex.

17. The Baytown Refinery makes motor gasoline, jet and diesel fuels, solvents and lubricants, heating oil, and carbon coke. Tr. 2-199:9-16 [Kovacs].

18. The Refinery's crude oil refining capacity is over 550,000 barrels per day. DX 1012F; Tr. 3-77:7-14 [Kovacs].

19. The Chemical Plant makes over 7 billion pounds per year of linear paraffins, butyl rubber, polypropylene, and other petrochemical products. DX 1012G; Tr. 2-199:20-23 [Kovacs].

20. The Olefins Plant makes approximately 6 billion pounds per year of ethylene, propylene, and butadiene. DX 1012H; Tr. 2-199:17-19 [Kovacs].

21. Exxon has proposed to construct and operate additional units at the Olefins Plant. Tr. 11-87:8-10 [Robbins].

D. Air emissions from the Baytown Complex.

22. The Baytown Complex contains hundreds, if not thousands, of identified sources from which air pollutants[10] are emitted to the atmosphere. E.g., PX 122 and 176 (Maximum Allowable Emission Rate Tables for NSR permits 20211 and 18287, respectively, identify emission points); PX 583, 583.1, and 583.2 (plot plans for each plant with emission points identified); Tr. 9-7:20 – 9-9:5 [Cabe].

23. Sources of air pollutant emissions at the Baytown Complex that are identified in Exxon's permits include, among other things, flares, vents, stacks, tanks, engines, heaters, furnaces, boilers, incinerators, thermal oxidizers, cooling towers, regenerators, pumps, valves, and seals. E.g., PX 122

[10] The terms "air pollutant" and "air contaminant" are used interchangeably herein.

(Chemical Plant permit 20211 [at ETSC 075768-88]) and PX 176 (Refinery permit 18287 [at ETSC 077583-687]).

24. In addition to the sources of emissions identified in Exxon's permits, pollutants can also be released into the atmosphere from such sources as leaks, spills, and fires. PX 427, pp. 9-10; PX 436, 438.

25. All three plants have elevated open flares. PX 462, pp. 10-11; Tr. 3-24:17 – 3-25:3 [Kovacs].

26. There are 26 flares in all at the Baytown Complex. PX 469; PX 462, pp. 11-12; Tr. 3-25:4-5 [Kovacs]. They range from 50 feet to greater than 450 in height. Tr. 5-103:20-24; 5-106:3-8 [Sahu].

27. Flares are essentially towers. Gases are sent up a pipeline to the top of the tower where they are ignited by a pilot flame, creating an open flame. In 25 of the 26 flares at the Complex, steam is added to the gases to reduce smoking of the flares, and to cool equipment located in the flares. Tr. 5-103:3 - 5:104:9; 5-106:17-20 [Sahu].

28. A flare's pilot flame(s) must be lit to enable gases to be burned, or combusted, in the flare. Tr. 3-25:14-20 [Kovacs]; 5-104:10-12 [Sahu].

29. Under the best of circumstances, open elevated flares do not fully combust gases and the air contaminants they contain. Tr. 5-111:2-24 [Sahu].

30. The gases that are partially combusted in Baytown Complex flares include waste gases from process units. PX 462, pp. 6, 10; Tr. 3-25:6-13, 3-26:13-16 [Kovacs]; Tr. 5:103:3-19 [Sahu].

31. At times, Exxon uses flares at the Baytown Complex to burn "off-spec product" rather than storing or recycling it. Tr. 3-26:17 – 3-28:12 [Kovacs]. "Off-spec product" means a finished good that doesn't meet one or more of the specifications in the customer's contract. Tr. 2-200:2-10 [Kovacs].

32. The gases fed into the flares at the Baytown Complex contain a variety of chemical compounds, including hydrocarbons and sulfur compounds. Tr. 3-29:9 – 3-30:3 [Kovacs].

33. One of the reasons flares must be used at the Baytown Complex is for safety. Gases can be burned in flares to relieve pressure in the system. Gases are vented to the flares at times to keep equipment in the Complex at safe pressures and temperatures (PX 462, p. 16; Tr. 3-26:5-12 [Kovacs]) and to prevent explosions and fires (Tr. 5-104:25 - 5-104:3 [Sahu]).

34. The Baytown Complex also attempts to use flares for pollution control on a routine basis, although Plaintiffs presented evidence (discussed below) that flares are not a reliable means of controlling the emission of air pollutants.

35. Exxon measures the flow rate and composition of the gases that are sent to each flare, but does not measure the amount of pollutants released into the atmosphere from its flares. Tr. 3-32:4-12 [Kovacs].

II. Background On The Plaintiff Groups.

A. Environment Texas.

36. Environment Texas Citizen Lobby ("Environment Texas") is a state-wide environmental group that advocates for Texas's land, air, and water. Tr. 1-227:19-25 [Metzger].

37. Environment Texas is a non-profit corporation. Tr. 1-227:16-18 [Metzger]; PX 338, Environment Texas Bylaws, Art. II, par. (1).

38. The corporate purpose of Environment Texas "is to engage in activities, including public education, research, lobbying, litigation, issue advocacy, and other communications and activities to promote pro-environment ideas, policies and leaders." PX 338, Environment Texas Bylaws, Art. II, par. (2); Tr. 1-227:19-22 [Metzger].

39. Environment Texas considers itself to be a "grassroots organization," defined by and exclusively supported by its members. As such, encouraging people to join as members is important to the organization's mission and to its effectiveness as an advocacy group. Tr. 1-233:19 – 1-234:9 [Metzger].

40. Environment Texas members elect one of the three members of the organization's board of directors. Tr. 1-234:15-17 [Metzger]; PX 338, Environment Texas Bylaws, Art. III, par. (3).

41. Environment Texas communicates its work to its members in a variety of ways. The group's Director, Luke Metzger, testified that he personally interacts with members through personal meetings, holding member events (such as a holiday party at which the Speaker of House of the Texas legislature spoke), conducting advocacy training for members, and communicating through emails and social media. Tr. 1-231:21 – 1-232:22 [Metzger]. In addition, Environment Texas staff regularly go door-to-door to talk to people about the organizations' work, and the group puts out a member newsletter and annual report. Tr. 1-236:1-8 [Metzger].

42. In turn, Environment Texas members participate in setting the organization's agenda by communicating interests and concerns via in-person meetings and presentations with staff, door-to-door canvassing, telephone outreach calls, website feedback, feedback on email action alerts, and social media. Tr. 1-236:12-25 [Metzger].

43. Member concerns and feedback led to Environment Texas launching a water conservation campaign, and the concerns of the group's hundreds of Houston-area members about air quality led to the organization's

involvement in activities such as Clean Air Act enforcement litigation. Tr. 1-237:1-19 [Metzger].

44. Environment Texas's members, and particularly its Houston-area members, have indicated repeatedly that promoting clean air is a high priority for them. Tr. 1-237:7-17 [Metzger].

45. Environment Texas members join by paying a membership fee, or by signing up as "grassroots" (non-dues paying) members. Tr. 1-231:3-18 [Metzger]; PX 338, Environment Texas Bylaws, Art. VII, par. (2).

46. Environment Texas has approximately 2,900 dues paying members in Texas. Tr. 1-234:24-1-235:4 [Metzger].

B. Sierra Club.

47. Sierra Club is a national non-profit organization that advocates for clean air, among other environmental issues, and works to restore the quality of the natural and human environment. Tr. 2-125:13-16 [Carman]; PX 341, Sierra Club Bylaws, Bylaw 2, Sec. 2.1.

48. The bylaws of Sierra Club state that its purpose is

> To explore, enjoy, and protect the wild places of the Earth; to practice and promote the responsible use of the Earth's ecosystems and resources; to educate and enlist humanity to protect and restore the quality of the natural and human environment; and to use all lawful means to carry out these objectives.
>
> PX 341, Sierra Club Bylaws, Bylaw 2, Sec. 2.2.

49. The Lone Star Chapter of the Sierra Club has approximately 25,000 members in Texas. Tr. 2-125:25 - 2-126:1 [Carman].

50. Sierra Club members elect the organization's national board of directors. Tr. 2-126:22-25 [Carman]; PX 341, Sierra Club Bylaws, Bylaw 5, Sec. 2.

51. Sierra Club members in each Sierra Club chapter, including the Lone Star Chapter, elect the chapter's executive committee. Tr. 2-126:7-13 [Carman]; PX 341, Sierra Club Bylaws, Bylaw 8, Sec. 8.2-8.3.

52. Sierra Club members participate in setting the agenda for the organization. Tr. 2-126:5-18 [Carman].

53. Reducing air pollution is a priority for the Lone Star Chapter of the Sierra Club. Tr. 2-126:19-21 [Carman].

C. Plaintiffs provided pre-suit notice of this lawsuit.

54. Plaintiffs gave notice of the violations alleged in the Complaint more than 60 days prior to the commencement of this lawsuit to each of the ExxonMobil Defendants, to the U.S. Environmental Protection Agency ("EPA"), to the Texas Commission on Environmental Quality ("TCEQ"), and to the Governor of Texas. PX 395, ¶¶ 2-3 and Exs. 1-2; Tr. 1-96:21-1:97:13; Tr. 1-161:10-14 [Cottar].

55. Notice was provided by letters dated November 30, 2009, and July 2, 2010, sent by certified mail, return receipt requested. The notice letters were

addressed to Rex Tillerson, then President and Chief Executive Officer of ExxonMobil Corporation, and were also sent to the President of ExxonMobil Chemical Company, the President of ExxonMobil Refining and Supply Company, the Baytown Refinery manager, the Baytown Chemical Plant manager, and the Baytown Olefins Plant manager. Copies of the letters were sent contemporaneously to the Administrator of EPA, the Regional Administrator for EPA Region VI, the Executive Director of TCEQ, the Governor of Texas, and the registered agents for the three ExxonMobil Defendants. Plaintiffs received return receipts for each letter from all addressees, with the exception of the President of ExxonMobil Refining and Supply Company. PX 395, ¶¶ 2-3 and Exs. 1-2.

56. On February 10, 2011, Plaintiffs served the Complaint in this case on U.S. Attorney General Eric Holder, EPA Administrator Lisa Jackson, and EPA Region VI Administrator Al Armendariz by sending them copies of the Complaint by certified mail, return receipt requested. Plaintiffs received return receipts from each of the addressees. PX 395, ¶ 4 and Ex. 3.

III. The Baytown Complex's Clean Air Act Title V Permits.

A. The Complex is covered by five Title V permits.

57. The Texas Commission on Environmental Quality ("TCEQ") has issued operating permits to the Exxon Defendants for the Baytown Complex under 30 Tex. Admin. Code Chapter 122, which implements Title V of the

federal Clean Air Act. Answer ¶ 23 (Docket Entry 37); PX 190-208, 210-11, 213-15, 218-19, 222-52. These operating permits are also referred to as "Title V permits" and "federal operating permits" ("FOPs"). Tr. 2-207:18 – 2-208:9 [Kovacs].

58. A Title V permit gathers in one place all of the applicable air pollution control requirements for a facility. 42 U.S.C. § 7661c(a), (b); *see, e.g.*, United States v. Cemex, Inc., 864 F. Supp. 2d 1040, 1044-45 (D. Colo. 2012); Tr. 2-208:13 – 2-209:13 [Kovacs].

59. The Exxon Defendants have been issued a total of five Title V permits for the Baytown Complex. PX 190-208, 210-11, 213-15, 218-19, 222-52.

60. The Baytown Complex has one federal operating permit for the Baytown Refinery, numbered O1229, which is in the name of ExxonMobil Refining and Supply Company. Answer ¶ 13 (Docket Entry 37); PX 190-207.

61. The Baytown Complex has three federal operating permits for the Chemical Plant, numbered O1278, O2269, and O2270, which are in the name of ExxonMobil Corporation. Answer ¶ 11 (Docket Entry 37); PX 235-52.

62. The Baytown Complex has one federal operating permit for the Olefins Plant, numbered O1553, which is in the name of ExxonMobil Corporation. Answer ¶ 11 (Docket Entry 37); PX 208, 210-11, 213-15, 218-19, 222-34.

B. The Title V permits incorporate numerous state-issued NSR and PSD permits.

63. The five federal operating permits for the Baytown Complex incorporate the emission standards and limitations set forth in the Complex's New Source Review ("NSR") and Prevention of Significant Deterioration ("PSD") permits, which are also issued to the Complex by TCEQ. *E.g.*, PX 223, p. 132 [ETSC 079795]; Tr. 1-245:9-17 [Metzger], 2-208:25 – 2-209:13 [Kovacs].

64. The Refinery's federal operating permit O1229 incorporates NSR permit 18287 and PSD permit PSD-TX-730M4. PX 191, p. 137 [ETSC 078293].

65. The Chemical Plant's federal operating permit O1278 incorporates NSR permits 20211, 36476, 4600, and 5259, and PSD permit PSD-TX-966, among other permits. PX 235, p. 96 [ETSC 080649]. The Chemical Plant's FOP O2269 incorporates NSR permits 20211, 4600, and 9571, among other permits. PX 241, p. 13 [ETSC 080999]. The Chemical Plant's FOP O2270 incorporates NSR permit 8586, among other permits. PX 246, p. 85 [ETSC 081184].

66. The Olefins Plant's federal operating permit O1553 incorporates NSR permit 3452 and PSD permit PSD-TX-302M2, among other permits. PX 223, p. 133 [ETSC 079796].

1. Many of the emission limits Plaintiffs seek to enforce are plant-wide limits, each of which encompasses numerous emission sources.

67. Some of the NSR and PSD permits incorporated into the Complex's Title V permits are "flexible permits." Tr. 2-210:5-7 [Kovacs].

68. TCEQ issues flexible permits pursuant to 30 Tex. Admin. Code Chapter 116, Subchapter G.

69. One characteristic of a flexible permit is that emission limits or "caps" may be established that govern the aggregate emissions from more than one emission point; a single emission limit or cap for an air contaminant may govern the facility-wide emissions of that contaminant, from all sources at the facility. 30 Tex. Admin. Code § 116.716; Tr. 1-254:3-15, 2-10:3-11 [Metzger], 2-209:23 – 2-210:4, 2-213:6 – 2-214:19 [Kovacs]; *see, e.g.*, PX 176, flexible permit 18287 [at ETSC 077591-600].

70. The establishment of plant-wide emission limits in flexible permits is important in this case, because repeated violations of a plant-wide limit or cap can be caused by many different emission points.

71. Exxon chose to seek flexible permits for many of its facilities, rather than permits that impose a separate emission limit for each emission point, for "business reasons." Tr. 2-210:8-18 [Kovacs].

72. Permit 18287/PSD-TX-730M4, incorporated into the Refinery's Title V permit O1229, is a flexible permit. PX 176; Tr. 2-211:2-6 [Kovacs].

73. Permit 20211, incorporated into the Chemical Plant's Title V permits O1278 and O2269, is a flexible permit. PX 189; Tr. 2-211:12-16 [Kovacs].

74. Permit 3452/PSD-TX-302M2, incorporated into the Olefins Plant's Title V permit O1553, is a flexible permit. PX 133; Tr. 2-9:24 – 2-10:1 [Metzger]; Tr. 2-211:7-11 [Kovacs].

2. Many of the emission limits Plaintiffs seek to enforce are hourly emission limits.

75. The NSR and PSD permits that are incorporated in Exxon's Title V permits contain maximum allowable emission rate limits for the sources of air contaminants (known as emission points) covered by the permits. Tr. 2-211:20 – 2-212:6 [Kovacs]; PX 113-89.

76. The maximum allowable emission rate limits are set forth in "maximum allowable emission rate tables" (abbreviated as "MAERTs"). 30 Tex. Admin. Code § 116.10(8); PX 113-89.

77. MAERTs authorize emissions only of specifically named pollutants and only from specifically identified emission points or groups of emission points. PX 113-89 (General Conditions 8, 14 and 15, Special Condition 1, and MAERT Tables in each permit); Tr. 2-212:7-13 [Kovacs].

78. Authorized emissions are subject to different types of limits: maximum pounds per hour and maximum tons per year. Exxon is required to

comply with each type of limit. PX 113-89 (General Conditions 8, 14 and 15, Special Condition 1, and MAERT Tables in each permit); Tr. 2-212:7-13 [Kovacs].

79. Although Exxon presented evidence that its annual emissions have generally been lower than its permitted tons per year limits, Plaintiffs' claims focus primarily on violations of the hourly emission limits, as well as violations of other requirements unrelated to annual emission totals.

80. As discussed below in Section XII.B.1, adverse health effects can be caused either by short-term ("acute") exposures to air pollutants or by long-term ("chronic") exposures. Thus, regulatory agencies set different ambient air thresholds for short-term, typically one-hour, exposures and for longer term exposures. PX 476, p. 24; DX 195, p. 7. Similarly, Exxon's permits contain hourly emission limits, which serve a purpose independent of Exxon's annual emission limits. "Hourly emission limits are necessary in order to ensure protection of public health from short-term exposure;" hourly emission limits are necessary "since both ambient standards and ESL guidelines exist on an hourly basis, therefore a direct confirmation is the most appropriate and practically enforceable rule requirement." 36 Tex.Reg. 950 (February 18, 2011), available at http://texashistory.unt.edu/ark:/67531/metapth145988/m1/64/ (accessed June 23, 2014).

C. The Title V permit for the Refinery prohibits emissions from "upsets."

90. Special Conditions 38 (concerning emissions from flares) and 39 (concerning emissions from other sources) of Permit 18287/PSD-TX-730M4 for the Refinery, which is incorporated into Refinery Title V permit O1229, each provide as follows:

> This permit does not authorize upset emissions, emissions from maintenance activities that occur as a result of upsets, or any unscheduled/unplanned emissions associated with an upset. Upset emissions are not authorized, including situations where that upset is within the flexible permit emission cap or an individual emission limit.

Permit 18287/PSD-TX-730M4, as amended May 14, 2013, pp. 20-21 (prior to October 30, 2006, these Special Conditions were numbered 60 and 61, respectively). PX 159-176.

D. The Title V Permits for all three plants limit emissions of highly reactive volatile organic compounds ("HRVOCs").

91. The Title V permits for all three plants in the Complex incorporate a Texas state rule, 30 Tex. Admin. Code § 115.722, limiting plant-wide emissions of highly reactive volatile organic compounds ("HRVOCs") to no more than 1,200 pounds per hour. PX 203, Refinery permit O1229 [at ETSC 078579]; PX 224, Olefins Plant permit O1553 [at ETSC 080010 *ff.*]; PX 236, Chemical Plant permit O1278 [at ETSC 080662]. This rule is known as the "HRVOC Rule."

92. Highly reactive volatile organic compounds have a very high propensity to form ground-level ozone. Tr. 7-143:17 – 7-144:1 [Brooks]; Tr. 8-180:24 – 8-181:1; 8-181:6-9 [Cabe]; PX 476, p. 25.

93. Texas promulgated the hourly HRVOC Rule specifically to prevent industrial facilities from releasing large amounts of HRVOCs in a short period of time, as such releases have been determined to cause or contribute to spikes in ground-level ozone concentrations. PX 553 [at ETSC 083375].

E. The Title V permits for all three plants limit "smoking" flares.

94. The Title V permits for all three plants incorporate federal regulations, 40 C.F.R. §§ 60.18(c)(1) and/or 63.11(b)(4), prohibiting visible emission (*i.e.*, smoke) from flares except for periods not to exceed a total of five minutes during any two consecutive hours. PX 203, Refinery permit O1229 [at ETSC 078706-16]; PX 215, Olefins Plant permit O1553 [at ETSC 079480-81]; PX 236, Chemical Plant permit O1278 [at ETSC 080728-29]; PX 240, Chemical Plant permit 02269 [at ETSC 080949].

F. The Title V permits for all three plants require flares to be operated with a pilot flame present at all times.

95. The Title V permits for all three plants incorporate federal regulations, 40 C.F.R. §§ 60.18(c)(2) and/or 63.11(b)(5), requiring flares to operate with a pilot flame present at all times. PX 203, Refinery permit O1229 [at ETSC 078706-16]; PX 215, Olefins Plant permit O1553 [at ETSC 079480-

81]; PX 236, Chemical Plant permit O1278 [at ETSC 080728-29; PX 240, Chemical Plant permit 02269 [at ETSC 080949].

G. The Title V permits for all three plants prohibit "fugitive" emissions.

96. The Title V permits for all three plants prohibit fugitive emissions (emissions that do not exit from a stack or vent). MAERTs incorporated into the Title V permits state that any listed emission rates from fugitive sources "are an estimate only and should not be considered as a maximum allowable emission rate." *E.g.*, PX 168, Refinery NSR permit 18287 [at ETSC 077128]; PX 132, Olefins Plant NSR permit 3452 [at ETSC 076050]; PX 122, Chemical Plant NSR permit 20211 [at ETSC 075790]; PX 124, Chemical Plant NSR permit 28441 [at ETSC 075805]; PX 137, Chemical Plant NSR permit 36476 [at ETSC 076126]; PX 151, Chemical Plant NSR permit 9571 [at ETSC 076284]; Tr. 11-144:17 – 11-146:3 [Olson] (MAERT table does not set a maximum allowable emission rate for fugitive emissions).

H. The Title V permits for all three plants incorporate a variety of additional emission standards and limitations set forth in federal and state regulations.

97. The Complex's Title V permits also incorporate a variety of state and federal air quality regulations. *E.g.*, PX 223, p. 132 [ETSC 079795]; Tr. 2-208:13-18 [Kovacs].

98. The incorporated state and federal regulations are considered to be emission standards and limitations, and they are listed in the "Applicable Requirements Summary" section of each Title V permit. PX 203 (Refinery permit O1229 [at ETSC 078647-823]); PX 215 (Olefins Plant permit O1553 [at ETSC 079469-534]); PX 236 (Chemical Plant permit O1278 [at ETSC 080710-826]); PX 240 (Chemical Plant permit O2269 [at ETSC 080947-59]); PX 249 (Chemical Plant permit O2270 [at ETSC 081226-55]).

IV. Exxon Does Not Deny That It Has Violated Its Title V Permits Thousands Of Times.

A. Exxon admits that its personnel are well trained to recognize permit violations.

99. Exxon's operating personnel at all three plants in the Baytown Complex are trained to know when environmental requirements are not being complied with and to report such instances of non-compliance. Tr. 2-201:14 – 2-203:3, 3-85:8 – 3-88:8 [Kovacs]; 11-68:16 – 11-69:8 [Robbins].

100. Exxon's employees in the Environment Section of the Baytown Complex are able to apply Clean Air Act regulations to the Baytown Complex and to recognize and document when violations of those regulations occur. Tr. 2-214:25 – 2-215:22, 2-254:8 – 2-255:15, 3-90:16 – 3-91:3 [Kovacs].

101. As required by law, Exxon reports Baytown Complex Title V permit violations to TCEQ; Exxon personnel refer to these violations as

instances of "non-compliance" or "exceedance of a permit condition." Tr. 2-205:13 – 2-206:14; 2-216:3-20 [Kovacs].

102. Exxon uses three types of records or reports to document Title V permit violations at the Baytown Complex: "STEERS Reports," lists of "recordable emission events," and "Deviation Reports." PX 16-112.

103. The parties stipulated to the contents of Exxon's STEERS Reports, lists of recordable emission events, and Deviation Reports. Those stipulations are contained in Plaintiffs' Exhibits 1A through 7E. Tr. 1-246:3-15 [Metzger].

B. Violations resulting from "emission events" are reflected on STEERS reports and recordable emission event lists.

104. As required by TCEQ regulation, 30 Tex. Admin. Code § 101.201, Exxon both reports, and keeps on-site records of, "emission events" at the Baytown Complex. PX 16-112.

105. All three plants at the Baytown Complex have had emission events. Tr. 2-230:17-22 [Kovacs].

1. By definition, all "emission events" involve permit violations.

106. In practice and by regulatory definition, every reported and recorded emission event involves an emission of one or more air pollutants that was not authorized by any permit or regulation. Tr. 2-228:13 – 2-230:22 [Kovacs].

107. An emission event is defined as "[a]ny upset event or unscheduled maintenance, startup, or shutdown activity, from a common cause that results in unauthorized emissions of air contaminants from one or more emissions points at a regulated entity." Tex. Health and Safety Code § 382.0215(a)(1); 30 Tex. Admin. Code § 101.1(28).

108. TCEQ regulations define "upset event" as: "An unplanned and unavoidable breakdown or excursion of a process or operation that results in unauthorized emissions. A maintenance, startup, or shutdown activity that was reported under § 101.211 of this title (relating to Scheduled Maintenance, Startup, and Shutdown Reporting and Recordkeeping Requirements), but had emissions that exceeded the reported amount by more than a reportable quantity due to an unplanned and unavoidable breakdown or excursion of a process or operation is an upset event." 30 Tex. Admin. Code § 101.1(109).

109. TCEQ regulations define "unauthorized emissions" as: "Emissions of any air contaminant except carbon dioxide, water, nitrogen, methane, ethane, noble gases, hydrogen, and oxygen that exceed any air emission limitation in a permit, rule, or order of the commission or as authorized by Texas Clean Air Act, § 382.0518(g)." 30 Tex. Admin. Code § 101.1(107).

2. Exxon reports and records emission events as required by TCEQ regulations.

a. Exxon reports "reportable" emission events to the publicly accessible STEERS database.

110. As required by TCEQ regulations, 30 Tex. Admin. Code § 101.201**,** the Baytown Complex reports an emission event to TCEQ if the unauthorized emission of any pollutant during the event exceeds a "reportable quantity" of that pollutant. Such an emission event is called a "reportable emission event." Tr. 2-232:13-18 [Kovacs].

111. Reportable quantities for each pollutant are established by TCEQ regulation, at 30 Tex. Admin. Code § 101.1(88). Tr. 2-232:19-20 [Kovacs].

112. The Baytown Complex files reports of reportable emission events using the State of Texas Environmental Electronic Reporting System ("STEERS"). These reports are typically referred to as "STEERS Reports." Tr. 2-232:13-20 [Kovacs].

113. Staff in the Environment Section of the Safety, Security, Health and Environment Department of the Baytown Complex are responsible for submitting STEERS Reports. Tr. 2-204:3-5 [Kovacs]; Tr. 8-39:24-8-40:16 [Ranna]; Tr. 8-42:23-8-43:8 [Ranna].

114. It is Exxon's policy to follow TCEQ regulations in submitting a STEERS Report. Tr. 3-179:12-18 [Kovacs].

115. Information from STEERS Reports is available on TCEQ's website, which is accessible by the general public. Tex. Health & Safety Code § 382.0215(e).

116. Pursuant to TCEQ regulations, 30 Tex. Admin. Code § 101.201, the Baytown Complex files a STEERS Report within 24 hours of a reportable emission event's discovery. This is called an "Initial STEERS Report."

117. The Baytown Complex can correct or update information in an Initial STEERS Report within 14 days of the filing of the Initial STEERS Report by filing a "Final STEERS Report." If no additional report is filed within 14 days, the Initial STEERS Report becomes the Final STEERS Report. Tr. 2-234:12 – 2-235:2 [Kovacs].

118. A Final STEERS Report includes the name of the process units or areas that experience the emission event; the estimated date and time of discovery of the emission event; the estimated duration of the emissions during the emissions event; a list of air contaminants released during the emission event; estimated quantities of the air contaminants released during the emission event; the authorization number or rule governing the facilities involved in the emission event; the authorized emission limits, if any, for the facilities involved in the emission event; the best known cause of the emissions event at the time of reporting; and, the actions taken, or being taken, to correct the

emissions event and minimize the emissions. 30 Tex. Admin. Code § 101.201(b)(1); Tr. 2-236:3 – 2-238:5 [Kovacs]; PX 16-22, 412.

119. Both the Initial and Final STEERS Reports contain an entry signifying whether Exxon is claiming an affirmative defense to penalties for the emission event. Tr. 2-240:12-22 [Kovacs].

120. In its STEERS Reports, Exxon reports emissions only from those sources involved in the emission event. Exxon does not include in STEERS Reports the pollutant emissions from other sources at the plant that occurred at the same time as the emission event. Tr. 2-239:18 – 2-240:11 [Kovacs].

121. When Exxon states in the "Authorization" column of its STEERS Reports that an emission is "not specifically authorized," this phrase signifies that that the emissions being reported are not authorized, even though other emissions from that emission source at other times may be authorized. When Exxon states in the "Authorization" column of its STEERS Reports that: "portions are authorized," "portions may be authorized," or "[x] lbs. out of [y] total lbs. are authorized," these phrases signify that at least some portion of the emissions being reported are not authorized. Tr. 2-239:12-17 [Kovacs]; PX 412.

122. Once a company submits an emission event report to STEERS, the data in it cannot be manipulated by TCEQ or by the company that submitted the report; the data are locked. PX 623, at 238:8-14 [Sadlier].

b. Exxon maintains records of non-reportable (or "recordable") emission events on site.

123. Also as required by TCEQ regulation, 30 Tex. Admin. Code §101.201(b), the Baytown Complex keeps records of emission events that involve unauthorized emissions of air contaminants in amounts that do not exceed a reportable quantity. No STEERS Reports are filed for such events. Tr. 2-232:21 – 2-233:16 [Kovacs].

124. Emission events in which unauthorized emissions do not exceed a reportable quantity are known as "recordable" or "non-reportable" emission events. Tr. 2-232:22-24 [Kovacs].

125. Records of recordable emission events are kept on site at the Baytown Complex for at least five years, as required by TCEQ regulations. 30 Tex. Admin. Code § 101.201(b); Tr. 2-233:3-16, 3-23:4 – 3-24:10 [Kovacs]; PX 101-112.

126. The information documenting recordable events is similar to that filed in STEERS Reports for reportable events. PX 16-22, 101-112.

3. Duration of emission events.

127. It is Exxon's general practice to report the duration of an emission event involving a leak as the time between discovery of the leak and the time the leak is fixed. Tr. 8-46:13-16 [Robbins].

128. The durations of many of Exxon's emission events exceed 24 hours. PX 16-22, 101-112. Even recordable emission events can involve unauthorized releases of pollutants that continue for more than 24 hours: according to Exxon's own count, 408 recordable emission events in this case, or more than one out of every ten, lasted over 24 hours. Tr. 10-212:19-22 [Robbins].

129. Exxon does not know, and cannot predict, the amount of pollutants that will be emitted during an emission event before the event happens. Tr. 4-77:2-22, 4-131:5-15 [Bowers].

4. The number of emission events at the Complex: more <u>than one per day.</u>

130. From October 14, 2005, through September 3, 2013, the Baytown Complex as a whole experienced 352 reportable emission events and 3,742 recordable emission events, for a total of 4,094 emission events. PX 1A-2F, 16-22, 101-112. On average, this is more than one emission event per day over this period.

131. From October 14, 2005, through September 3, 2013, the annual numbers of emission events occurring at the Baytown Complex as a whole are as follows:

Year	Number of Recordable Emission Events	Number of Reportable Emission Events	Total Events
2005 (10/14 –12/31)	67	17	84
2006	396	81	477
2007	467	40	507
2008	544	53	597
2009	529	37	566
2010	519	45	564
2011	454	37	491
2012	491	27	518
2013 (1/1 – 9/3)	275	15	290
TOTALS	3,742	352	4,094

PX 1A-2F, 16-22, 101-112, 431, p. 3-1; Tr. 4-72:19 – 4-74:8 [Bowers].

132. From October 14, 2005, through September 3, 2013, the annual numbers of emission events occurring at each of the three plants within the Baytown Complex are as follows:

	Chemical Plant			**Olefins Plant**			**Refinery**		
	# of Recordable Events	# of Report-able Events	Total Events	# of Recordable Events	# of Report-able Events	Total Events	# of Recordable Events	# of Report-able Events	Total Events
2005 (10/14-12/31)	19	3	22	5	4	9	43	10	53
2006	144	10	154	25	14	39	227	57	284
2007	137	6	143	76	6	82	254	28	282
2008	123	8	131	123	21	144	298	24	322
2009	122	4	126	116	9	125	291	24	315
2010	119	6	125	115	9	124	285	30	315
2011	57	3	60	145	7	152	252	27	279
2012	56	3	59	172	11	183	263	13	276
2013 (Partial Year)	28	0	28	68	5	73	179	10	189
TOTAL	805	43	848	845	86	931	2,092	223	2,315

PX 1A-2F, 16-22, 101-112, 431, p. 3-5.

133. This Court's summary judgment ruling removed from Plaintiffs' claims (a) 115 emission events (some reportable and some recordable) that occurred at the Refinery, because they were subject to a 2005 U.S Environmental Protection Agency consent decree, and (b) 20 additional reportable emission events because they were duplicates or were otherwise reported in error. EPA has taken no enforcement action regarding the alleged violations remaining in this case. The total number of reportable emission events at issue in this case is 240, the total number of recordable emission events at issue in this case is 3,719, and the total number of reportable plus recordable emission events at issue in this case is 3,959. PX 1A-2F, 8, 16-22, 101-112; DX 1000, p. 2; Tr. 10-210:16 – 10-211:5 [Robbins].

C. Violations unrelated to emission events are reflected on "Deviation Reports."

134. TCEQ regulations and the Title V permits for the Baytown Complex require Exxon to report its compliance status with respect to the requirements of the Title V permits. Answer ¶ 23 (Docket Entry 37); PX 190-208, 210-11, 213-15, 218-19, 222-52.

135. Every six months, Exxon files "Deviation Reports" with TCEQ for each of its Title V permits, as required by TCEQ regulations. 30 Tex. Admin. Code § 122.145(2); PX 23-100; Tr. 2-217:4-10, 2-217:24 – 2-218:14 [Kovacs].

136. The Baytown Complex uses a form for Deviation Reports provided by TCEQ. Tr. 2-218:10-19 [Kovacs]; PX 411.

137. In its Deviation Reports, Exxon is required to identify each instance of non-compliance with a term or condition of a Title V permit. Tr. 2-217:21-23 [Kovacs]. These include instances where actual emissions or other plant operations deviated from the emission limits or other operating requirements incorporated into the Title V permits. These incidents are referred to as "deviations." 30 Tex. Admin. Code § 122.10(5).

138. Failures to conduct required monitoring or to keep required records, failure to file timely reports, failures to run equipment within specified parameters required for air pollution control, pilot flame outages, smoking flares, exceedances of highly reactive volatile organic compound limits, and exceedances of maximum allowable emission rates are all examples of deviations that must be reported to TCEQ by Exxon. PX 623, at 44:4-46:3 [Sadlier]; Tr. 2-220:23 – 2-225:1; 3-129:10-20 [Kovacs].

139. Exxon personnel at all three plants in the Complex report instances of noncompliance with Title V permits to the Environmental Section of the Safety, Security, Health and Environment Department, which compiles them into Deviation Reports. Tr. 2-202:22-25 [Kovacs], Tr. 2-207:3-5 [Kovacs], 2-217:6-2-218:1 [Kovacs].

140. Each Deviation Report is signed and certified by one of the Complex's plant managers. Tr. 226:2-9 [Kovacs].

141. Given that Exxon's personnel apply Clean Air Act regulations to plant operations on a daily basis, are trained to know when permit violations occur, and are legally required to report permit violations, the Court finds that the deviations reported on Exxon's Deviation Reports are not mere "indications" of non-compliance but are, in fact, violations of Exxon's Title V permits. Exxon did not identify at trial a single instance of a reported deviation that it claimed was not, in fact, a violation.

V. Exxon's Legally Mandated Reports, And Witness Testimony, Establish Violations Of Each Of The Seven Counts Of The Complaint.

142. Based on the applicable statute of limitations and a cutoff date set by this Court, Plaintiffs seek liability for violations they allege occurred from October 14, 2005, through September 3, 2013. This period will be referred to as the Claim Period. PX 584, Complaint (Docket Entry 1); Order (Docket Entry 143), p. 1; Tr. 3-125:14-21.

A. Violations covered by Count I: Repeated, unauthorized upset emissions from the Refinery.

143. Count I of the Complaint alleges that Exxon violated the provisions of the Refinery's Title V permit that prohibit upset emissions. PX 584, Complaint ¶¶ 26-27 (Docket Entry 1).

144. Each emission event at the Refinery involved emissions that occurred as a result of an upset, as defined in 30 Tex. Admin. Code § 101.1(109). These events will be referred to as the "Count I emission events."

145. Count I emission events occurred both before the Complaint was filed and after the Complaint was filed. PX 1A-1B, 9.

146. Most of the Count I emission events at the Refinery involved emissions of more than one air contaminant. PX 1A-1B.

147. The Refinery's Title V permit incorporates General Condition 8 of flexible permit 18287/PSD-TX-730M4, which authorizes "only those sources of emissions and those air contaminants listed in" the Refinery's MAERT table. Emissions of air contaminants are authorized on a pollutant-by-pollutant basis (except that all VOCs are treated as a group and oxides of nitrogen are treated as a group). "Emissions that exceed the limits of this permit [number 18287] are not authorized and are violations of this permit" (General Condition 15). Thus, each type of regulated air contaminant emitted without authorization constitutes a separate violation of the Refinery's permit. PX 175 [at ETSC 077480].

148. Many of the Count I emission events at the Refinery involved unauthorized emissions with a duration longer than 24 hours. PX 1A-1B, 587-88; Tr. 1-257:5-17 [Metzger].

149. A large number of different types of pollutants were released into the atmosphere without authorization from the Refinery during Count I emission events both before and after the filing of the Complaint. PX 1A-1B, 9, 587-88; Tr. 1-258:2 – 1-259:12, 1-260:17 – 263:6 [Metzger]. For each of these pollutants, the violations were thus "repeated" and are "ongoing."

150. Two pollutants (identified by Exxon as "compounds with bp" and natural gas) were released into the atmosphere without authorization from the Refinery during Count I emission events before the Complaint was filed, but not after. However, these pre-Complaint violations of the upset prohibition each occurred more than once. PX 1A-1B, 9, 587-88; Tr. 1-258:2 – 1-259:12, 1-260:17 – 263:6 [Metzger]. For each of these pollutants, the violations were thus "repeated."

151. The breakdown of the number of days that each contaminant was emitted in violation of the Refinery permit's prohibition of upset emissions, both before and after the filing of the Complaint in this case, is contained in the following summary chart (taken from PX 9) assembled by Plaintiffs:

Violations of General Conditions 8 and 15, and Special Conditions 38 and 39 (formerly 60 and 61) in Permit 18287/PSD-TX-730M4 for Emissions of:	**Pre-Complaint Days of Violation**		**Post-Complaint Days of Violation**		**TOTALS**
	Days of Violation From STEERS	**Days of Violation From Recordables**	**Days of Violation From STEERS**	**Days of Violation From Recordables**	
Ammonia (NH_3)	117	177	3	22	**319**
Ammonium Compounds (ammonium hydroxide, ammonium polysulfide, NH_4OH, $(NH_4)_2S_x$)		4		1	**5**
Benzene	54	236	12	146	**448**
Carbon Disulfide (CS_2)	15	25		14	**54**
Carbon Monoxide (CO)	204	1,082	9	445	**1,740**
Carbonyl Sulfide (COS)	15	31		21	**67**
Compounds with bp-#		3			**3**
Crude Oil		2	2	25	**29**
Halon 1301 (Bromotrifluoromethane)	1		1		**2**
Hydrogen Chloride (HCl)		4		2	**6**
Hydrogen Cyanide (HCN)	105	148	1	4	**258**
Hydrogen Sulfide (H_2S)	114	954	11	302	**1,381**
Natural Gas		11			**11**
NO_x (Nitrogen Dioxide, Nitrogen Oxide)	187	821	9	325	**1,342**
N-Methyl-2-Pyrrolidone (NMP)	5	37		16	**58**
Opacity/Visible Emissions	29	1	7		**37**
"Other"		2		37	**39**
Particulate Matter (PM, coke fines)	98	183	3	27	**311**
Phosphoric Acid		1		1	**2**
Sodium Compounds (NaClO, NaOH)		7		3	**10**
Total Sulfur, Sulfur, Sulfur Compounds	9	11		3	**23**
Sulfur Dioxide (H_2O)	181	1,217	9	286	**1,693**
SO_x		6		1	**7**
Sulfuric Acid (H_2SO_4)	5	1		2	**8**
Total VOC	137	1,531	19	1,209	**2,896**

TOTALS	1,276	6,495	86	2,892	**10,749**

The Court adopts these calculations of repeated and ongoing emission limit violations. PX 9, 587-88; Tr. 1-246:22 – 1-247:25, 1-252:6 – 1-255:3, 1-255:16 – 1-256:14, 1-258:2 – 1-259:12, 1-260:17 – 263:6, 2-8:19 – 2-9:7 [Metzger].

152. The total number of separate 24-hour periods during which each of the above pollutants was emitted without authorization, and thus the total number of days of violation, during the Count I emission events was 10,749 days. PX 1A-1B, 9, 587-88; Tr. 1-257:18 – 1-258:16 [Metzger].

153. The findings of fact above regarding Count I are supported by Plaintiff Exhibits 1A and 1B, which are stipulations as to the contents of Exxon's STEERS Reports and Exxon's records of recordable emission events for the Count I emission events. Tr. 1-246:3-15 [Metzger]. They are also supported by Plaintiff Exhibits 587 and 588, which add a "Number of Days of Violation" column to Plaintiff Exhibits 1A and 1B containing a calculation of the number of 24-hour periods in which each pollutant was emitted in violation of the Refinery permit. Tr. 1-246:22 – 1-247:25, 1-252:6 – 1-255:3, 1-255:16 – 1-256:14, 2-8:19 – 2-9:7 [Metzger].

B. Violations covered by Count II: Repeated violations of hourly emission limits.

154. Count II alleges that Exxon violated hourly emission limits during emission events at all three plants in the Baytown Complex during the Claim Period (the "Count II emission events"). PX 584, Complaint ¶¶ 28-30 (Docket Entry 1).

1. Overview of hourly emission limits.

155. By incorporating Exxon's NSR and PSD permits, Exxon's Title V permits authorize "only those sources of emissions and those air contaminants listed in" the MAERT tables included in each NSR and PSD permit (General Condition 8 of each NSR and PSD permit). "Emissions that exceed the limits of" a permit "are not authorized and are violations of" the permit (General Condition 15). *E.g.*, PX 123 [at ETSC 075793], PX 175 [at ETSC 077480].

156. Authorized emissions of air contaminants are expressed in maximum pounds per hour and tons per year limits for each type of air contaminant (except that VOCs and oxides of nitrogen are each treated as a group), and are applicable either to individual emission points or to total emissions from a group of emission points. *E.g.*, PX 122 (MAERT table for NSR permit 20211 contains emission limits for individual emission points as well as for groups of emission points).

157. General Condition 14 or 15 of each NSR and PSD permit provides that "Emissions that exceed the limits of" a facility's permit "are not authorized and are violations of" the permit. *E.g.*, PX 123, NSR permit 20211 [at ETSC 075793]; PX 175, NSR permit 18287 [at ETSC 077480].

158. Many of the violations of hourly emission limits at the Baytown Complex involved unauthorized emissions with a duration longer than 24 hours. PX 2A-2F, 589-94.

2. How Exxon identifies hourly emission limit violations.

159. When Exxon lists an emission limit as being zero lbs/hr in a STEERS Report or in a recordable emissions event list, this means either that an air contaminant was emitted from a source that is not ever authorized to emit any air contaminants, or that an emission point that is authorized to emit certain air contaminants under certain conditions was not authorized to emit the contaminants that were emitted during the emission event. PX 2A-2F, 16-22, 101-112, 589-94. In either case, the emissions are unauthorized. Tr. 1-264:23 – 1-265:7 [Metzger].

160. Even when a non-zero lbs/hr limit is listed in the "Limit" column of Exxon's STEERS Reports, when Exxon states in the "Authorization" column of the same STEERS Reports that an emission is "not specifically authorized," this phrase signifies that no portion of the emission being reported is authorized, even though emissions from that source may be authorized at

other times, under other circumstances. PX 2A, 2C, 2E, 16-22, 589, 591, 593; Tr. 1-265:8-19 [Metzger].

161. Even when a non-zero lbs/hr limit is listed in the "Limit" column of Exxon's STEERS Reports, when Exxon states in the "Authorization" column of the same STEERS Reports that "portions are authorized," or "portions may be authorized," or "[x] lbs. out of [y] total lbs. are authorized," these phrases signify that at least some portion of the emissions being reported exceeded the hourly limit and are unauthorized. PX 2A, 2C, 2E, 16-22, 589, 591, 593; Tr. 1-265:8-19 [Metzger].

162. In addition, the hourly emission rate of an air contaminant can be determined from Exxon's STEERS Reports and recordable emission event lists by dividing the total amount of emissions of that contaminant by the duration (in hours) of the emission event. Whenever that rate exceeds the listed lbs/hr limit, the emission is unauthorized. PX 2A-2F, 16-22, 101-112, 589-94; Tr. 1-265:8 – 1-267:22 [Metzger].

163. Unlike Exxon's STEERS Reports, Exxon's recordable emission event lists do not contain an "Authorization" column that identifies the unauthorized portions of emissions. PX 2B, 2D, 2F, 101-112, 590, 592, 594. But because every emission event, by definition, involves an unauthorized emission, 30 Tex. Admin. Code § 101.1(28), there is at least one violation of

an emission limit (per 24-hour period the event lasted) for each recordable emission event. Tr. 2-5:21 – 2-6:20 [Metzger]; PX 590, 592, 594.

164. Where Exxon's record of a recordable emission event does not specify which pollutant or pollutants were emitted without authorization, Plaintiffs adopted the conservative approach of alleging only one day of violation for the event, per 24-hour period the event lasted, regardless of how many different pollutants were emitted. Tr. 2-5:21 – 2-6:20 [Metzger]; PX 590, 592, 594. The Court adopts that approach and finds one violation per day where Exxon's record of a recordable emission event does not specify which pollutant or pollutants were emitted without authorization.

3. Violations of hourly emission limits at the Refinery.

165. The plant-wide emission caps in the Refinery's flexible permit (18287/PSD-TX-730M4) authorize emissions of only the following contaminants, which are allowed to be emitted only from listed sources and only within specified limits: nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (H_2O), particulate matter (PM), volatile organic compounds (VOCs), benzene, hydrogen sulfide (H_2S), sulfuric acid (H_2SO_4), and ammonia (NH_3). Individual emission limits in the permit authorize emissions of carbonyl sulfide (COS) and carbonyl disulfide (CS_2) from one source only. PX 155-176.

166. A large number of contaminants were released into the atmosphere from the Refinery in violation of the applicable hourly emission limits in the Refinery's flexible permit, or without any permit authorization at all, both before and after the filing of the Complaint. PX 2A-2B; 10, pp. 2-3; 589-90. For each of these pollutants, the violations were thus "repeated" and are "ongoing."

167. Two contaminants (identified by Exxon as "compounds with bp" and natural gas) were released into the atmosphere from the Refinery in violation of the applicable hourly emission limits in the Refinery's flexible permit before the Complaint was filed, but not after. However, the pre-Complaint violations of these limits occurred more than once. For each of these pollutants, the violations were thus both "repeated." PX 2A-2B; 10, pp. 2-3; 589-90.

168. One contaminant (sodium hydroxide) was released in violation of applicable hourly emission limits only after the Complaint was filed, on two days. PX 2A-2B; 10, pp. 2-3; 589-90. For this pollutant, the violations are "ongoing."

169. The breakdown of the number of days that each contaminant was emitted in violation of each applicable plant-wide emission limit in the Refinery's flexible permit, or without any permit authorization at all, both

before and after the filing of the Complaint in this case, is contained in the following summary chart (taken from PX 10) assembled by Plaintiffs:

Violations of General Conditions 8 and 15, Special Condition 1, and MAERT Limits in Permit 18287/PSD-TX-730M4 for Emissions of:	**Pre-Complaint Days of Violation**		**Post-Complaint Days of Violation**		**TOTALS**
	Days of Violation From STEERS	**Days of Violation From Recordables**	**Days of Violation From STEERS**	**Days of Violation From Recordables**	
Ammonia	102	145	2	20	**269**
Ammonium Compounds (ammonium hydroxide, ammonium polysulfide, NH_4OH, $(NH_4)_2S_x$)		4		1	**5**
Benzene	49	171	12	139	**371**
Carbon Disulfide	14	10		11	**35**
Carbon Monoxide (CO)	189	488	8	248	**933**
Carbonyl Sulfide (COS)	14	16		21	**51**
Compounds with bp-#		3			**3**
Crude Oil		2	2	24	**28**
Halon 1301 (Bromotrifluoromethane)	1		1		**2**
Hydrogen Chloride (HCl)		3		2	**5**
Hydrogen Cyanide (HCN)	100	129	1	3	**233**
Hydrogen Sulfide (H_2S)	91	571	11	161	**834**
Natural Gas		10			**10**
NO_x (Nitrogen Dioxide, Nitrogen Oxide)	165	299	9	167	**640**
N-Methyl-2-Pyrrolidone (NMP)	5	37		16	**58**
Opacity/Visible Emissions	27	1	7		**35**
"Other"		2		37	**39**
Particulate Matter (PM)	95	145	2	21	**263**
Phosphoric Acid		1		1	**2**
Sodium Hydroxide (NaOH)				2	**2**

Sodium Hypochlorite (NaClO)		7		2	**9**
Total Sulfur, Sulfur, Sulfur Compounds	9	8		3	**20**
Sulfur Dioxide (H_2O)	152	309	8	128	**597**
SO_x		1		1	**2**
Sulfuric Acid (H_2SO_4)	5			1	**6**
Total VOC	123	894	19	890	**1926**
TOTALS	1141	3256	82	1899	**6378**

The Court adopts these calculations of repeated and ongoing emission limit violations. PX 10; Tr. 1-264:10 – 1-267:22, 2-8:19 – 2-9:7 [Metzger].

170. The total number of repeated, separate 24-hour periods during which an identified pollutant was emitted in violation of applicable hourly emission limits at the Refinery is 6,378. Adding to that total the 1,563 days on which Exxon's stipulation shows a recordable emission event emitted at least one of these pollutants (without identifying which one or ones was unauthorized), the total number of days of violation at the Refinery during the Count II emission events is 7,941 days. PX 2A-2B, 10, 589-90; Tr. 1-267:23 – 1-268:18 [Metzger].

4. Violations of hourly emission limits at the Olefins Plant.

171. The plant-wide emission caps in the Olefins Plant's flexible permit (3452/PSD-TX-302M2) authorize emissions of only the following contaminants, which are allowed to be emitted only from listed sources and only within specified limits: NO_x, CO, H_2O, PM, VOCs, H_2SO_4, and NH_3.

Individual emission limits authorize emissions of these contaminants during planned maintenance, startup, and shutdown events at listed sources. PX 129, 132.

172. A large number of contaminants were released into the atmosphere from the Olefins Plant in violation of the applicable hourly emission limits in the Olefins Plant's flexible permit, or without any permit authorization at all, both before and after the filing of the Complaint. PX 2C-2D; 10, p. 3; 591-92. For each of these pollutants, the violations were thus "repeated" and are "ongoing."

173. Three contaminants (hydrochloric acid, hydrogen cyanide, and sulfur dioxide) were released into the atmosphere from the Olefins Plant in violation of the applicable hourly emission limits in the Olefins Plant's flexible permit before the Complaint was filed, but not after. However, the pre-Complaint violations of these limits occurred more than once. PX 2C-2D; 10, p. 3; 591-92. For each of these pollutants, the violations were thus "repeated."

174. One contaminant (sodium) was released in violation of applicable hourly emission limits only after the Complaint was filed, on seven days. PX 2C-2D; 10, p. 3; 591-92. For this pollutant, the violations are "ongoing."

175. The breakdown of the number of days that each contaminant was emitted in violation of each applicable plant-wide emission limit in the Olefins Plant's flexible permit, or without any permit authorization at all, both before

and after the filing of the Complaint in this case, is contained in the following summary chart (taken from PX 10) assembled by Plaintiffs:

Violations of General Condition 8, Special Condition 1, and MAERT Limits in 3452/PSD-TX-302M2 for Emissions of:	**Pre-Complaint Days of Violation**		**Post-Complaint Days of Violation**		**TOTALS**
	Days of Violation From STEERS	**Days of Violation From Recordables**	**Days of Violation From STEERS**	**Days of Violation From Recordables**	
Ammonia		5	4	2	**11**
Carbon Monoxide (CO)	119	419	23	237	**798**
Chlorine		10		12	**22**
Hydrochloric Acid (HCl)		2			**2**
Hydrogen Cyanide (HCN)		2			**2**
Hydrogen Sulfide (H_2S)	4	1	2	3	**10**
NO_x (Nitrogen Dioxide, Nitrogen Oxide)	100	197	21	38	**356**
Opacity/Visible Emissions	33		9		**42**
Particulate Matter (PM, coke fines)		109		184	**293**
Sodium				7	**7**
Sulfur Dioxide (H_2O)	4	1			**5**
Total VOC	132	712	81	719	**1644**
TOTALS	392	1458	140	1202	**3192**

The Court adopts these calculations of repeated and ongoing emission limit violations. PX 10; Tr. 1-268:25 – 1-269:9, 2-8:19 – 2-9:7 [Metzger].

176. The total number of repeated, separate 24-hour periods during which an identified pollutant was emitted in violation of applicable hourly

limits at the Olefins Plant is 3,192. Adding to that total the 873 days on which Exxon's stipulation shows a recordable emission event emitted at least one of these pollutants (without identifying which one or ones were unauthorized), the total number of days of violation at the Olefins Plant during the Count II emission events is 4,065 days. PX 10, 591-92.

5. Violations of hourly emission limits at the Chemical Plant.

177. The Chemical Plant's NSR and PSD permits contain a combination of multiple-source emission limits, or caps (imposing a single emission limit on a group of emission points), and individual source emission limits (each applicable to a single emission point). These limits authorize emissions of only the following contaminants, which are allowed to be emitted only from listed sources and only within specified limits: NO_x, CO, H_2O, PM, total suspended particulates, VOCs, H_2S, H_2SO_4, NH_3, COS, bromine (Br), hydrogen chloride (HCl), hydrogen bromide (HBr), acetone, and caustic (NaOH). PX 113, 118, 124-127, 134-142, 144-154.

178. A large number of contaminants were released into the atmosphere from the Chemical Plant in violation of the applicable hourly emission limits in Chemical Plant permits 4600, 5259, 20211, and 36476, or without authorization by any Chemical Plant permit (neither the four previously listed permits nor permits 28441, 9571, 5710, 1419, 96220, 8586, or 8942). These

violations occurred both before and after the filing of the Complaint. PX 2E-2F; 10, pp. 3-6; 593-94. For each of these pollutants, the violations were thus "repeated" and are "ongoing."

179. Four contaminants (carbon monoxide, nitrogen oxides, total VOCs, and opacity, which measures particulate matter) were released into the atmosphere from the Chemical Plant in violation of the applicable hourly emission limits before the Complaint was filed, but not after. However, the pre-Complaint violations of these limits occurred more than once. PX 2E-2F; 10, pp. 3-6; 593-94. For each of these pollutants, the violations were thus "repeated."

180. Pollutants identified by Exxon as "other" were released without authorization from the Chemical Plant only after the Complaint was filed, on two days. PX 2E-2F; 10, pp. 3-6; 593-94. For these pollutants, the violations are "ongoing."

181. The breakdown of the number of days that each contaminant was emitted in violation of each applicable emission limit in each of the Chemical Plant's permits, both before and after the filing of the Complaint in this case, is contained in the following summary chart (taken from PX 10) assembled by Plaintiffs:

Violations of General Condition 8, Special Condition 1, and MAERT Limits in Permit 4600 for Emissions of:	**Pre-Complaint Days of Violation**	**Post-Complaint Days of Violation**	**TOTALS**
	Days of Violation From STEERS	**Days of Violation From STEERS**	
Carbon Monoxide (CO)	3		**3**
NO_x (Nitrogen Dioxide, Nitrogen Oxide)	3		**3**
Total VOC	3		**3**
TOTALS	9		**9**

Violations of General Condition 8, Special Condition 1, and MAERT Limits in Permit 5259 for Emissions of:	**Pre-Complaint Days of Violation**		**Post-Complaint Days of Violation**		**TOTALS**
	Days of Violation From STEERS	**Days of Violation From Recordables**	**Days of Violation From STEERS**	**Days of Violation From Recordables**	
Carbon Monoxide (CO)	1	1		1	**3**
TOTALS	1	1		1	**3**

Violations of General Condition 8, Special Condition 1, and MAERT Limits in Permit 20211 for Emissions of:	**Pre-Complaint Days of Violation**		**Post-Complaint Days of Violation**		**TOTALS**
	Days of Violation From STEERS	**Days of Violation From Recordables**	**Days of Violation From STEERS**	**Days of Violation From Recordables**	
Flare Stack 12					
Carbon Monoxide (CO)	1		2		**3**
Hydrochloric Acid/Hydrogen Chloride (HCl)	2	1	2		**5**
NO_x (Nitrogen Dioxide, Nitrogen	1		2		**3**

Oxide)					
Total VOC	1		3		**4**
Butyl Units (emissions points other than FS12)					
Total VOC		2		2	**4**
TOTALS	5	3	9	2	**19**

Violations of General Condition 8, Special Condition 1, and MAERT Limits in Permit 36476 for Emissions of:	**Pre-Complaint Days of Violation**		**Post-Complaint Days of Violation**		**TOTALS**
	Days of Violation From STEERS	**Days of Violation From Recordables**	**Days of Violation From STEERS**	**Days of Violation From Recordables**	
Flare Stack 28					
Ammonia (NH_3)	1			1	**2**
Carbon Monoxide (CO)	3			1	**4**
Carbonyl Sulfide (COS)	5		2		**7**
Hydrogen Cyanide (HCN)	2		1		**3**
Hydrogen Sulfide (H_2S)	5	2	2		**9**
NO_x	4		1	1	**6**
Sulfur Dioxide (SO_2H_2O)	5	1	2		**8**
Total VOC	3	2	2		**7**
Syngas Fugitives					
Carbon Monoxide (CO)		6		1	**7**
Hydrogen Sulfide (H_2S)		7		2	**9**
TOTALS	28	18	10	6	**62**

No Applicable Permit Listed for Emissions of:	**Pre-Complaint Days of Violation**		**Post-Complaint Days of Violation**		**TOTALS**
	Days of Violation From STEERS	**Days of Violation From Recordables**	**Days of Violation From STEERS**	**Days of Violation From Recordables**	
Ammonia (NH_3)	10	60		13	**83**
Carbon Monoxide	29	88		30	**147**

(CO)					
Carbonyl Sulfide (COS)	7	37		5	**49**
Freon R-22		1		2	**3**
Hydrochloric Acid/Hydrogen Chloride (HCl)	8	13		4	**25**
Hydrogen Sulfide (H_2S)	7	56		11	**74**
NO_x (Nitrogen Dioxide, Nitrogen Oxide)	27	42		20	**89**
Opacity/Visible Emissions	2				**2**
"Other"				2	**2**
Particulate Matter (PM, PM_{10})	1	5		3	**9**
Sodium Hypochlorite (NaOCl)		5		2	**7**
Sulfur Dioxide (SO_2)	8	1		2	**11**
Total VOC	37	204	3	96	**340**
TOTALS	136	512	3	190	**841**

The Court adopts these calculations of repeated and ongoing emission limit violations. PX 10; Tr. 1-268:25 – 1-269:9, 2-8:19 – 2-9:7; 2-10:20 – 2-11:9 [Metzger].

182. The total number of repeated, separate 24-hour periods during which an identified pollutant was emitted in violation of the applicable hourly limits at the Chemical Plant is 934. Adding to that total the 798 days on which Exxon's stipulation shows a recordable emission event emitted at least one of these pollutants (without identifying which one or ones were unauthorized), the

total number of days of violation at the Chemical Plant during the Count II emission events is 1,732 days. PX 10, 593-94.

6. Total number of violations of hourly emission limits at the Baytown Complex.

183. The findings of fact above regarding Count II are supported by Plaintiff Exhibits 2A through 2F, which are stipulations as to the contents of Exxon's STEERS Reports and Exxon's records of recordable emission events for the Count II emission events. Tr. 1-246:3-15 [Metzger]. They are also supported by Plaintiff Exhibits 589 through 594, which add a "Number of Days of Violation" column to Plaintiff Exhibits 2A through 2F containing a calculation of the number of 24-hour periods in which each hourly emission limit was violated. These exhibits exclude the reportable emission events no longer at issue by virtue of the Court's summary judgment ruling.

184. The total number of separate 24-hour periods during which pollutants were emitted without authorization at the entire Baytown Complex (*i.e.*, the Refinery, Olefins Plant and Chemical Plant combined) during the Count II emission events, and thus the total number of days of violation under Count II, is 13,738 days. PX 10, 589-94.

185. Because the hourly emission limit violations stemming from the Count II events at the Refinery (Plaintiff Exhibits 2A and 2B) are a subset of the Count I violations of the broader "no upset emissions" provisions of the

Refinery's permit (Plaintiff Exhibits 1A and 1B), the Court will not double-count days of violation stemming from Refinery emission events under Counts I and II when determining a civil penalty, nor have Plaintiffs sought to double-count these violations for purposes of assessing a penalty. Tr. 2-115:1-12 [Metzger].

C. Violations covered by Count III of the Complaint.

186. Count III of the Complaint alleges that Exxon has violated the HRVOC Rule (which states that facility-wide emissions of HRVOCs shall not exceed 1,200 lbs/hr), which is incorporated into Title V permits for all three plants. PX 584, Complaint ¶¶ 31-33 (Docket Entry 1); PX 203, Refinery permit O1229 [at ETSC 078579]; PX 224, Olefins Plant permit O1553 [at ETSC 080010 *ff.*]; PX 236, Chemical Plant permit O1278 [at ETSC 080662].

187. By TCEQ regulation, the following air contaminants are defined as HRVOCs: ethylene, propylene, 1,3-butadiene, butenes, and beta-butylene. 30 Tex. Admin. Code § 115.10(18)(A).

188. Exxon reports violations of the HRVOC Rule at the Baytown Complex in its STEERS Reports and Deviation Reports. PX 3.

189. Plaintiff Exhibit 3 is a stipulation as to the contents of Exxon's STEERS Reports and Deviation Reports for emission events at the Olefins Plant and the Chemical Plant during the Claim Period that involved emissions that exceeded the HRVOC Rule limit. Tr. 1-246:3-15 [Metzger]. This exhibit

excludes emission events no longer at issue by virtue of the Court's summary judgment ruling. PX 3.

190. Violations of the HRVOC Rule sometimes took place over multiple 24-hour periods. PX 3, 595.

191. At the Olefins Plant, Exxon committed a total of 15 days of violations of the HRVOC Rule. Eight of these days of violations occurred before the Complaint was filed, and seven occurred after the Complaint was filed. PX 11, 595; Tr. 2-11:10 – 2-12:19 [Metzger]. These violations were thus "repeated" and are "ongoing."

192. At the Chemical Plant, Exxon committed a total of three days of violations of the HRVOC Rule. Two of these days of violations occurred before the Complaint was filed, and one occurred after the Complaint was filed. PX 11, 595; Tr. 2-11:10 – 2-12:19 [Metzger]. These violations were thus "repeated" and are "ongoing."

193. The total number of days of violation under Count III is 18 days.

D. Violations covered by Count IV of the Complaint.

194. Count IV of the Complaint alleges that Exxon has violated rules prohibiting visible emissions from flares for periods exceeding five minutes during any two-hour period ("smoking flare prohibition"), which are incorporated into Title V permits of all plants. PX 584, Complaint ¶¶ 34-36 (Docket Entry 1); PX 203, Refinery permit O1229 [at ETSC 078706-16]; PX

215, Olefins Plant permit O1553 [at ETSC 079480-81]; PX 236, Chemical Plant permit O1278 [at ETSC 080728-29]; PX 240, Chemical Plant permit 02269 [at ETSC 080949].

195. When visible emissions from flares exceed five minutes in a two-hour period, Exxon reports these emissions in STEERS Reports and Deviation Reports. PX 4.

196. Exxon's reports typically describe visible emissions from flares in terms of "opacity." Opacity is defined as "the degree to which an emission of air contaminants obstruct the transmission of light expressed as a percentage of light obstructed as measured by an optical instrument or trained observer." 30 Tex. Admin. Code § 101.1(72). Smoke with 100% opacity is completely opaque, while emissions with 0% opacity are not visible.

197. Plaintiff Exhibit 4 is a stipulation as to the contents of Exxon's STEERS Reports and Deviation Reports (PX 16-100) that concern visible emissions from flares during the Claim Period. Tr. 1-246:3-15 [Metzger]. This exhibit excludes emission events no longer at issue by virtue of the Court's summary judgment ruling. PX 4.

198. The duration of violations of the smoking flare prohibition sometimes extended beyond a 24-hour period. PX 4, 596.

199. At the Refinery, Exxon committed 12 days of violations of the smoking flare prohibition in Title V permit O1229 before the Complaint was

filed, and 3 days of violations after the Complaint was filed, for a total of 15 days of violation. At the Olefins Plant, Exxon committed 18 days of violations of the smoking flare prohibition in Title V permit O1553 before the Complaint was filed, and 6 days of violations after the Complaint was filed, for a total of 24 days of violations. PX 4, 596. The violations at the Refinery and the Olefins Plant were thus "repeated" and are "ongoing."

200. At the Chemical Plant, Exxon committed 4 days of violations of the smoking flare prohibition in Title V permit O1278 before the Complaint was filed, and 1 day of violation of the smoking flare prohibition in Title V permit O2269 that arose from the same cause as three of the violations of permit O1278. The violations at the Chemical Plant were thus "repeated." PX 4, 12, 596; Tr. 2-12:25 – 2-14:4 [Metzger].

201. The total number of days of violation at the Complex under Count IV is 44 days.

E. Violations covered by Count V of the Complaint

202. Count V of the Complaint alleges that Exxon has violated rules requiring flares to operate with a pilot flame present at all times ("pilot flame rule"), which is incorporated into Title V permits of all three plants. PX 584, Complaint ¶¶ 37-39 (Docket Entry 1); PX 203, Refinery permit O1229 [at ETSC 078706-16]; PX 215, Olefins Plant permit O1553 [at ETSC 079480-81];

PX 236, Chemical Plant permit O1278 [at ETSC 080728-29; PX 240, Chemical Plant permit 02269 [at ETSC 080949].

203. Exxon reports flare pilot flame outages in its STEERS Reports and Deviation Reports. PX 5.

204. Plaintiff Exhibit 5 is a stipulation as to the contents of Exxon's STEERS Reports, recordable emission event lists, and Deviation Reports (PX 16-100) that concern flare pilot flame outages during the Claim Period. Tr. 1-246:3-15 [Metzger]. This exhibit excludes emission events no longer at issue by virtue of the Court's summary judgment ruling. PX 5.

205. At the Refinery, Exxon committed 14 days of violations of the pilot flame rule in Title V permit O1229 before the Complaint was filed, and 11 days of violations after the Complaint was filed, for a total of 25 days of violations. PX 5, 597. These violations were thus "repeated" and are "ongoing."

206. At the Olefins Plant, Exxon committed 5 days of violations of the pilot flame rule in Title V permit O1553 before the Complaint was filed. PX5, 597. These violations were thus "repeated."

207. At the Chemical Plant, Exxon committed 2 days of violations of the pilot flame rule in Title V permit O1278, 1 before the Complaint was filed and 1 after. These violations were thus "repeated" and are "ongoing." PX 5, 13, 597; Tr. 2-14:5-25 [Metzger].

208. The total number of days of violation at the Complex under Count V is 32 days.

F. Violations covered by Count VI of the Complaint

209. Count VI of the Complaint alleges that Exxon violated its NSR permits, which are incorporated into the Title V permits for all three plants, by emitting pollutants from fugitive emission points, which are not authorized by the Maximum Allowable Emission Rate Tables of those permits. PX 584, Complaint ¶¶ 40-41(Docket Entry 1); PX 168, Refinery NSR permit 18287 [at ETSC 077128]; PX 132, Olefins Plant NSR permit 3452 [at ETSC 076050]; PX 122, Chemical Plant NSR permit 20211 [at ETSC 075790]; PX 124, Chemical Plant NSR permit 28441 [at ETSC 075805]; PX 137, Chemical Plant NSR permit 36476 [at ETSC 076126]; PX 151, Chemical Plant NSR permit 9571 [at ETSC 076284].

210. Exxon's Title V permits incorporate General Condition 8 of its NSR permits, which authorize "only those sources of emissions and those air contaminants listed in" each permit's MAERT table. Emissions of air contaminants are authorized on a pollutant-by-pollutant basis (except that all VOCs are treated as a group and oxides of nitrogen are treated as a group). General Condition 14 or 15 of each permit provides, "Emissions that exceed the limits of this permit are not authorized and are violations of this permit." Thus, each type of regulated air contaminant emitted without authorization

from a fugitive emission point constitutes a separate violation of the applicable permit. PX 175, Refinery NSR permit 18287 [at ETSC 077480]; PX 133, Olefins Plant NSR permit 3452 [at ETSC 076058]; PX 123, Chemical Plant NSR permit 20211 [at ETSC 075793]; PX 126, Chemical Plant NSR permit 28441 [at ETSC 075818]; PX 139, Chemical Plant NSR permit 36476 [at ETSC 076137]; PX 152, Chemical Plant NSR permit 9571 [at ETSC 076288].

211. Exxon reports emissions of air contaminants from fugitive emission sources on STEERS Reports and Deviation Reports and documents such emissions in its records of recordable emission events. PX 6.

212. Plaintiff Exhibit 6 is a stipulation as to the contents of Exxon's STEERS Reports, Deviation Reports, and records of recordable emission events (PX 16-100) that concern unauthorized fugitive emissions. Tr. 1-246:3-15 [Metzger]. This exhibit excludes emission events no longer at issue by virtue of the Court's summary judgment ruling. PX 6.

213. A large number of contaminants were released into the atmosphere from the Baytown Complex from fugitive emission points without authorization both before and after the filing of the Complaint. PX 6, 14, 598. For each of these pollutants, the violations were thus "repeated" and are "ongoing."

214. Four contaminants (ammonia, carbonyl sulfide, particulate matter, and sulfur dioxide) were released into the atmosphere from fugitive emission

points at the Refinery without authorization before the Complaint was filed, but not after. However, the pre-Complaint violations of these limits occurred more than once. PX 6, 14, 598. For each of these pollutants, the violations were thus "repeated."

215. The breakdown of the number of days that each contaminant was emitted without authorization from a fugitive emission point in violation of each applicable Baytown Complex permit, both before and after the filing of the Complaint in this case, is contained in the following summary chart (taken from PX 14) assembled by Plaintiffs:

Violations of General Conditions 8 and 14/15, Special Condition 1, and MAERT Limits for emissions of:	**Pre-Complaint**	**Post Complaint**	**Total**
REFINERY			
Ammonia (NH_3)	10	0	**10**
Benzene	23	3	**26**
Carbon Monoxide (CO)	8	2	**10**
Carbonyl Sulfide (COS)	3	0	**3**
Hydrogen Sulfide (H_2S)	26	2	**28**
NO_x	1	1	**2**
Other/Unspecified	1	1	**2**
Particulate Matter PM)	2	0	**2**
Sulfur Dioxide (SO_2)	4	0	**4**
VOC	71	5	**76**
REFINERY TOTALS	**149**	**14**	**163**
OLEFINS PLANT			
VOCs	1	1	**2**
OLEFINS PLANT TOTALS	**1**	**1**	**2**
CHEMICAL PLANT			
Ammonia (NH_3)	10	2	**12**
Carbon Monoxide (CO)	7	2	**9**
Carbonyl Sulfide (COS)	7	1	**8**

Hydrogen Sulfide (H_2S)	10	2	**12**
Methyl Chloride (MeCl)	5	1	**6**
Particulate Matter	3	2	**5**
VOCs	15	1	**16**
CHEMICAL PLANT TOTALS	**57**	**11**	**68**
COMPLEX-WIDE TOTALS	**209**	**26**	**235**

The Court adopts these calculations of repeated emission limit violations. PX 6, 14, 598; Tr. 2-16:4-18, 2-17:15 – 2-18:18 [Metzger].

216. At the Refinery, Exxon committed 144 days of violations of the fugitive emission prohibition prior to June 2, 2010, during the time period when the fugitive emission prohibition was included in flexible permit 18287/PSD-TX-730M4. At the Olefins Plant, Exxon committed 1 day of violation of the fugitive emission prohibition before the Complaint was filed, and 1 day of violation after the Complaint was filed, for a total of 2 days of violations. At the Chemical Plant, Exxon committed 58 days of violations of the fugitive emission prohibition before the Complaint was filed, and 11 days of violations after the Complaint was filed, for a total of 69 days of violations. PX 6, 14, 598; Tr. 2-16:4-18, 2-17:15 – 2-18:18 [Metzger].

217. The total number of days of violation at the Complex under Count VI is 215 days.

218. Because the fugitive emission violations in Count VI overlap with violations of the emission standards and limitations described in Counts I, II,

and VII, the Court will not double-count days of violation found with respect to events that appear both in Count VI and in Counts I, II, or VII when determining a civil penalty.

G. Violations covered by Count VII of the Complaint.

219. Count VII of the Complaint alleges that Exxon violated a variety of emission standards and limitations in its Title V permits, as reflected in the twice-yearly Deviation Reports Exxon has submitted for each of the three plants in the Complex. PX 584, Complaint ¶¶ 42-44 (Docket Entry 1).

220. Plaintiff Exhibits 7A through 7E are stipulations as to the contents of Exxon's Deviation Reports (PX 23-100) for each of the five Title V permits in effect for the Baytown Complex during the Claim Period. Tr. 1-246:3-15 [Metzger]. These exhibits exclude emission events no longer at issue by virtue of the Court's summary judgment ruling, and do not contain information relating to deviations occurring near the end of the Claim Period because Deviation Reports had not yet been filed with TCEQ at the time the stipulation was compiled.

221. In its Deviation Reports, Exxon includes a description of each incidence of non-compliance with an emission standard or limitation, and reports the number of permit deviations connected with each incidence of non-compliance. PX 7A-7E, 23-100.

222. The testimony of Exxon personnel, described in Section IV.A, above, establishes that the permit deviations Exxon reported reflect instances of non-compliance with, and thus violations of, Exxon's permits.

223. The number of deviations Exxon has stipulated that it reported to TCEQ during the Claim Period, as reflected in Plaintiff Exhibits 7A through 7E, for each of its Title V permits, is as follows:

Exhibit 7A, Permit O1229 (Refinery):	663
Exhibit 7B, Permit O1553 (Olefins Plant):	156
Exhibit 7C, Permit O1278 (Chemical Plant, olefins and aromatics):	133
Exhibit 7D Permit O2269 (Chemical Plant, butyl polymers):	83
Exhibit 7E, Permit O2270 (Chemical Plant, propylene):	25
TOTAL:	1,060

PX 7A-7E.

224. Some deviations involve non-compliance with more than one permit condition or regulatory requirement at the same time. For example, at the Refinery each "open-ended line" – a pipe that has been left open to the atmosphere without a cap or other device to prevent the release of pollutants, Tr. 2-226:13 – 2-227:3 [Kovacs] – violates numerous regulatory requirements incorporated into the Refinery's Title V permit: Special Condition 34.E of flexible permit 18287; 40 C.F.R. §§ 60.482-7(a), 63.167, and 63.648(a); and 30 Tex. Admin. Code § 115.352(4). Plaintiffs have taken the conservative

approach of counting only one violation for each such incident involving overlapping regulatory requirements (Tr. 2-24:13-23 [Metzger], PX 599, p. 1, row 1), and the Court adopts that approach.

225. However, in reporting the number of deviations in its Deviation Reports, Exxon often improperly undercounts the number of violations by aggregating multiple deviations and counting them only as a single deviation. Using "open-ended lines" again as an example, in Exxon's Deviation Report covering the period Nov. 22, 2010 – May 21, 2011 at the Refinery, plant personnel discovered 126 open-ended lines, yet Exxon reported this as only one deviation. PX 7A, row 481. In the next Refinery Deviation Report, however, Exxon correctly reported the number of deviations: the discovery of 47 more open-ended lines was reported as 47 deviations. PX 7A, row 516.

226. In addition, the duration of some deviations extended beyond 24 hours; one day of violation should be counted for each 24-hour period a deviation lasts. PX 7A-7E, 23-100; Tr. 2-20:8 – 2-22:13 [Metzger].

227. Accordingly, the number of *permit violations*, and the resulting number of *days of violation*, reflected in the Deviation Reports is higher than the number of *deviations* counted and reported to TCEQ by Exxon. PX 7A-7E, 599-603; Tr. 2-20:8 – 2-22:13; 2-25:18-25 [Metzger].

228. Plaintiffs prepared a summary chart listing, for each Title V permit, each emission standard and limitation identified on Exxon's Deviation

Reports. PX 15. For each emission standard and limitation, Plaintiffs identified whether a violation had been repeated and whether there was a post-Complaint violation. Because of the size of this summary chart, it is included as an appendix to this opinion rather than in the text. The Court adopts Plaintiffs' summary of Exxon's Deviation Reports. PX 15, 599-603; Tr. 2-20:8 – 2-22:13; 2-25:18-25 [Metzger].

229. The Court finds that, for the vast majority of the emission standards and limitations that were violated, violations of each standard or limitation occurred more than once – that is, they were "repeated" – and occurred after the Complaint was filed – that is, they are "ongoing." PX 15, pp. 2-11; Tr. 2-26:16 – 2-27:17 [Metzger].

230. An examination of the Deviation Reports shows that they reflect the following number of repeated and/or continuing days of violations, broken down by permit:

Exhibit 7A, Permit O1229 (Refinery):	2,814
Exhibit 7B, Permit O1553 (Olefins Plant):	883
Exhibit 7C, Permit O1278 (Chemical Plant, olefins and aromatics):	579
Exhibit 7D Permit O2269 (Chemical Plant, butyl polymers):	299
Exhibit 7E, Permit O2270 (Chemical Plant, propylene):	102
TOTAL:	4,677

PX 15, 599-603; Tr. 2-20:8 – 2-22:13; 2-25:18-25 [Metzger].

VI. Emission Events And Other Types Of Clean Air Act Permit Violations Are A Serious Matter.

A. Violations of health-based emission limits create a risk to public health.

231. This point is discussed in detail in Sections X through XII, below.

B. Emission events at the Baytown Complex, which involve loss of containment of flammable liquids and gases, create a risk of fire and explosion.

232. Emission events involve a loss of containment of gases or liquids at the Baytown Complex. Tr. 4-39:16 – 4-40:3 [Bowers].

233. One cannot know, before it happens, whether an equipment breakdown, a hole in a pipe or heat exchanger, an instrument failure, or some other malfunction will result in a minimal release – what Plaintiffs' engineering expert Keith Bowers called a "warning event" or "near miss" – or a major loss of containment. Tr. 4-77:2-22, 4-131:5-15 [Bowers].

234. It is for this reason that Mr. Bowers testified, "The second commandment in refining is thou shalt not have fires. The first one is thou shalt not have leaks. Because without a leak you can't have a fire. And a fire is extremely uncontrollable and unpredictable." Tr. 4-134:25 – 4-135:3 [Bowers].

235. Exxon witnesses agreed that because much of the gases and liquids present throughout the Baytown Complex are flammable, precautions must be

taken to prevent ignition of those materials should they escape. Tr. 4-12:7-25 [Kovacs], 11-65:21 – 11-66:2 [Robbins], 12-66:5-14 [Buehler].

236. Plaintiffs' expert, Mr. Bowers, described a worst case-type example of loss of containment: one source he relied on in forming his opinion for this case was a U.S. Chemical Safety Board report on an incident at the Chevron refinery in Richmond, California. Mr. Bowers testified that many people living near the facility were hospitalized after fuel oil released during an emission event at the refinery caught fire by contacting a hot surface and released air pollutants into the community. Tr. 4-81:12 – 4-82:21, 4-89:11 – 4-91:1 [Bowers].

237. At the Baytown Complex, the seriousness of the risk created by loss of containment is evidenced by precautions that include prohibitions on vehicles and other items or activities that can serve as potential sources of ignition. Tr. 4-12:7-25 [Kovacs], 4-77:4-11 [Bowers].

238. Smoldering wood, which Exxon witnesses at trial repeatedly held up as an example of a non-serious infraction, is a potential ignition source. Tr. 4-13:6-22 [Kovacs], 4-109:19-20 [Bowers]. Even static electricity is a potential ignition source. Tr. 4-109:17-18 [Bowers].

239. The many recordable emission events at the Baytown Complex can create a dilemma for Exxon: fixing a leak or other failure may require a shutdown of the unit involved, which would cause even more unauthorized

emissions than the recordable event itself. Therefore, Exxon intentionally allows leaks of hydrocarbons and other unauthorized emissions to continue for hours or even days before they are repaired. Tr. 10-212:23 – 10-213:25 [Robbins]. As a result, there were 264 recordable events that each released more than 500 lbs. of pollutants. Tr. 10-215:9-19, 10-234:10-19 [Robbins].

C. The greater the number of emission events at the Baytown Complex, the greater the risks Exxon is creating.

240. It is logical that the more times there is a loss of containment the greater the chance that one of the losses of containment will have serious consequences. Failure to take sufficient steps to reduce the possibility of *all* such incidents to a minimum would therefore increase the risk of a fire or explosion or large pollution release. Mr. Bowers likened such a situation to "rolling the dice" regarding worker and community health and safety. PX 427, p. 6; Tr. 4-77:23 – 4-80:19 [Bowers]; 12-66:5-14 [Buehler].

241. The Baytown Complex experienced over 4,000 emission events between October 14, 2005, and September 3, 2013. This is an average of more than one emission event per day – about 4 emission events every 3 days – for nearly 8 years. This is a very high number of "rolls of the dice." PX 430, pp. 7, 3-1; PX 431, p. 3-1; Tr. 4-74:7-15 [Bowers].

242. For the foregoing reasons, the Baytown Complex can be viewed, in Mr. Bowers' characterization, as a catastrophe in the making. PX 427, p. 6.

D. Non-emission-related permit violations are a serious matter.

243. Exxon attempts to highlight the fact that many of the permit violations Plaintiffs seek to enforce did not directly involve the unauthorized emission of an air pollutant. *E.g.*, Tr. 10-205:2-19 [Robbins].

244. While there may be some purposes for which drawing such a distinction makes sense, there should be no doubt that all violations of a Clean Air Act permit are taken seriously by this Court. Credible evidence was presented at trial demonstrating that Exxon's non-emission-related violations are also serious.

245. Examples of serious reporting, recordkeeping or monitoring violations described at trial include the failure to publicly report an emission event within 24 hours (PX 7A and 599, row 597; Tr. 2-22:14 – 2-23:5 [Metzger]); failures to monitor the flow rate or analyze the composition of waste gases sent to a flare (PX 7A and 599, rows 605-606; Tr. 2-23:6-14 [Metzger]); the failure to re-calibrate a nitrogen oxide analyzer in a timely fashion (PX 7A and 599, row 607; Tr. 2-23:15-18 [Metzger]).

246. An example of a long-lasting monitoring violation described at trial was Exxon's failure, for a year and a half, to install continuous emission monitors on the emission stacks of several furnaces at the Refinery, as required by federal New Source Performance Standard regulations. PX 7A and 599, rows 106-110; Tr. 11-69:12 – 11-71:4 [Robbins].

247. An example of a serious failure to maintain proper emission controls described at trial was the absence of required equipment on the external floating roofs of numerous tanks at the Refinery, which Exxon's environmental coordinator had described as an important emission control device. PX 7A and 599, rows 237-248; Tr. 10-49:20 – 10-50:3, 11-72:5 – 11-73:11 [Robbins]. An improperly functioning floating roof can lead to unauthorized emissions. Tr. 11-7:5 – 11-8:2 [Robbins].

248. Another serious permit deviation described at trial involved the failure to fully implement the Hazardous Organic National Emission Standards for Hazardous Air Pollutants (abbreviated as "HON") to control air emissions from the Baytown Complex's wastewater plant. PX 7A and 599, row 40; Tr. 2-75:2-18 [Metzger], 3-249:8-14 [Kovacs].

249. The presence of open-ended lines creates the conditions for corrosion and leaks. Tr. 4-162:1-13 [Bowers]. Exxon's attempt to downplay the significance of open-ended lines, by arguing that no emissions were escaping at the time they were discovered, is simplistic and unpersuasive. Tr. 3-119:24 – 3-120:9 [Kovacs].

250. Plaintiffs' expert Mr. Bowers testified that a pattern of failure to file mandated reports on time and failure to comply with monitoring requirements is an indication of lax operations that can lead to greater problems. Tr. 4-161:10-25 [Bowers]. The Court finds Exxon's dismissive

attitude regarding the significance of reporting, record-keeping, and monitoring violations (*e.g.*, Tr. 3-120:10-20, 3-120:25 – 3-122:4 [Kovacs]) to be troubling.

VII. Emission Events Can Be Prevented.

251. Plaintiffs proved at trial that the violations at issue in this could have been, but were not, prevented, and that more can be done to reduce the frequency of emission events in the future.

A. The types of evidence establishing that emission events are preventable.

252. Plaintiffs presented three types of evidence to prove that Exxon has not devoted sufficient resources to preventing emission events.

1. Documents from Exxon and TCEQ.

253. At trial, the parties stipulated to the contents of Exxon's STEERS Reports, lists of recordable emission events, and Title V Deviation Reports (Tr. 1-246:3-15 [Metzger]), which contain descriptions of the causes of emission events and other violations. Plaintiffs also relied on internal Exxon documents and TCEQ investigation reports and enforcement documents that were admitted into evidence.

2. Testimony of Exxon personnel.

254. Plaintiffs also relied on admissions made during the testimony of Exxon witnesses at trial.

3. Expert testimony.

a. Plaintiffs' expert Keith E. Bowers.

255. Keith E. Bowers, a retired refinery and chemical plant engineer, testified that there are systemic problems underlying emission events at the Baytown Complex, and that most or all emission events can be, and could have been, prevented by increased spending on preventive maintenance, greater attention to operator training, and capital investments to improve the design of the Complex. Mr. Bowers also testified that Exxon failed to satisfy the criteria for an affirmative defense to penalties for the vast majority of STEERS events for which the defense was claimed.

256. I find Mr. Bowers qualifies as an expert to provide this testimony.

257. Mr. Bowers' education is in fields relevant to his testimony: he has a bachelor's degree in chemical engineering, and post-graduate training in advanced thermodynamics. PX 432; Tr. 4-31:12 – 4-33:4 [Bowers]. Mr. Bowers has co-authored a textbook on petroleum refining, and was a member of the American Institute of Chemical Engineers and the Project Management Institute. PX 432; Tr. 4-33:24 – 4-35:2, 4-36:4-23 [Bowers].

258. Mr. Bowers' 50 years of experience working in the oil and gas industry is directly relevant to the subject matter of his testimony. PX 432; Tr. 4-33:8-23 [Bowers]. He testified that his experience includes: seven years of hands-on operation and supervisory work as a refinery process engineer (Tr. 4-

42:12 – 4-44:7); implementing and designing preventive maintenance plans at refineries (Tr. 4-44:8 -4-45:13); developing operating plans for a variety of refinery and chemical plant units (Tr. 4-45:21 – 4-47:12); and performing process design engineering, both for individual units of refineries and chemical plants and for entire facilities (Tr. 4-50:3 – 4-51:15). PX 432. Mr. Bowers also testified to his familiarity with the functions, operations, and maintenance needs of the units and types of equipment at issue in this case, including flares, compressors, piping, seals and valves, and instrumentation. Tr. 4-51:20 – 4-55:24 [Bowers]. He has previously been qualified to testify as an expert witness on the causes of an emission event at a Texas refinery. Tr. 4-61:23 – 4-62:5 [Bowers]; PX 432.

259. In addition, Mr. Bowers has professional experience in calculating the capital costs of refinery and chemical plant units and equipment, and in calculating and creating operation and maintenance budgets for refineries and chemical plants. Tr. 4-55:25 – 4-60:9 [Bowers]. He has previously been qualified to testify as an expert witness on the valuation and operating costs of oil refineries. Tr. 4-62:6 – 4-63:1 [Bowers].

260. In forming his opinion in this case, Mr. Bowers testified that he reviewed tens of thousands of pages of Exxon and TCEQ documents, including STEERS Reports, recordable emission event spreadsheets, Deviation Reports, TCEQ investigation reports, Exxon root cause analyses and operating

manuals, and transcripts of deposition testimony of Exxon personnel. Tr. 4-63:2 – 4-67:11, 4-230:2-4, 4-240:2-5 [Bowers]. Mr. Bowers also participated in a site inspection of selected areas within the Baytown Complex. Tr. 4-67:14 – 4-69:18 [Bowers].

261. Mr. Bowers performed both in-depth analyses of the causes of individual emission events, and bigger-picture analysis of patterns of emission events at the Baytown Complex. Tr. 4-91:2 – 4-92:10 [Bowers]. Mr. Bowers performed these analyses himself, with assistance from Plaintiffs' legal staff acting under his direction in compiling certain tables attached to Mr. Bowers' expert reports. Tr. 4-93:12 – 4-95:24 [Bowers].

262. Mr. Bowers testified that he spent approximately 850 hours reviewing documents and preparing his opinions for this case. Tr. 4-67:8-11 [Bowers]. Mr. Bowers' time records show approximately 160 hours of that time was spent on document review as part of the preparation of his initial report in this case (DX 524; Tr. 4-199:1-10 [Bowers]), although he testified that he had been reviewing documents for "several weeks" before he started tracking his time for billing purposes (Tr. 4-236:13 – 4-237:16 [Bowers]).

263. The Court finds that Mr. Bowers performed a sufficiently thorough review of the relevant information to provide a basis for his opinions in this case.

b. Plaintiffs' expert Dr. Ranajit Sahu.

264. Dr. Ranajit Sahu, an engineer with expertise regarding industrial flares and in the modeling and monitoring of air pollutant dispersion, testified that Exxon can reduce the amount of unauthorized emissions caused by emission events by installing additional flare gas recovery capacity and by developing flare minimization plans.

265. Exxon did not file a Daubert motion challenging Dr. Sahu's testimony and the Court finds it admissible. (See discussion of Dr. Sahu's qualifications in Section X.D.1, below.)

B. Emission events are not inherently unavoidable.

266. Emission events are *not* inherently unavoidable. This fact is recognized by the regulatory structure established by the state of Texas: the availability of an affirmative defense to penalties for violations resulting from an emission event is based in part on whether unauthorized emissions stemmed "from any activity or event that could have been foreseen and avoided or planned for, and could not have been avoided by better operation and maintenance practices or technically feasible design consistent with good engineering practice." 30 Tex. Admin. Code § 101.222(b)(3).

267. Plaintiffs' engineering expert Mr. Bowers and Exxon witnesses agree that individual emission events can be analyzed to determine the immediate cause of the event and whether better design, operation, or

preventive maintenance could have avoided it and others like it in the future. This exercise is often called a "root cause analysis." PX 427, Bowers Op., pp. 7-8; Tr. 3-134:8-23 [Kovacs], 4-91:15-21 [Bowers].

268. Plaintiffs' engineering expert Mr. Bowers and Exxon's witnesses agree that emission events can also be analyzed as a group to determine whether there are patterns that shed light on the causes of emission events and how they might be prevented. Tr. 4-91:22 – 4-92:4, 4-96:11 – 4-97:11 [Bowers].

269. Exxon admits that "learnings" (*i.e.*, information learned) from a root cause analysis of an emission event occurring in one part of the Baytown Complex (or of any petrochemical facility) often can be applied to help reduce emission events in other parts of the Baytown Complex, and even at facilities other than Baytown. Tr. 3-116:17 – 3-117:4 [Kovacs], 4-97:12-22 [Bowers].

270. Data regarding emission events can be used to detect trends in emission events and can be used for more detailed root cause analysis. Tr. 8-36:5-13 [Ranna]. Both of these ways that emission event data can be used can provide useful information.

C. There are techniques available to reduce the occurrence of emission events at the Baytown Complex.

271. In contrast to the legal positions Exxon has taken in this case, Exxon's actions are consistent with the view that emission events at the

Baytown Complex are preventable and that prevention of emission events can be addressed on a systemic, or programmatic, basis. *See, e.g.*, DX 69 (Exxon's "Freeze Plan" document contains Complex-wide guidelines for preventive actions regarding cold weather) and DX 71 (Exxon's "Piping Erection, Leak Testing, Flushing, And Cleaning" document contains "global practices" for piping systems at the Baytown Complex).

272. At trial, Exxon touted recent reductions in the frequency of reportable (but not recordable) emission events, and in the annual amounts of pollutants released during emission events. But these reductions contradict another of Exxon's main trial themes: that emission events are "unavoidable," Tr. 3-114:12-18 [Kovacs], that "as long as we have humans and as long as we have machines" emission events will necessarily continue. Tr. 3-112:2-8 [Kovacs].

273. The evidence presented at trial established a number of approaches to reducing the occurrence of emission events at the Baytown Complex.

1. Exxon agrees with Plaintiffs' expert that tracking plant-wide equipment reliability by type of equipment can prevent emission events.

274. Equipment can break down and lead to an emission event. Tr. 6-179:6-8 [Ranna]; PX 427, Bowers Op., p. 5.

275. Plaintiffs' engineering expert, Mr. Bowers, stated in his initial report that an equipment malfunction that may appear to have been

unforeseeable or unavoidable when examined in isolation can be part of a larger pattern that suggests underlying, correctable problems. PX 427, p. 8.

276. Thus, one way that Mr. Bowers analyzed the emission events that have occurred at the Baytown Complex was to track them according to the type of equipment involved in each event. PX 430, Revised Supplemental Opinion of Keith Bowers ("Bowers Rev. Op."), p. 7 and exhibits 8, 10-14; PX 437, 439-43.

277. Similarly, Exxon's senior reliability engineer, Thomas Ranna, testified that recurring issues with equipment failure can be caused by Exxon's work practices as well as by mechanical problems, and that work processes therefore need to be tracked. Tr. 7-202:23 – 7-203:7 [Ranna].

278. Mr. Ranna also testified that proper design and construction of equipment is necessary for reliable operations at the Baytown Complex. Tr. 7-218:20-24 [Ranna].

279. Accordingly, Exxon, like Mr. Bowers, tracks the failures and reliability of various types of equipment at the Complex. Tr. 6-179:20 – 6-180:4 [Ranna].

280. Mr. Ranna testified that data on equipment failures can be used for a variety of purposes, including improving the design of equipment, such as pumps, and improving preventive and predictive maintenance. Tr. 6-180:21 – 6-181:10 [Ranna].

281. The Reliability Department at the Baytown Complex tracks pump failures and failures of a variety of types of fixed equipment. Tr. 6-180:21 – 6-182:1 [Ranna]. Mr. Bowers also tracked emission events caused by pump failures. PX 439.

282. Exxon agrees that tracking information on pump failures and pump repairs can provide suggestions for making pumps more reliable. Tr. 6-182:2-5 [Ranna].

283. Several Exxon witnesses testified at trial, with reference to Mr. Bowers' categorization of emission events, that simply noting that an emission event was caused by "compressor failure" would provide no useful information. *E.g.*, Tr. 3-133:19-24 [Kovacs]; Tr. 12-14:9-21 [Buehler].

284. But in practice, the machinery engineering group in the Baytown Complex Reliability Department does track compressor performance by plant, to give an overarching measure of the health of compressor reliability systems. An unfavorable trend could lead to plant-wide changes. Tr. 6-182:6 – 6-183:13, 6-184:3-10 [Ranna].

285. And Exxon sets plant-wide goals for compressor performance at the Olefins Plant, where the goal is expressed in number of compressor "trips" per compressor per year, and at the Refinery, where the goal is expressed in the percentage of "up time." Tr. 6-184:11 – 6-187:8 [Ranna].

286. Exxon uses computerized data on failures to track overall trends in compressor performance. Tr. 8-31:14 – 8-33:5 [Ranna].

2. Exxon agrees with Plaintiffs' expert that tracking the number of emission events by unit can prevent emission events.

287. Another way that Mr. Bowers analyzed the emission events that have occurred at the Baytown Complex was to track them according to the process unit at which each event occurred, to detect patterns and identify areas of concern. Tr. 4-96:11 – 4-97:7 [Bowers]; PX 430, pp. 7, 10 and exhibits 4-6; PX 433-35.

288. Exxon witnesses admitted that Exxon also looks at the number of emission events per unit at the Complex. Tr. 8-38:19-20, 8-43:12 – 8-44:1 [Robbins].

289. Exxon agrees with Mr. Bowers that the number of emission events occurring at a unit is relevant to improving performance and reducing the number of emission events. Tr. 8-44:2-23 [Robbins].

290. Exxon also agrees that the number of emission events occurring at a unit is relevant to improving design and operation of pieces of equipment within that unit. Tr. 8-44:23 – 8-45:17 [Robbins].

291. And Exxon agrees that the number of emission events occurring at a unit is relevant to revealing areas where personnel training can be improved. Tr. 8-45:18-21 [Robbins].

3. Exxon agrees with Plaintiffs' expert that tracking leaks across the Complex can prevent emission events.

292. A third way that Plaintiffs' expert Mr. Bowers analyzed the emission events that have occurred at the Baytown Complex was to track them according to the nature of the failure that caused the unauthorized release of pollutants. Such common causes tracked by Mr. Bowers include leaks, fires, and cold weather conditions. PX 430, pp. 10-11, 13-15, and exhibits 7, 9, 15; PX 436, 438, 444.

293. Exxon, too, treats "leaks" as a category by tracking the occurrence of leaks at the Complex. Tr. 6-190:1-8 [Ranna].

294. Exxon breaks down data on leaks to the unit level. Data on leaks is also viewed on a department level by a site management team, for the purpose of determining whether improvements in leaks can be made. Tr. 6-190:11-25 [Ranna].

4. Exxon agrees with Plaintiffs' expert that "preventive maintenance" can prevent emission events.

295. According to Plaintiffs' expert Mr. Bowers, a "preventive maintenance" activity – such as regularly scheduled inspection, repair, and replacement of parts – is one performed to prevent failures of machinery. Preventive maintenance is akin to regularly changing the oil in a car regardless of how the car is performing at the time. PX 430, p. 12; Tr. 4-100:25 – 4-101:9 [Bowers]; 8-14:2-11 [Ranna].

296. A "predictive maintenance" activity, in contrast, involves measuring the present condition of equipment in order to predict or estimate when the failure of machinery is likely to occur, and to allow mitigation of the consequences of failures when they occur. PX 430, Bowers Rev. Op., p. 12; Tr. 8-13:11-19 [Ranna].

297. Exxon employs both "predictive maintenance" and "preventive maintenance" at the Baytown Complex. Tr. 6-176:19 – 6-177:6, 8-13:6-10 [Ranna].

298. Exxon's senior reliability engineer, Mr. Ranna, agreed with Mr. Bowers that a "preventive maintenance" activity can actually prevent future failures of machinery and reduce the occurrence of emission events. Tr. 6-177:16-19, 6-179:9-19, 8-14:2-11 [Ranna].

D. Exxon's root cause analyses are not relevant to the legal and factual issues in this case.

299. Plaintiffs did not dispute that Exxon performs "root cause" analysis of reportable emission events. Tr. 3-114:25 – 3-115:13 [Kovacs].

300. Yet Exxon witnesses spent a great deal of time at trial describing many of these sometimes highly detailed analyses. *E.g.*, Tr. 3-135:12 – 3-153:19 [Kovacs]; 10-233:11 – 10-277:15, 11-5:17 – 11-58:7 [Robbins]. The purpose of this testimony appeared to be two-fold.

301. First, Exxon takes the position that, as a legal matter, unless violations of a particular emission standard or limitation all stem from the identical root cause, then there has been no "repeated" violation that citizens are entitled to challenge. As discussed above, Exxon's position is wrong as a matter of law. Root cause analysis of the specific cause of each emission event is irrelevant to whether a particular emission standard or limitation has been repeatedly violated, except in the case of violations of *different* standards that may all stem from a common underlying cause.

302. Second, Exxon contrasted its root cause analyses of emission events with the work done by Plaintiffs' expert Keith Bowers in this case, in an attempt to discredit Mr. Bowers' testimony. This comparison also misses the mark, in a number of ways.

303. For one thing, Mr. Bowers did perform highly specific analyses of the root causes of a significant number of both reportable and recordable emission events; they are described in his initial, rebuttal, and revised supplemental reports, and many of these analysis are referred to in Section VIII, below. PX 427, 428, 430; Tr. 4-91:15-21 [Bowers].

304. However, the scope of Mr. Bowers' work was broader than determining the specific cause of each event. As he testified, he was looking for patterns among a very large number of events to determine where efforts to

prevent emission events could be most effective. Tr. 4-91:22 – 4-92:10 [Bowers].

305. Detailed root cause analysis of individual events, taken alone, cannot explain the vast number of emission events that have occurred at the Baytown Complex. PX 427, p. 8.

306. To be effective, the proper level of detail must be employed in determining the causes of an emission event as required by the purpose for which the analysis is being conducted. Tr. 4-220:4-14 [Bowers]. In other words, if a root cause analysis is too highly detailed and specific, it will not reveal larger patterns of similar failures at the same unit or the same type of equipment. And a more general analysis may not reveal the immediate cause of a breakdown.

307. Indeed, Exxon's environmental specialist, Gary Robbins, admitted that the events in Mr. Bowers' various groupings of emission events do share "a common cause," although not always the same "root cause." Tr. 10-238:11-23 [Robbins].

VIII. Exxon's Efforts To Prevent Emission Events At The Baytown Complex Have Been Inadequate.

308. The frequent occurrence of equipment breakdowns, operator errors, and design-related failures at every location throughout the Complex is

persuasive evidence that the facility is not being managed and run in a way that enables it to comply with its CAA permits.

309. Plaintiffs' engineering expert identified common and recurrent characteristics of emission events at the Baytown Complex. These include: leaks in pipes, seals, valves, and gaskets, as well as other types of loss of containment; compressor trips; electrical failures; plugged lines; furnace failures; pump failures; instrument failures; control valve failures and other equipment failures due to cold weather; fires; operator errors; and other, more specific problems that recur at particular process units. PX 427, p. 1; PX 430, p. 7 and exhibits 4-15; PX 433-444.

310. Exxon's efforts to prevent both reportable and recordable emission events at the Baytown Complex have proven to be inadequate. Although the frequency of all emission events at the Chemical Plant dropped significantly after 2010 (there were between 125 and 154 emission events at the Chemical Plant each year from 2006 through 2010, and then 60 events in 2011 and 59 events in 2012), the frequency of all emission events at the Olefins Plant has increased dramatically (from 39 in 2006 to 183 in 2012) and the frequency of all emission events at the Refinery and for the Baytown Complex as a whole has remained fairly constant. PX 430, Bowers Rev. Op., pp. 3-6, Figs. 1-4; PX 431.

A. Many units at the Baytown Complex have had a high frequency of emission events.

311. Every emission event involves unauthorized emissions. Many units at the Baytown Complex have a significant number of recurring emission events, and thus significant amounts of recurring unauthorized emissions.

312. During the Claim Period, the following units had the following numbers of emission events:

1. Refinery Units.

a. Booster Station 4.

313. The gas recovery facility at the Refinery known as Booster Station Number 4 has a long history of unreliability, with numerous trips and component failures that cause large and lengthy flaring until the unit is repaired and restarted. There is no spare or backup compressor installed to prevent these flaring events. PX 427, Bowers Op., p. 8; Tr. 4-158:6-23 [Bowers].

314. Booster Station 4 had 21 reportable emission events and 28 recordable emission events, for a total of 49 emission events. PX 433, pp. 4-1–4-4.

315. Mr. Bowers personally observed Booster Station 4 during the Plaintiffs' site inspection, and noticed a slight odor of leaking hydrocarbon gas

and that the facility appeared to be in poor repair. Tr. 4-158:24 – 4-159:10 [Bowers].

b. Catalytic Light Ends Units.

316. The Catalytic Light Ends Units, as a group, had 11 reportable emission events and 136 recordable emission events, for a total of 147 emission events. PX 433, pp. 4-5 – 4-12.

317. Catalytic Light Ends Unit 1 had 2 reportable emission events and 19 recordable emission events, for a total of 21 emission events. Id. at 4-5 – 4-6.

318. Catalytic Light Ends Unit 2 had 2 reportable emission events and 43 recordable emission events, for a total of 45 emission events. Id. at 4-6 – 4-8.

319. Catalytic Light Ends Unit 3 had 6 reportable emission events and 74 recordable emission events, for a total of 80 emission events. Id. at 4-8 – 4-12.

c. Delayed Coking Unit.

320. The Delayed Coking Unit had 13 reportable emission events and 51 recordable emission events, for a total of 64 emission events. 24 of these emission events were leak-related, and several of them occurred in the same blow-down line. PX 433, pp. 4-13 – 4-16; PX 430, pp. 7-8.

d. Flexicoker.

321. The Flexicoker is a complicated unit that converts heavy hydrocarbons, such as tar or heavy oil, into fuel gas by using high temperatures to crack the material's molecular structure. Tr. 4-155:3 – 4-156:3 [Bowers].

322. The Flexicoker had 23 reportable emission events and 90 recordable emission events, for a total of 113 emission events. PX 433, pp. 4-17 – 4-22.

323. The large number of emission events at the Refinery's Flexicoker Unit show that the unit is either in poor condition, making it unreliable, or is inherently unstable and unreliable. Flexicokers at other refineries, including other Exxon refineries, run with fewer emission events. PX 427, p. 15; Tr. 4-156:10 – 4-157:6 [Bowers].

324. Plaintiffs' engineering expert Keith Bowers personally observed that the outside wall of the Flexicoker's waste heat boiler is covered with weld repairs of innumerable lengthy cracks in its steel plating, which Mr. Bowers attributed to "fatigue type cracking" that he considers to be indicative of poor condition. PX 427, Bowers Op., pp. 15-16; PX 445 (in pictures taken during Plaintiffs' site inspection, gray oval areas indicate the locations of welds, at EOMCS 56364-65); Tr. 4-157:7 – 4-158:5 [Bowers].

e. Fluid Catalytic Cracking Units.

325. The Fluid Catalytic Cracking Units as a group had 47 reportable emission events and 150 recordable emission events, for a total of 197 emission events. PX 433, pp. 4-23 – 4-34.

326. Fluid Catalytic Cracking Unit 2 had 16 reportable emission events and 65 recordable emission events, for a total of 83 emission events. Id. at 4-23 – 4-27.

327. Fluid Catalytic Cracking Unit 3 had 31 reportable emission events and 85 recordable emission events, for a total of 116 emission events. Id. at 4-27 – 4-34.

f. The Gofiner Unit.

328. The Gofiner Unit had 10 reportable emission events and 27 recordable emission events, for a total of 37 emission events. PX 433, pp. 4-35 – 4-37.

g. The Hydrocracker.

329. The Hydrocracker had 27 reportable emission events and 54 recordable emission events, for a total of 81 emission events. PX 433, pp. 4-38 – 4-42.

h. Oil Movements Unit.

330. The Oil Movements Unit had 12 reportable emission events and 233 recordable emission events, for a total of 245 emission events. PX 433, pp. 4-43 – 4-54.

i. Sulfur Conversion Unit 2

331. Sulfur Conversion Unit 2 had 17 reportable emission events and 103 recordable emission events, for a total of 120 emission events. PX 433, pp. 4-55 – 4-61.

2. Olefins Plant Units.

332. The sharply increasing number of recordable emission events at the Olefins Plant since 2010, and the descriptions of those events, indicate, according to Mr. Bowers, that significant deterioration of piping, valves, and other equipment is allowing more leaks. PX 430, Bowers Rev. Op, p. 9.

a. Butadiene Unit.

333. The Butadiene Unit had 12 reportable and 65 recordable emission events, for a total of 77 emission events. PX 434, pp. 5-1 – 5-6.

b. Cold Ends Unit.

334. The Cold Ends Unit had 33 reportable and 193 recordable emission events, for a total of 226 emission events. PX 434, pp. 5-7 – 5-22. Plaintiffs' expert Mr. Bowers provided root cause analyses of selected events showing that such events were preventable: the vibration-induced metal fatigue that

Exxon identified as the cause of STEERS number 182864, for example, should have been caught using "low-tech maintenance" (banging the bleeder valve in question with a hammer to detect excessive vibration) during the very recent prior turnaround at the unit. PX 430, pp. 8-9; Tr. 4-113:23 – 4-114:21 [Bowers].

c. Hot Ends Unit.

335. The Hot Ends Unit had 4 reportable and 383 recordable emission events, for a total of 387 emission events. PX 434, pp. 5-23 – 5-46.

d. Utilities Unit.

336. The Utilities Unit had 2 reportable and 182 recordable emission events, for a total of 184 emission events. PX 434, pp. 5-47 – 5-58.

3. Chemical Plant Units.

a. Butene Processing Unit.

337. The Butene Processing Unit had 1 reportable emission event and 25 recordable emission events, for a total of 26 emission events. PX 435, pp. 6-1 – 6-2.

b. Butyl Unit.

338. The Butyl Unit had 9 reportable emission events and 187 recordable emission events, for a total of 196 emission events. PX 435, pp. 6-3 – 6-14.

c. Naphtha Unit.

339. The Naphtha Unit had 1 reportable emission event and 32 recordable emission events, for a total of 33 emission events. PX 435, pp. 6-15 – 6-16.

d. Polypropylene Unit.

340. The Polypropylene Unit had 13 reportable emission events and 287 recordable emission events, for a total of 300 emission events. PX 435, pp. 6-17 – 6-34.

341. "Common Train Line 5, 6, 7" had 25 recordable emission events. PX 435, pp. 6-19 – 6-20.

342. Line 4 had 1 reportable emission event and 68 recordable emission events, for a total of 69 emission events. PX 435, pp. 6-20 – 6-24.

343. Line 5 had 1 reportable emission event and 31 recordable emission events, for a total of 32 emission events. PX 435, pp. 6-24 – 6-26.

344. Line 6 had 1 reportable emission event and 51 recordable emission events, for a total of 52 emission events. PX 435, pp. 6-26 – 6-29.

345. Line 7 had one reportable emission event and 43 recordable emission events, for a total of 44 emission events. PX 435, pp. 6-29 – 6-31.

346. Line 8 had six reportable emission events and 42 recordable emission events, for a total of 48 emission events. PX 435, pp. 6-31 – 6-34.

347. It appears that past problems with Line 8 of the Polypropylene Unit, which alone has accounted for 48 emission events, were finally corrected: there has only been one emission event there since April 2011. Plaintiffs' expert Mr. Bowers believes this demonstrates how a focus on recurrent types and locations of emission events can point the way to prevention. PX 430, Bowers Rev. Op., p. 10.

e. Propylene Concentration Unit.

348. The Propylene Concentration Unit had 3 reportable emission events and 32 recordable emission events, for a total of 35 emission events. PX 435, pp. 6-35 – 6-37.

f. Syngas Unit.

349. The Syngas Unit had 8 reportable emission events and 89 recordable emission events, for a total of 97 emission events. PX 435, pp. 6-38 – 6-44.

B. A significant number of emission events at the Baytown Complex are caused by certain types of equipment that repeatedly fail.

350. At the Baytown Complex, certain types of equipment break down often and are repeatedly involved in causing unauthorized emissions.

351. During the Claim Period, the following types of equipment were involved in the following numbers of emission events:

1. Compressors.

352. There were 316 emission events involving compressor failures or "trips" (which are automatic shut-downs) at the Baytown Complex. 181 occurred at the Refinery; 46 occurred at the Olefins Plant; 89 occurred at the Chemical Plant. PX 437.

353. Compressor failures and trips are significant because they cause emission events by necessitating pressurized gases to be sent to the flares. Tr. 4-136:6 – 4-138:5 [Bowers].

354. Both parties agree that not all emission events involving compressor failures were attributable to the same root cause. Tr. 4-138:17-22 [Bowers]; 7-201:20 – 7-203:7 [Ranna].

355. Plaintiffs' expert Mr. Bowers concluded that most compressor failures were caused by ancillary systems, such as lube oil systems, seal oil systems, and power supply problems. Tr. 4-138:17 – 4-139:9 [Bowers]. Exxon reliability engineer Mr. Ranna agreed with that assessment. Tr. 8-16:10 – 8-17:8 [Ranna].

356. The failure of ancillary systems for compressors can result from a variety of very specific root causes, including poor maintenance work, faulty maintenance procedures, or equipment failures. Tr. 7-201:20 – 7-203:7 [Ranna].

357. Nonetheless, Exxon tracks overall compressor reliability across the Baytown Complex. Tr. 6-182:6 – 6-183:13, 6-184:3-10, 8-31:14 – 8-33:5 [Ranna]. And similarly, Mr. Bowers testified that by examining the specific root causes of compressor-related emission events as a group, he was able to determine that Exxon is not performing frequent enough preventive maintenance on the systems that are relied on to prevent compressor failures. Tr. 4-139:1-21 [Bowers].

358. Plaintiffs' expert Mr. Bowers provided detailed analyses of specific emission events involving compressor failures that could have been prevented: STEERS number 68234, involving improper refurbishing of a high-horsepower motor (PX 428, pp. 6-7); STEERS number 77038, involving corrosion in piping (PX 428, p. 4); STEERS number 179941, involving operator error and/or malfunctioning process control equipment (PX 430, p. 9); and 22 emission events that occurred at compressor C-904/C-905 alone, many involving leaks in piping, (PX 430, pp. 10-11).

2. Tanks.

359. There were 245 emission events involving tanks at the Baytown Complex. 189 occurred at the Refinery; 17 occurred at the Olefins Plant; 39 occurred at the Chemical Plant. PX 441.

360. Unauthorized emissions from tanks can result from a variety of very specific root causes, including faulty maintenance, equipment failures, and operator errors. *E.g.*, Tr. 11-9:15-21 [Robbins].

3. Instrumentation.

361. There were 138 emission events involving instrument failures at the Baytown Complex. 81 occurred at the Refinery; 26 occurred at the Olefins Plant; 31 occurred at the Chemical Plant. PX 440.

4. Power supply.

362. There were 31 emissions events involving power supply failures at the Baytown Complex. 21 of these occurred at the Refinery; 1 occurred at the Olefins Plant, and 9 occurred at the Chemical Plant. PX 443.

363. Power supply failures leading to emission events can result from a variety of very specific root causes. In one case of operator error, six lightning arrestors at the Olefins Plant were all installed improperly approximately 10 years ago, allowing moisture to penetrate and cause short circuits. Such a short circuit caused at least one of the emission events at issue in this case. Tr. 10-246:3 – 10-247:5 [Robbins].

364. Emission events have also been caused by animals getting into electrical equipment at the Complex. Tr. 10-249:9-21, 10-251:5 – 10-253:3 [Robbins].

5. Mechanical equipment.

365. There were 1,205 emissions events involving mechanical failures at the Baytown Complex. 651 of these occurred at the Refinery; 323 occurred at the Olefins Plant, and 231 occurred at the Chemical Plant. PX 439. More specifically:

366. There were 48 emission events involving electrical failures: 26 at the Refinery, 8 at the Olefins Plant, and 14 at the Chemical Plant. PX 439.

367. There were 125 emission events involving flange failures: 64 at the Refinery, 26 at the Olefins Plant, and 35 at the Chemical Plant. PX 439.

368. There were 171 emission events involving furnace failures: 61 at the Refinery, 104 at the Olefins Plant, and 6 at the Chemical Plant. PX 439.

369. There were 30 emission events involving gasket failures: 15 at the Refinery, 7 at the Olefins Plant, and 8 at the Chemical Plant. PX 439.

370. There were 188 emission events involving pump failures: 118 at the Refinery, 33 at the Olefins Plant, and 37 at the Chemical Plant. PX 439. Plaintiffs' expert Mr. Bowers provided detailed analysis of a specific emission event involving a pump failure that could have been prevented with better design (STEERS number 79486). PX 428, p. 5.

371. There were 120 emission events involving seal failures: 75 at the Refinery, 21 at the Olefins Plant, and 24 at the Chemical Plant. PX 439. Plaintiffs' expert Mr. Bowers provided detailed analyses of specific emission

events involving seal failures that could have been prevented with proper maintenance and design (STEERS numbers 92944 and 113195). PX 428, pp. 7, 8-9.

372. There were 512 emission events involving valve failures: 283 at the Refinery, 122 at the Olefins Plant, and 107 at the Chemical Plant. PX 439. Plaintiffs' expert Mr. Bowers provided a detailed analysis of a specific emission event involving a valve failure that could have been prevented with proper maintenance and design (STEERS number 110320). PX 428, p. 8.

6. Plugged lines.

373. There were 27 emissions events involving plugged lines at the Baytown Complex. Tr. 2-227:5 – 2-228:11 [Kovacs]. 17 of these occurred at the Refinery, 6 occurred at the Olefins Plant, and 4 occurred at the Chemical Plant. PX 442.

374. Different types of material can cause plugging of lines and lead to emission events, including coke fines and ammonium salts. Tr. 11-16:6-11 [Robbins].

C. Leaks are a major, continuing problem at the Baytown Complex.

375. During the Claim Period, the Baytown Complex had 1,758 emission events involving leaks. 889 occurred at the Refinery; 519 occurred at the Olefins Plant; 350 occurred at the Chemical Plant. PX 436.

376. At the Baytown Complex, the following types of equipment can leak: pipes and lines, pumps and compressors, seals, pressure relief devices, valves, process drains, screw fittings, liquid relief valves, agitators, heat exchanger heads and tubes, sight glasses, bolted manways and hatches, blind flanges, caps and plugs, and compression fittings. Tr. 4-109:21 – 4-110:20 [Bowers].

377. A leak can lead to an emission event. Tr. 6-188:5-16 [Ranna].

378. Leaks are important from an engineering standpoint because they involve a loss of containment. Tr. 108:17 – 4-109:9 [Bowers].

379. Continuous containment is vital in a refinery or chemical plant from an air pollution standpoint. The Baytown Refinery processes high sulfur ("sour") crude oil. Massive quantities of hydrogen sulfide, a harmful air pollutant, are therefore in piping and vessels all over the Refinery. Containing such material only "most of the time" would understandably be a concern for those who live near the Complex. PX 427, p. 6; PX 430, Bowers Rev. Op, p. 13.

380. Continuous containment is also vital in a refinery or chemical plant from a safety standpoint. A leak of hydrocarbons into the air provides two of the three elements (flammable gas and oxygen) necessary for a fire or explosion. The third element is an ignition source. Tr. 4-109:5-15 [Bowers]; 12-66:5-14 [Buehler].

381. Witnesses and exhibits from both parties acknowledged that leaks of flammable material can lead to a large release of pollutants or an explosion at the Complex. Mr. Bowers discussed the leak at Chevron's Richmond, California, refinery that led to a fire and large release of harmful pollutants. PX 427, p. 6; PX 430, pp. 9-10, and 13. Exxon environmental supervisor Jeffrey Kovacs explained that an Exxon worker sprayed the area around a leaking pipe with water to prevent ignition of hydrocarbon vapors. Tr. 3-141:21 – 3-142:21 [Kovacs]. Exxon's internal review of the hydrocarbon leak involved in STEERS number 159900 identified "Vapor Cloud Explosion" as a "Potential Consequence" of such a pipe leak. DX 20W [at EOMCS00174818]. Defendants' expert Dr. Buehler agreed that one reason leaks should be minimized at the Baytown Complex is to minimize explosion risks. Tr. 12-66:5-14 [Buehler].

382. Leaks can be predicted and prevented through inspections, using observations that include sight, smell, and touch (Tr. 6-188:17-22, 189:8-25 [Ranna]) and even hearing (Tr. 4-113:23 – 4-114:21 [Bowers]).

383. The leaks that caused emission events at the Complex were preventable. Exxon's own descriptions of leak-related recordable emission events at Olefins Plant, for example, indicate significant deterioration of piping, valves, and other equipment. PX 427, pp. 11-14; PX 430, p. 9.

384. Corrosion is a prevalent (although not the only) cause of leaks at the Baytown Complex. Tr. 4-99:14-17, 4-104:22 – 4-105:3, 4-112:10-12, 4-129:11 – 4-130:10 [Bowers].

385. Corrosion can be internal, caused by the material passing through the pipe, or external, caused by water and rusting. Tr. 4-110:21 – 4-111:4 [Bowers]; Tr. 10-239:9 – 10-241:5 (STEERS event caused by internal corrosion), 10:241:24 – 10-243:6 (STEERS event caused by external corrosion) [Robbins]. Although the specific root causes of each type of corrosion differ, Mr. Bowers' opinion is that Exxon is not doing a good enough job at preventing either type of corrosion.

386. Corrosion under insulation on pipes can lead to pipe failure, and Exxon admits it is a risk at all three plants in the Baytown Complex. Tr. 7-196:13-22, 7-197:13-19 [Ranna].

387. Exxon's Reliability Department has found the need to revise inspection and prevention techniques for corrosion under insulation. Tr. 7-197:6 – 7-198:1 [Ranna].

388. Corrosion-related leaks are preventable. The walls of the metal piping at the Baytown Complex range from a quarter-inch to an inch thick. Tr. 8-34:9-22 [Ranna]. Because corrosion is not an instantaneous failure, corrosion can be detected with sufficiently diligent inspection and corrosion-related leaks can be prevented by identifying and taking care of their root

causes. Tr. 4-98:23 – 4-99:8, 4-112:1-9 (corrosion can take years), 4-112:25 – 4-113:21, 4-114:15 – 4-115:3 [Bowers].

389. To detect potential corrosion, pipe thickness can be measured ultrasonically or with x-rays. For insulated pipes, corrosion can be detected by first cutting a hole in the insulation and then performing thickness testing. Tr. 8-7:4-23 [Ranna]; 4-113:10-19 [Bowers].

390. Leaks can also develop over time as a result of vibration or temperature changes. Tr. 4-111:11-25, 4-112:13-15 [Bowers].

391. Leaks caused by vibration or metal fatigue at the Baytown Complex have not developed instantaneously, and have characteristic warning signs that allow them to be prevented. Tr. 4-112:20-24, 4-113:23 – 4-114:14 [Bowers].

392. In addition to the general conclusions described above, Plaintiffs' expert Mr. Bowers provided detailed analyses of numerous emission events involving leaks that were the result of the following preventable root causes:

393. Poor maintenance: repeated instances of corroded piping at Booster Station 4 in STEERS numbers 66872 and 60533. PX 428, p. 3.

394. Faulty repairs: STEERS numbers 137570 and 136676. PX 427, pp. 12-13.

395. Poor maintenance and design: STEERS number 68364 (PX 427, p. 13, and PX 428, pp. 9-11) and 77038 (PX 428, p. 5).

396. Failure to replace hard-to-inspect underground piping: STEERS numbers 85714 and 156946, and 18 recordable emission events involving underground pipe leaks, including a June 2013 event that lasted 58 hours. PX 427, pp. 13-14; PX 430, p. 14 n.2. The Baytown Complex has underground piping. Tr. 4-127:18-20 [Kovacs]. Some of the underground piping at the Complex carries hydrocarbons. Tr. 8-9:1-23 [Ranna]. Because leak detection is easier for above ground pipes than underground pipes, replacing the underground pipes, as other refineries have done, would reduce emission events. Tr. 4-127:18 – 4-128:25 [Bowers]; PX 427, p. 13.

397. Running valves until they fail: STEERS numbers 135717 and 142545. PX 428, p. 3.

398. Failure to detect water penetration and external corrosion: STEERS number 77038. PX 428, p. 5. *See also* PX 430, pp. 14-15 (analysis of causes of five leak-related recordable events).

399. Mr. Bowers also described how the faulty design of heat exchangers at the Olefins Plant leads to excessive emissions when a leak occurs, such as with STEERS number 68364. The inability to isolate leaking components requires Exxon to either run the entire unit while a leak is occurring, or to shut down and then re-start the entire unit – each alternative results in emissions that could be avoided if Exxon chose to implement

available design improvements. Tr. 4-126:3 – 4-127:6, 4-132:21 – 4-133:8 [Bowers].

400. A pipe leak in 2011 that caused STEERS event 159900 was discussed at great length by Exxon environmental supervisor Jeffrey Kovacs. Tr. 3-135:12 – 3-153:19 [Kovacs]. Exxon's root cause analysis of that event determined that it was "unforeseeable" because the corrosion under insulation was the result of the failure of the acrylic coating applied to the pipe, and the pipe had been inspected at a different location from where the leak developed in 2007 and was determined to have 29 years of useful life left. Tr. 3-149:17 – 3-150:19 [Kovacs].

401. Plaintiffs' expert Mr. Bowers testified that Exxon missed the actual root cause of STEERS number 159900. Tr. 4-208:21 – 4-209:19 [Bowers]. The Court agrees. Exxon's internal report regarding the incident shows that the pipe was installed and coated in 1991 (DX 20W [at EOMCS00174823]), and that the coating had "an acceptable life" of 10 years or less (DX 20W [at EOMCS 00174825]). More frequent or more thorough inspection of this pipe, or awareness of the fact that the coating had gone 10 years past its "acceptable life" without re-coating, could have prevented this emission event.

402. The Baytown Complex-wide incidence of leak-related emission events has increased rather than decreased during the eight years covered by this lawsuit, either because more leaks are occurring or because Exxon did not

previously detect and report all leak-related emission events. PX 430, pp. 13-15; PX 436; Tr. 4-106:23 – 4-107:12 [Bowers]. Either explanation reveals a serious problem.

403. The total duration of the 1,758 emission events at the Complex caused by leaks adds up to a greater number of hours (82,983) than the actual number of hours (69,168) that passed from October 14, 2005, through September 3, 2013. This is because more than one leak has been occurring at the same time on many occasions. PX 436, p. 7-2; Tr. 4-107:13 – 4-108:11 [Bowers].

D. Fires are a major, continuing problem at the Baytown Complex.

404. During the Claim Period, there have been a large number of emission events at the Baytown Complex involving a fire breaking out: 353 in total, comprised of 240 at the Refinery, 54 at the Olefins Plant, and 59 at the Chemical Plant. PX 438; Tr. 4-133:11 – 4-134:12 [Bowers].

405. The number of fires per month at the Complex was higher for the year 2012 than for the year 2006. PX 430, p. 11; Tr. 4-134:13-22 [Bowers].

406. Plaintiff Exhibits 620-22 are photographs of an October, 2012, fire at Baytown Complex. PX 620-22; Tr. 11-88:16 – 11-91:21 [Robbins].

407. Fires in a petrochemical complex that contains huge amounts of flammable material pose serious risks, including risk of explosion. PX 430, p. 11; Tr. 4-134:23 – 4-135:8 [Bowers]; 12-66:5-14 [Buehler].

408. Although Exxon claims to "share learnings" about the causes of emission events between facilities, Exxon's environmental specialist, Gary Robbins, testified that he did not consider it his area of responsibility to learn the causes of a fire that broke out in a heat exchanger at Exxon's Beaumont, Texas, refinery in April 2013 and injured 12 workers. The Baytown Complex has also had emission events involving leaking heat exchangers, including a recordable event in 2008 that, like the Beaumont event, involved a flash fire. Tr. 8-51-17 – 8-54:5 [Robbins].

E. Violations that Exxon attributed to weather conditions, including Hurricane Ike, were foreseeable and could have been prevented.

409. Cold weather is predictable and can be planned for in order to prevent emission events. Tr. 4-149:5-17 [Bowers].

410. The Baytown Complex is designed so that it can operate properly during cold weather. Tr. 8-47:3-13 [Robbins].

411. Exxon has a procedure to guard against cold weather. Tr. 12-23:19 – 12-24:8 [Buehler].

412. Yet, Exxon attributed the causes of 21 emission events at the Baytown Complex that occurred during the Claim Period to cold weather. 11

occurred at the Refinery; 3 occurred at the Olefins Plant; 7 occurred at the Chemical Plant. PX 444; Tr. 4-149:18-24 [Bowers].

413. These "cold weather" emission events were actually caused by faulty maintenance and inadequate freeze protection measures, and were preventable. PX 427, pp. 7-8; Tr. 4-149:25 – 4-150:5 [Bowers].

414. Exxon environmental specialist Mr. Robbins described two emission events at the Refinery, under the "[s]ame permit," "[s]ame permit limits" (Tr. 11-21:6), one of which was caused by freeze protections not being in "proper working status" (Tr. 11-18:8 – 11-19:2, STEERS number 117636) and the other was caused by instruments freezing due to formation of hydrates during cold weather (Tr. 11-19:10 – 11-20:14, STEERS number 134069).

415. Hurricanes are also predictable events on the Gulf Coast: we don't know when they will occur, but they will occur. Thus, Plaintiffs were able to negotiate settlements in similar Clean Air Act suits they filed against Shell Oil Company and Chevron Phillips Chemical Company that included hurricane preparedness plans that dramatically minimized pollution releases before and after hurricane events. Tr. 2-28:17-2-29:4 [Metzger].

416. Emissions during the re-start of the Baytown Complex following Hurricane Ike, after the emergency situation had passed, could have been reduced or eliminated through careful planning and sequencing of unit re-starts to prevent emissions to the atmosphere. Tr. 4-152:2-10 [Bowers].

IX. Emission Events And Unauthorized Emissions At The Baytown Complex Can Be Reduced To A Far Greater Extent Than Exxon Has Yet Achieved.

A. The size of the Baytown Complex is not an excuse.

417. Exxon's environmental supervisor admitted that the larger the size of a facility, the greater the number of valves, piping, and other equipment, then the greater the responsibility of the owner to ensure that these components do not leak or fail to comply with all of the facility's permit conditions. Tr. 3-259:25 – 3-261:14 [Kovacs]. The Court agrees that, "independent of size," as Mr. Kovacs put it, Exxon has a responsibility to manage its environmental performance. Tr. 3-257:15-23 [Kovacs].

418. Because of the size and complexity of the Baytown Complex, the Clean Air Act regulations and permit requirements applicable to its operation cover many thousands of pieces of equipment. Tr. 11-66:22 – 11-67:15 [Robbins].

419. Exxon's environmental specialist, Mr. Robbins, testified that he made various calculations showing that Exxon is achieving greater than 99% compliance with these requirements. Tr. 10-221:9 – 10-223:16 [Robbins]. Given the vast number of emission events and pollution releases at the Baytown Complex since 2005, whatever metrics Mr. Robbins used to calculate his compliance figures cannot mask the fact that Exxon's level of compliance is plainly inadequate.

420. Exxon's expert Dr. Buehler suggested that, given the size and complexity of the Baytown Complex, Exxon cannot be expected to do a better job of preventing emission events: "it's impossible for – to look at over 12,000 miles of pipe." Tr. 12-7:12-17, 12-8:6-23 [Buehler].

421. Mr. Bowers examined the same data and, based on his approximately 50 years of experience in the petrochemical and refining industry, arrived at the opposite conclusion: the number and type of emission events at the Baytown Complex, and the size and complexity of the facility, mean that more and better preventive maintenance, more frequent testing or replacement of parts, and more and better inspections are needed.

422. The diligent inspection needed to detect potential leaks and other types of failures at a facility the size of the Baytown Complex – with its one million valves and thousands of miles of piping – obviously requires a larger dedication of personnel than Exxon is currently devoting to the task. Tr. 4-115:15-25, 4-148:10 – 4-149:1, 4-171:21 – 4-173:2 [Bowers].

423. According to Mr. Bowers, nothing about the complexity or age of the Baytown Complex would prevent Exxon from performing sufficient preventive maintenance to prevent emission events, should Exxon choose to devote sufficient resources to that effort. Tr. 4-173:3 – 4-174:12 [Bowers].

B. Recent improvements show that Exxon has not been doing all it could to prevent emission events.

424. According to figures produced by Exxon, the total amount of unauthorized emissions of the so-called "criteria pollutants" – SO_2, NO_x, CO, VOCs, and particulate matter – from emission events at the Baytown Complex in 2006 was nearly 1,800 tons, or nearly 3.6 million pounds. DX 1002. The total amount of unauthorized emissions of criteria pollutants from emission events was over 400 tons in 2007, over 1,000 tons in 2008, over 700 tons in 2009, and was slightly under 200 tons in each of 2012 and 2013. DX 1002. These totals do not include unauthorized emissions of non-criteria pollutants. Tr. 3-242:13-17 [Kovacs].

425. These figures show great variability from year to year: annual emissions in 2008 and 2009 were larger than those in 2007, for example. DX 1002.

426. Exxon also produced figures showing that the annual number of STEERS events at the Complex has dropped since 2005 (DX 1000), although the number of STEERS events at the Olefins Plant has not changed appreciably (PX 431, p. 3-5).

427. The Court is aware of no evidence Exxon presented to demonstrate that Exxon changed its methods of preventing, identifying, or responding to emission events during the time period from 2005 to 2013 so as to explain

these decreases in reportable emission events and unauthorized emissions. In fact, Exxon reliability engineer Thomas Ranna testified that any increases in Exxon's maintenance budget were unrelated to prevention of emission events. Tr. 7-196:9-12, 8-34:23 – 8-35:21 [Ranna].

428. Thus, as an initial matter, this Court cannot conclude that the recent reductions in reportable events and emissions at the Baytown Complex, as measured on an annual basis, are either meaningful (*i.e.*, not just a result of random variation) or irreversible.

429. But even if Exxon has achieved a lasting reduction in the frequency of reportable emission events, and in the annual amounts of pollutants released during emission events, that leaves open the question of why Exxon, which has operated this facility since 1920, waited so long to try to minimize permit violations and unauthorized emissions. Plaintiffs point out that a large proporation of the reductions that Exxon highlights did not occur until after Plaintiffs initiated their CAA enforcement suits regarding emission events at Shell's Deer Park facility (filed in January 2008)[11] and Chevron Phillips' Cedar Bayou facility (filed in August 2009),[12] and the instant case, in

[11] Envt. Texas Citizen Lobby, Inc. v. Shell Oil Company, No. 4:08-cv-00070 (S.D. Tex.), Docket Entry 1 (Jan. 7, 2008).
[12] Envt. Texas Citizen Lobby, Inc. v. Chevron Phillips Chemical Co., LP, No. 4:09-cv-02662 (S.D. Tex.), Docket Entry 1 (Aug. 19, 2009).

which Plaintiffs' initial notice of intent to sue was sent in November 2009. Complaint, ¶ 18, Ex. 1 (Docket Entry 1).

430. In addition, if there has been a systemic, Complex-wide effort that has been successful in reducing emission events, that would contradict one of Exxon's main themes at trial: that emission events are "unavoidable," Tr. 3-114:12-18 [Kovacs], and that "as long as we have humans and as long as we have machines" emission events will necessarily continue. Tr. 3-112:2-8 [Kovacs].

C. <u>Recent improvements have not solved the problem.</u>

431. In any event, Exxon has not reduced the overall frequency with which *all* emission events – both reportable and non-reportable events – occur at the Baytown Complex. In 2006, the first full year that falls within the statute of limitations period, the Baytown Complex had 477 emission events; in 2012, the last full year within the statute of limitations period, the Baytown Complex had 518 emission events. PX 431, p. 3-1 and Fig. 1; Tr. 4-74:20 – 4-75:12 [Bowers].

432. And as previously noted, the annual number of STEERS events at the Olefins Plant has not changed appreciably during the Claim Period. PX 431, p. 3-5.

433. The annual number of recordable emission events at the Baytown Complex as a whole has remained nearly unchanged from 2006 to 2013. PX

430, p. 3, Fig. 1; PX 431, p. 3-5. The number of recordable events at the Chemical Plant decreased after 2010, but the number of recordable events at the Olefins Plant increased dramatically, while recordable emission events at the Refinery have continued to occur at roughly the same frequency. PX 430, pp. 4-6, Figs. 2-4; PX 431, p. 3-5; Tr. 4-75:15 – 4-77:3 [Bowers].

434. The annual amount of unauthorized emissions of pollutants during emission events remains extremely high: Exxon released 193.6 tons, or nearly 400,000 pounds, of criteria pollutants (DX 1004, p. 6) and at least another 9 tons, or 18,000 pounds, of non-criteria pollutants (DX 1008) during emission events in 2012, and approximately 150 tons, or 300,000 pounds, during emission events in 2013 (Tr. 3-242:6-12 [Kovacs]). All of these emissions violate hourly emission limits.

435. Defendants' engineering expert, Mr. Buehler, was not able to say whether the annual tonnage of unauthorized emissions, at any point during the statute of limitations period of this case, represented good performance or bad performance by the Baytown Complex. Tr. 12-37:10 – 12-38:25 [Buehler].

436. Although Exxon witnesses testified that emission events cannot be completely eliminated, Exxon did not present any evidence to substantiate the proposition that further significant reductions in either the frequency of emission events or in the amount of unauthorized emissions is impossible. In fact, Exxon witnesses testified that improvement in environmental

performance, and reduction of emission events, *are* possible at the Baytown Complex. Tr. 3-115:3-13; 3-236:14 – 3-237:4; 3-264:7-13; 3-271:25 – 3-274:20 [Kovacs].

D. Comparable facilities have achieved greater reductions in unauthorized emissions.

437. Exxon compared its performance with respect to emission events to the performance of Shell Oil Company's and Shell Chemical Company's ("Shell") Deer Park facility (which consists of a refinery and a chemical plant) and to the performance of Chevron Philips Chemical Company's ("CP Chem") Cedar Bayou facility (which is a chemical plant). Tr. 3-226:10 *ff.*; DX 1006.

438. Those comparisons suggest that Exxon has not achieved comparable success to those companies in reducing unauthorized emissions, and that there is additional room for improvement at the Baytown Complex.

439. Each of those facilities, Shell Deer Park and CP Chem Cedar Bayou, was the subject of a previous Clean Air Act enforcement action initiated by Environment Texas and Sierra Club, and each case resulted in a consent decree filed in the U.S. District Court for the Southern District of Texas. PX 568 (Shell) and 569 (CP Chem).

440. Each consent decree required the defendants, Shell and CP Chem, to pay penalties for past violations, to implement a number of corrective actions at their facilities, and to ratchet down the annual amounts unauthorized

emissions resulting from emission events in the years immediately following the entry of each consent decree. PX 568 and 569; Tr. 1-238:15 – 1-239:3 [Metzger].

441. As a result of the consent decrees, Shell and CP Chem each reduced the annual amount of their unauthorized emissions by 95% within three years, as compared to the five-year average of unauthorized emissions from each facility prior to the filing of each lawsuit. Tr. 1-239:12 – 1-240:13 [Metzger].

442. Within two years after entry of its consent decree (PX 569), CP Chem had reduced its annual emissions from emission events at the Cedar Bayou facility to near zero (DX 1006, p. 4, years 2012 and 2013).

443. The percentage reductions in Baytown Complex emissions that Exxon calculated were based on comparisons to single "worst year," or worst three-year period, selected by Exxon, rather than to an established five-year average performance level. DX 1001, 1002.

444. Exxon's total annual emissions from emission events at the Baytown Complex have been greater than the emissions from Shell Deer Park in every year except 2007 and 2013, and greater than the emissions from CP Chem Cedar Bayou every year from 2005 through 2013. DX 1006, p. 4.

445. In 2012, the third full calendar year after entry of its consent decree, Shell's total annual emissions from emission events at the Deer Park

facility amounted to just 19 tons (PX 619, p. 6), or less than one-tenth the amount of Exxon's 2012 emissions of 193 tons. Exxon relied on faulty data at trial to prove that its performance was comparable to Shell's (DX 1006, pp. 4-5); Shell's corrected 2012 emissions data was submitted to TCEQ during the trial of this case (PX 619, p. 1).

446. Despite learning that Shell had submitted corrected emission data to TCEQ, Exxon's corporate representative at trial, Mr. Robbins, took no steps to investigate or correct the data Exxon used in its exhibits comparing Baytown Complex performance to that of Shell Deer Park. Tr. 11-85:25 – 11-86:14 [Robbins].

447. Most of Shell Deer Park's 2013 emissions were from a single, extremely large event that occurred after the expiration of Shell's consent decree. Tr. 1-241:2-11 [Metzger]; 3-234:3-13 [Kovacs].

448. Even after adjusting for plant size, Exxon's total annual emissions from emission events – on a barrel-per-barrel of oil basis, and pound-for-pound of chemicals basis – have been greater than the emissions from Shell Deer Park in six of the nine years from 2005 through 2013. DX 1006, p. 5, as revised by PX 619, p. 6.

449. In terms of the number of reportable emission events, Exxon had a greater number of reportable emission events than Shell Deer Park in six of the

nine years from 2005 through 2013, and a greater number than CP Chem Cedar Bayou every year from 2005 through 2013. DX 1006, p. 1.

450. Even after adjusting for plant size, Exxon had approximately the same number of reportable emission events in 2013 as Shell Deer Park. Tr. 3-229:13 – 3-230:10 [Kovacs]; DX 1006, p. 2.

451. In addition, Plaintiffs presented uncontroverted evidence that Exxon's emissions from flares during emission events may be significantly undercounted. *See* Section X.D, below. Conversely, one provision of the Shell consent decree required Shell to document that its flare emission estimates are accurate. Tr. 2-100:17 – 2-101:9 [Metzger]. There is thus evidence that Exxon's emission event emissions are in reality even greater, compared to Shell's recent emission totals, than the numbers above suggest. Tr. 3-242:18-25 [Kovacs] (Exxon's emission totals include emissions from flares).

E. Exxon's preventive maintenance at the Baytown Complex is inadequate to prevent emission events and can be improved.

452. Inadequate preventive maintenance is a facility-wide, common cause underlying the vast majority of emission events at the Baytown Complex. Tr. 4-162:17 – 4-163:1 [Bowers].

453. As noted earlier, Exxon employs both "predictive maintenance" and "preventive maintenance" at the Baytown Complex. Tr. 6-176:19 – 6-177:6, 8-13:6-10 [Ranna].

454. Predictive maintenance does not actually eliminate failures. Tr. 6-176:19 – 6-177:6 [Ranna].

455. The vast majority of maintenance at the Baytown Complex consists of predictive maintenance. Tr. 6-177:125 – 6-178:5 [Ranna].

456. Exxon employs predictive maintenance to run equipment for as long as possible before taking it out of service for maintenance and repairs, which is known as a "turnaround." Tr. 4-100:5 – 4-101:18 [Bowers]. This practice saves money but contributes to the occurrence of emission events at the Baytown Complex, because failures happen while equipment is in active service. Tr. 4-102:6-19 [Bowers].

457. There is evidence that the long time that Exxon runs its units between turnarounds contributes to the occurrence of emission events, particularly at the Olefins Plant. Tr. 4-124:15 – 4-126:2 [Bowers].

458. Necessary *preventive* maintenance, on the other hand, is being neglected or under-prioritized on a consistent, Complex-wide basis. PX 427, p. 2; Tr. 4-117:10 – 4-118:8 [Bowers].

459. The sheer number and frequency of leaks, fires, spills, trips, mechanical breakdowns, plugged lines, electrical problems, instrumentation

failures, and the like show that the common underlying cause of these emission events is that fundamental and routine preventive maintenance is grossly sub-par at the Baytown Complex. PX 427, pp. 9-10; Tr. 4-119:13-22 (if Exxon had been doing enough inspections it would not have had so many leaks) [Bowers].

460. There is also visible evidence of poor maintenance at the Complex. PX 427, pp. 10-11, 15-16. The evidence of poor maintenance observed by Mr. Bowers went far beyond the mere appearance of rust; it included the absence of heat-sensitive paint on reactor surfaces, missing anti-freeze protection on flare knockout drums, visible evidence of water penetration on pipes, and innumerable cracks in the Flexicoker's waste heat boiler. Tr. 4-119:23 – 4-122:4, 4-157:7 – 4-158:5 [Bowers]; 10-73:15-21 [Robbins]; PX 427, pp. 15-16; PX 445, at EOMCS 56364-65).

461. There is also visible evidence that Exxon's ultrasonic inspection of pipes for corrosion is not being performed in the right places, that is, at the locations where corrosion is most likely to occur. Tr. 4-122:5 – 4-124:14 [Bowers]; PX 445 [at EOMCS00056372-73].

462. The mere fact that Exxon follows American Petroleum Institute recommendations for inspection of piping and other equipment does not establish that Exxon did all it could to prevent an emission event. API recommendations do not have the force of a regulatory standard and are considered by industry as a starting point only; in fact, it is common practice

for companies to augment the API recommendations with their own more specific and more comprehensive guidelines and practices. Tr. 4-253:3 – 4-254:12 [Bowers]; 7-225:3-14, 7-239:13-23 (API provides "minimum practices") [Ranna]; 12-16:5-9 [Buehler].

463. Exxon performed a seemingly large number of pipe thickness measurements in 2011. Tr. 12-21:1-7 [Buehler]. But these measurements were not sufficient to reduce the number of leak-related emission events, which have in fact been increasing. PX 430, pp. 13-15; PX 436; Tr. 4-106:23 – 4-107:12 [Bowers].

464. Mr. Robbins testified that a particular failure of a specific electrical component "was not repeatable to this particular transmitter, nor could it have been predicted." Tr. 11-23:19-21 [Robbins]. Regarding another emission event, he testified that corrosion under insulation at a specific place on a specific pipe "was not reasonably predictable." Tr. 11-24:4-8 [Robbins]. Similarly, Dr. Buehler testified that "it's virtually impossible to tell in advance where failures are going to occur, particularly in piping." Tr. 12-8:11-18 [Buehler].

465. Given the vast number of emission events at the Baytown Complex since 2005, the fact that the specific time and location of a failure cannot be predicted is not a defense but rather evidence that more attention needs to be paid to preventive maintenance.

1. Exxon's shortfall in maintenance spending at the Baytown Complex has been approximately $90 million per year.

466. Plaintiffs' expert Keith Bowers testified to the shortfall on maintenance spending at the Baytown Complex.

467. Before learning Exxon's actual level of spending on maintenance for the Baytown Complex, Mr. Bowers used commonly accepted principles of process economics and his engineering judgment regarding the age and complexity of the Baytown Complex to derive a rough estimate of the "typical" maintenance and repair costs that would likely be budgeted for a facility such as this one. Mr. Bowers concluded that Exxon's maintenance budget was likely to be approximately 3% of the replacement value of the Complex. Mr. Bowers then estimated that the replacement value of the Baytown Complex is at least $18 billion, meaning that Exxon likely spends at least $540 million per year (3% of $18 billion) on maintenance-related labor and equipment. PX 427, pp. 17-18; PX 430, p. 16.

468. The refinery, chemical plant, and olefins plant each establish an annual budget for maintenance. PX 451 [EOMCS 232200]. The actual average amount the Complex spent on maintenance at the Complex from 2005 through 2012, based on Exxon's own records, is very close to Mr. Bowers' estimate: $569.75 million per year. PX 430, p. 16; PX 451 [EOMCS 232200].

469. The size of Exxon's current maintenance budget is relevant because it provides a yardstick, or baseline, when evaluating the magnitude of additional resources – for maintenance activities, operational improvements, and equipment upgrades – that will be needed to address the problem of emission events at a facility of this size. PX 427, p. 18.

470. In attempting to quantify the shortfall in Exxon's actual maintenance and operation spending compared to the amount that would be needed to greatly reduce the occurrence of emission events at the Baytown Complex, Mr. Bowers did not attempt an event-by-event assessment of the cost of preventing each one of Exxon's approximately 4,000 emission events. Rather, he used the global approach that he successfully used to esimate the likely level of Exxon's current maintenance budget. This is the methodology Mr. Bowers has utilized in his professional work to calculate and budget an existing or proposed facility's operation and maintenance costs for his clients. Tr. 4-177:2 – 4-180:17, 4-182:14-25 [Bowers]. The validity of Mr. Bowers' approach and methodology is supported by the fact that his global estimate of Exxon's current level of maintenance spending was very close to Exxon's actual maintenance budgets. Tr. 4-180:18 – 4-181:14 [Bowers]; PX 430, p. 16; PX 451. I find Mr. Bowers' methodology for estimating the shortfall in Exxon's annual maintenance spending to be reliable.

471. Using generally accepted process economics principles for estimating maintenance costs, and factoring in the size, age, and complexity of the Baytown Complex and the number and nature of emission events there, Mr. Bowers calculated that the shortfall in needed operation and maintenance upgrades is equivalent to approximately one-half of one percent of the facility replacement value (0.5% of $18 billion), or $90 million annually. This shortfall extends back to at least 2005. PX 427, p. 18; PX 430, p. 16.

2. Additional spending on operations and maintenance at the Baytown Complex can be put to good use.

472. In his testimony, Mr. Bowers described the ways in which $90 million in additional annual spending on operation and maintenance would enable Exxon to reduce emission events. He testified that this increase would enable Exxon to hire as many as 900 additional workers to perform inspections and other preventive maintenance, which is the number of additional employees he believes are needed. Tr. 4-116:1 – 4-117:4, 4-181:15 – 4-182:13 [Bowers].

473. Mr. Bowers also reviewed Exxon's annual spending on capital improvements as part of its maintenance budgets, and concluded that Exxon's spending in this area is grossly inadequate to keep the Baytown Complex in good working order. Tr. 4-183:11 – 4-185:10, 4-247:11-16 [Bowers]; PX 614.

474. Ameliorating this shortfall in spending on equipment upgrades was also factored into Mr. Bowers' estimate of a $90 million shortfall in annual operation and maintenance spending. Tr. 4-181:15 – 4-182:13 [Bowers].

475. Exxon's senior reliability engineer, Mr. Ranna, confirmed that the portion of Exxon's capital maintenance budget criticized by Mr. Bowers was precisely that part devoted to "maintain[ing] our existing capability." Tr. 7-231:3-15 [Ranna].

476. The evidence presented at trial shows that Exxon has not addressed this shortfall in operation and maintenance spending. Exxon's capital expenditures on new product lines or other areas of "expanding" the Baytown Complex are not relevant to Mr. Bowers' critique. Tr. 7-233:2-7 [Ranna]. And the increase in the size of the maintenance budget for the Baytown Complex in 2013, to $685 million, had nothing to do with prevention of emission events or with this litigation. Tr. 7-196:9-12, 8-34:23 – 8-35:21 [Ranna]; DX 413. Mr. Ranna testified that any changes in the size of Exxon's maintenance budget over the years has been due only to the changing cost of labor and materials. Tr. 7-233:20 – 7-236:21 [Ranna].

F. Exxon's operator training at the Baytown Complex is inadequate to prevent emission events and can be improved.

477. Maintenance work at the Baytown Complex is performed both by Exxon employees and by outside contractors. Tr. 7-213:7-9 [Ranna].

478. Pipe thickness inspections, to detect corrosion, are performed primarily by third-party contractors. Tr. 8-33:6-13 [Ranna].

479. The Plaintiffs presented evidence that Exxon's employees or contractors are not performing ultrasonic inspections of pipes for corrosion in the right places, in the locations where corrosion is most likely to occur. Tr. 4-122:5 – 4-124:14 [Bowers]; PX 445 [at EOMCS00056372-73].

480. The Plaintiffs also presented evidence that effective techniques exist to efficiently inspect extensive amounts of piping and other equipment for susceptibility to leaks. For example, banging a pipe or a metal connection with a hammer to judge how clear the resulting ring is can provide advantages over more "high-tech" inspection techniques such as ultrasonic thickness tests, which only assess the precise spot being tested. Tr. 4-113:23 – 4-114:21 [Bowers].

481. Operator simulators, which are computer-run equipment similar to flight simulators for pilots, can prevent emission events by reducing operator errors. Simulators can provide olefins plant operators with a simulated control panel, allowing them to practice responding to both normal operating scenarios and scenarios in which things go wrong. Tr. 4-144:9 – 4-145:15-25 [Bowers].

482. Although simulator technology has been available and in use for 20 years, Exxon did not obtain a simulator device to train operators at the

Olefins Plant until after installation of such a device was required by a 2012 agreed order Exxon negotiated with TCEQ. Tr. 4-146:9 – 4-147:14 [Bowers].

G. Improved operations and maintenance at the Baytown Complex would reduce the occurrence of emission events.

483. Despite all the testimony of Exxon personnel regarding the number of employees working on engineering and maintenance (*e.g.*, Tr. 7-206:11 – 7-209:25, 7-210:4-24, 8-12:7-12 [Ranna]) and the systems Exxon has in place to track problems and improve operations (*e.g.*, Tr. 7-219:25 – 7-221:17, 8-18:9-16 [Ranna]) and the frequency with which inspections are made (*e.g.*, Tr. 7-248:25 – 7-249:6, 8-7:24 – 8-8:4 [Ranna]), the proof is in the pudding: the Baytown Complex has averaged more than one emission event per day for eight full years.

484. Although every refinery has emission events, emission events are preventable. Exxon can do more to prevent emission events than it has, and can get closer to a no-emission event status than it currently is. Tr. 4-174:13 – 175:13 [Bowers].

485. Exxon's own reports describing the causes of its emission events show that Exxon's current maintenance program and other systems have not been adequate to prevent emission events. Tr. 4-175:24 – 4-176:15 [Bowers].

486. Exxon's engineering expert, Dr. Buehler, admitted that had Exxon had better engineering practices it could have prevented numerous emission events that he analyzed. Tr. 12-53:17 – 12-55:5 [Buehler].

487. Mr. Bowers' recommendation for an additional $90 million per year in operation and maintenance spending includes both additional spending on labor and additional spending on equipment. Tr. 4-176:16 – 4-177:1 [Bowers].

488. I find that, given the vast size of the Baytown Complex, Exxon has not devoted sufficient attention to preventing all emission events. If Exxon had more people inspecting more equipment more frequently, it is indisputable that more potential leaks and other potential failures would be caught before they caused an emission event. And if Exxon replaced or upgraded or serviced its piping and valves and pumps and other equipment more frequently, there would be fewer failures of that equipment that cause emission events.

H. Capital upgrades to the Baytown Complex would further reduce unauthorized emissions from emission events.

489. Plaintiffs' expert Keith Bowers identified, and estimated the capital costs of, several capital projects that would reduce unauthorized emissions. PX 427, pp. 18-20.

490. Plaintiffs' expert Dr. Ranajit Sahu explained that, even though human errors and equipment failures may be impossible to eliminate

completely, good plant design can ensure that those "inevitable" errors and failures do *not* cause unauthorized emissions. Tr. 5-191:9 – 5-193:18 [Sahu]. For example, flare gas recovery capacity and other design upgrades can "de-couple" accidents from emissions:

> In the course of human events, there will be errors. But the consequence of the errors in emissions is avoidable. What I'm saying is events are not avoidable perhaps, but their impacts in terms of emissions are avoidable. De-coupling – we're de-coupling two things here. They're not both unavoidable.

Tr. 5-193:13-18 [Sahu].

1. <u>Upgrades to the Refinery's sulfur units.</u>

491. To prevent upsets at the Refinery's sulfur plants from resulting in flaring during the largest types of emission events, Exxon could install an additional sulfur unit to add more capacity to the system, including a Tail Gas Treating Unit. PX 427, p. 19; Tr. 4-187:2-21 [Bowers].

492. An additional sulfur unit would likely cost $100 million or more. PX 427, p. 19; Tr. 11-173:4-7, 11-179:3-8 [Olson] (installation and operating costs would increase the total cost).

493. Exxon itself determined that such an upgrade would reduce unauthorized emissions significantly. By Exxon's own calculations, produced for defense expert Karen Olson (Tr. 11-180:19-23, 11-182:15-16), had the additional sulfur unit recommended by Mr. Bowers been in place from 2005 through 2010, it could have prevented 86,700 pounds, or 44 tons, of sulfur

dioxide and hydrogen sulfide emissions that occurred during STEERS events. PX 607; Tr. 4-187:22 – 4-189:5 [Bowers]; 11-181:12 – 11-182:16 [Olson]. Going forward, additional emission events and unauthorized emissions could be avoided during such a unit's 25-year useful life. Tr. 4-189:6 – 4-190:4 [Bowers].

494. To reduce and prevent emissions of hydrogen sulfide at the Refinery's sulfur plants, Exxon could also install a single additional sour gas flare and interconnecting piping and instrumentation at a cost of approximately $10 million. PX 427, p. 19.

495. Alternatively, when any of the existing sulfur units is not on-line, the Refinery could reduce hydrogen sulfide production to levels that can safely be handled by the presently existing units. PX 427, p. 19.

2. Additional flare gas recovery capacity.

496. Compressors can be used to recover and store waste gases, for later productive use, that would otherwise be combusted in a flare. The availability of compressors for this purpose can reduce the need to use flares during emission events. Tr. 4-140:3-24 [Bowers].

497. Only half of the flares at the Baytown Complex are connected to a flare gas recovery compressor. Tr. 10-54:9-13 [Robbins].

498. Exxon has not provided flare gas recovery compressors for the other half of the Baytown Complex flares because it does not consider that expenditure to be "economic" to Exxon. Tr. 10-54:14 – 10-56:1 [Robbins].

499. Both of Plaintiffs' engineering experts, Mr. Bowers and Dr. Sahu, testified that Exxon can reduce the amount of flaring caused by upset events by installing additional flare gas recovery capacity. PX 427, p. 20; PX 462, pp. 4, 33-34; Tr. 4-141:3-20 [Bowers]; 5-187:4-9 [Sahu].

500. As Dr. Sahu explained, increasing flare gas recovery capacity would reduce the possibility that a human or mechanical error would lead to air emissions. Tr. 5-192:13 – 5-193:9 [Sahu]. Even if human errors are unavoidable, the consequences of those errors – in terms of emissions – *is* avoidable. Tr. 5-193:10-18 [Sahu].

501. At least two Title V deviations were caused when the capacity of a flare gas compressor was exceeded at the Refinery. PX 7A and 599, rows 167 and 436-37; Tr. 11-73:12-25 [Robbins].

502. Again, Exxon itself determined that such an upgrade would reduce unauthorized emissions significantly. Exxon's own internal estimate, prepared for its expert Karen Olson (Tr. 11-189:16 – 11-190:12 [Olson]), is that additional flare gas recovery capacity could possibly have prevented 449.17 tons, or approximately 900,000 pounds, of pollutants from being released during the reportable STEERS emission events that occurred between October

2005 and December 2010 alone. Tr. 5-187:21-22; 5-189:7-12; 5-191:2-5 [Sahu]; PX 605.

503. Given this specific expert analysis regarding prevention of flare emissions during actual emission events, I do not find credible Mr. Robbins' assertion that flare gas recovery capacity is only effective in reducing flare emissions during normal plant operations. Tr. 10-56:13 – 10-57:18 [Robbins].

504. Additional flare gas recovery capacity, in the form of two additional Booster Station 4-type compressor installations and associated equipment, would cost approximately $50 million. PX 427, p. 20; Tr. 4-143:8 – 4-144:7 [Bowers]; 8-16:1-9 [Ranna].

505. Exxon is currently considering adding flare gas recovery capacity at the Baytown Complex. Exxon employee Lisa Chisholm stated in a presentation to the Baytown City Council on October 24, 2013: "We are evaluating projects right now that would add more flare gas recovery to our site. So we really recognize that flaring creates emissions, it definitely can be a nuisance to the public." PX 452A.

3. The concept of "economic reasonableness" is irrelevant to compliance with an already issued permit.

506. Exxon takes the position that the Court should consider how much it would cost to comply with its permit limits, and that if it is not

"economically reasonable" to comply, compliance should not be required. This is a way of putting a dollar value on public health.

507. Mr. Robbins testified that Exxon decided not to install flare gas recovery compressors for all of its flares because such an expenditure would not be "economic" for the company. Tr. 10-54:9 – 10-56:1 [Robbins].

508. Exxon also offered Karen Olson as an expert witness on this issue. Ms. Olson's expertise is in the area of air permitting. Tr. 11-125:8 – 11-126:14, 11-130:2-19 [Olson]. She has no expertise in the area of a facility's compliance with permit requirements. Tr. 11-208:20 – 209:4 [Olson].

509. Ms. Olson testified that the concept of "economic reasonableness" is part of the permitting process, not the enforcement process, and that it was already taken into account by TCEQ when it established the Title V permit limits for the Baytown Complex. Tr. 11-205:5-10 [Olson].

510. This case is about compliance with permit limits once they have been established. Consistent with her testimony, Ms. Olson refused to say that Exxon should not comply with its permits if it thinks it would cost too much. Tr. 11-210:16-20, 11-211:4-6 [Olson]. The Court notes that Ms. Olson testified that she was not providing an opinion on what Exxon should do to prevent emission events. Tr. 11-208:23-25 [Olson]. Similarly, during her deposition, Ms. Olson testified:

> Q: Is economic reasonableness one of those things that's taken into consideration in deciding whether to take steps to prevent emission events from occurring?
> A: I can't speak to that. I don't feel comfortable having an opinion on what companies do to evaluate what they do to prevent emission events.

Tr. 11-205:19-24 [Olson].

511. Exxon offered no evidence to show that the unauthorized emissions that could have been prevented with the additional sulfur unit and the flare gas recovery compressors recommended by Plaintiffs' experts could have been prevented through less expensive means.

I. Additional steps to reduce flaring can be taken.

512. Dr. Sahu testified that because of the inconsistency of flare destruction efficiencies (see Section X.D, below), flares should not be considered primarily as pollution control devices. They are designed to be safety devices. Tr. 5-185:10-19 [Sahu].

513. Dr. Sahu also testified that there are feasible steps that refineries and chemical plants can take to minimize the gases sent to the flares and that, while these steps have been taken at other plants, they have not been taken at the Baytown Complex. Tr. 5-185:20 – 5-186:17 [Sahu]. Even other Exxon facilities, such as the one in Torrance, California, are more successful than Baytown in minimizing flaring. Tr. 5-186:4-17 [Sahu].

514. Dr. Sahu testified that Exxon could reduce the frequency of flaring events by implementing a flare minimization plan, which may involve: capital

expenditures, such as the addition of backup waste gas compressors (at a cost of $10 million for two) or other controls such as thermal oxidizers, to eliminate routine flaring; changes to operating procedures; changes to maintenance procedures, including more frequent maintenance; changes to training procedures; additional staffing; and better planning in order to minimize flaring during scheduled events such as unit turnarounds. PX 462, pp. 33-35.

X. The Amount Of Illegally Emitted Air Contaminants Is Large.

A. Exxon has emitted over 50 different chemicals during violations.

515. Exxon emits over 50 different chemicals into the air from the Baytown Complex during emission events. Complaint, ¶¶ 49-51 (Docket Entry 1) and Answer, ¶¶ 49-51 (Docket Entry 37).

516. The Baytown Refinery has released the following chemicals during reported emission events during the Claim Period: sulfur dioxide; carbon monoxide; nitrogen oxides; benzene; 1,3-butadiene; hexane; toluene ; hydrogen sulfide; propane; ethylene; butane; butene; isobutylene; isobutene; pentanes; isopentane; propylene; ammonia; particulate matter; hydrogen cyanide; ethylbenzene; xylene; total sulfur; cis-2-butene; trans-2-butene; carbon disulfide; carbonyl sulfide; cumene; decane; ethyl-cyclohexane; octane; heptane; methylpentene; methylpentane; dimethylpentene; cispentene; cyclohexene; cylcopentadiene; cyclopentane; cyclopentene; isopentane;

isoprene; petroleum distillate; methyl ethyl ketone; methyl isobutyl ketone; naphthalene; phenol ; orthoxylene; paraxylene; bromotrifluoromethane; and monoethanolamine. Complaint, ¶ 49 (Docket Entry 1); Answer, ¶ 49 (Docket Entry 37).

517. The Baytown Olefins Plant has released the following chemicals during emission events during the Claim Period: carbon monoxide; nitrogen oxides;1,3-butadiene; acetylene; benzene; butane; C5 hydrocarbons; cis-2-butene; ethylene; isobutene; isobutylene; propane; propylene; cyclohexane; cyclopentane; heptane; nonane; octane; toluene; heptene; cumene; ethylbenzene; decane; ethyl cyclohexane; bromotrifluoromethane; xylene; methyl cyclopentane; methylhexane; methylpentane; C6 hydrocarbons; C7/8 hydrocarbons; methylcyclopentadiene; vinylacetylene; dicyclopentadiene; methylcyclopentadiene; naphtha; styrene; dimethylbutane; isoprene; indene; naphthalene; hydrogen sulfide; methylacetylene. Complaint, ¶ 50 (Docket Entry 1); Answer, ¶ 50 (Docket Entry 37).

518. The Baytown Chemical Plant has released the following chemicals during reported emission events during the Claim Period: carbon monoxide; nitrogen oxide; sulfur dioxide; isobutylene; butane; butene; cis-2-butene; ethylene; isobutene; propane; propylene; trans-2-butene; carbonyl sulfide; hydrogen sulfide; hydrogen cyanide; methanol; xylene; hexane; hydrochloric acid; methyl chloride; ammonia; particulate matter (PM_{10}); aldehydes; nitrogen

dioxide; paradiethylbenzene; MTBE; pentenes; toluene; bromotrifluoromethane; and isobutyl alcohol. Complaint, ¶ 51 (Docket Entry 1); Answer, ¶ 51 (Docket Entry 37).

B. Exxon's own records evidence an extremely large amount of illegally emitted air contaminants.

519. According to data filed by Exxon with TCEQ, during the period 2006 through 2012, which is approximately a year less than the full Claim Period, the Baytown Complex emitted 9,404,940 pounds (4,702.47 tons) of criteria pollutants during emission events and startup, shutdown, and maintenance events. Tr. 2-129:12- 2-131:1 [Carman]; PX 609; PX 347-353, 356-362, 355-371.

520. During the Claim Period, the Baytown Complex has had:

- at least 10 emission events in which more than 100,000 lbs. of carbon monoxide was released in each event, with the largest single release totaling more than half a million pounds (PX 430, p. 16-1; PX 447, p. 16-1);
- at least 10 emission events in which more than 6,000 lbs. of nitrogen oxides were released in each event, with the largest single release totaling over 20,000 lbs. (PX 430, pp. 16-2 – 16-3; PX 447, pp. 16-2 – 16-3);

- 9 emission events in which more than 50,000 lbs. of sulfur dioxide was released in each event, with the largest single release totaling nearly 500,000 lbs. (PX 430, pp. 16-4 – 16-5; PX 447, pp. 16-4 – 16-5);
- at least 10 emission events in which more than 40,000 lbs. of volatile organic compounds (VOCs) were released in each event, with the largest single release totaling over 160,000 lbs. (PX 430, pp. 16-10 – 16-11; PX 447, pp. 16-10 – 16-11);
- at least 10 emission events in which more than 15,000 lbs. of highly reactive volatile organic compounds (HRVOCs) were released in each event, with the largest single release totaling over 125,000 lbs. (PX 430, pp. 16-12 – 16-13; PX 447, pp. 16-12 – 16-13);
- at least 10 emission events in which more than 800 lbs. of 1,3-butadiene was released in each event, with the largest single release totaling nearly 20,000 lbs. (PX 430, p. 16-15; PX 447, p. 16-15);
- at least 10 emission events in which more than 900 lbs. of benzene was released in each event, with the largest single release totaling over 5,700 lbs. (PX 430, p. 16-14; PX 447, p. 16-14);

- at least 5 emission events in which at least 275 lbs. of carbonyl sulfide was released in each event, with the largest single release totaling over 1,800 lbs. (PX 430, p. 16-9; PX 447, p. 16-9);
- at least 5 emission events in which at least 175 lbs. of hydrogen cyanide was released in each event, with the largest single release totaling 900 lbs. (PX 430, p. 16-9; PX 447, p. 16-9);
- at least 10 emission events in which more than 1,200 lbs. of hydrogen sulfide was released in each event, with the largest single release totaling over 3,500 lbs. (PX 430, pp. 16-6 – 16-7; PX 447, pp. 16-6 – 16-7);
- at least 5 emission events in which more than 1,000 lbs. of hydrogen chloride (or hydrochloric acid) was released in each event, with the largest single release totaling over 130,000 lbs. (PX 430, p. 16-8; PX 447, p. 16-8);
- at least 5 emission events in which more than 400 lbs. of ethyl benzene was released in each event, with the largest single release totaling over 12,000 lbs. (PX 430, p. 16-18; PX 447, p. 16-18);
- at least 5 emission events in which at least 795 lbs. of toluene was released in each event, with the largest single release totaling over 7,000 lbs. (PX 430, p. 16-18; PX 447, p. 16-18).

521. Since the beginning of 2012, large single releases during emission events include: over 21,000 lbs. of HRVOCs, over 1,800 lbs. of benzene, over 800 lbs. of 1,3-butadiene, over 1,800 lbs. of hydrogen sulfide, and over 20,000 lbs. of hydrogen chloride. PX 430, pp. 16-6 – 16-7; PX 447, pp. 16-13, 16-14, 16-15, 16-6, 16-8.

C. Emissions from leaks are understated.

522. Because it is Exxon's general practice to calculate the duration of an emission event involving a leak as the time between discovery of the leak and the time the leak is fixed (Tr. 8-46:13-16 [Robbins]), emissions occurring before the leak is discovered are not counted.

D. Emissions from flares are understated.

523. Exxon estimates, but does not directly measure, the amount of pollutants released during emission events that involve flaring at the Baytown Complex. Those amounts are included in STEERS Reports or reflected in Recordable Emission Event lists. PX 462, p. 12. Plaintiffs agree this is in accordance with EPA and TCEQ regulations governing reporting of flare emissions.

524. However, the EPA- and TCEQ-sanctioned reporting method understates the actual amounts of pollutants that are released from flares during emission events at the Baytown Complex. PX 462, pp. 3-4, 13, 15, 18-23, 25.

525. Plaintiffs argue that in order to assess the true seriousness and public impact of an illegal emission event that involves flaring, the Court should consider the actual amount of pollutants released during the event, not the understated amounted reported to TCEQ. Plaintiffs' expert Dr. Ranajit Sahu testified on this subject.

1. Dr. Ranajit Sahu is qualified to provide expert testimony on the underreporting of flare emissions.

526. Dr. Sahu, an independent consultant who is an environmental engineer, testified that Exxon's reports to TCEQ understate the types and amounts of pollutants emitted from the Complex's flares. Dr. Sahu explained that even though Exxon uses an EPA and TCEQ-prescribed reporting method, this reporting method does not reflect real-world emissions.

527. Exxon did not challenge Dr. Sahu's qualifications, and did not file a Daubert motion challenging Dr. Sahu's testimony, and the Court finds it admissible.

528. In 1988 Dr. Sahu received a PhD in Mechanical Engineering with a specialization in combustion from the California Institute of Technology. Tr. 5-92:24-5-93:1 and 5-93:7-8 [Sahu]; PX 464, p. 14 (Sahu c.v.).

529. Dr. Sahu has extensive work experience with combustion of gases in flares and other devices. In the first years of his career he was a research and design engineer and designed industrial combustion devices (Tr. 5-95:9-

12), including refinery equipment that utilizes combustion for processing (Tr. 5-94:19 - 5:95:3 and 5-95:9-12) [Sahu]. He became an environmental consultant, and has dealt with combustion for hundreds of projects over the last 20+ years. Tr. 5-95:4-8 [Sahu]. He has taught combustion in engineering courses. Tr. 5-95:13-18 [Sahu].

530. Dr. Sahu is an external peer reviewer for U.S. EPA for an EPA report on combustion efficiency of flares. Tr. 5-95:19-24 [Sahu]. Dr. Sahu is familiar with current research regarding flare combustion efficiency. Tr. 5-95:25 - 5:96-4 [Sahu].

531. Dr. Sahu is also familiar with the fate and transport of pollutants from flares, and how that is modeled. Tr. 5-96:15 – 5-97:2 [Sahu]. When he worked at the Parsons engineering firm, Dr. Sahu supervised a group that dealt with stack monitoring and ambient air monitoring. Tr. 5-97:4-10 [Sahu]. Also at Parsons, and as an independent consultant after that, Dr. Sahu used (and supervised others who used) air dispersion models, including the SCREEN3 model used by Exxon's consultants. Tr. 5-98:1-22 [Sahu].

532. Dr. Sahu has provided expert testimony on behalf of the EPA (Tr. 5-99:22-25), industry clients (Tr. 5-99:19-21), and non-profit group clients (Tr. 5-100:1-3) [Sahu].

2. Dr. Sahu's testimony was unrebutted.

533. Exxon offered no expert testimony or other witnesses or evidence to rebut Dr. Sahu's testimony regarding flare destruction efficiency and the underestimation of actual flare emissions.

3. Exxon does not report all air contaminants that are emitted from flares during emission events.

534. When gases are burned in a flare, the chemical constituents of the gas undergo a reaction and are converted into other types of chemical compounds. Flaring is intended to convert the constituents in the gas approaching the flare into less dangerous substances as a result of combustion. Tr. 5-104:20-5-105:6 [Sahu]. This process is sometimes referred to as "destruction." Tr. 5-109:8-25 [Sahu].

535. When burned, or combusted, in a flare, hydrocarbons (*e.g.*, ethylene, propylene, acetylene, butanes, etc.) are converted to carbon dioxide and water vapor. Tr. 5-107:10 - 5-108:9 [Sahu]. When burned in a flare, hydrogen sulfide is converted to sulfur dioxide. Tr. 5-108:20 – 5-109:4 [Sahu].

536. Flares do not completely combust all of the gases that are sent to them, and thus do not destroy (convert) all of the chemical compounds that are sent to them. In fact, it is impossible for flares to achieve 100% combustion of the gases sent to them. Tr. 5-109:8-12 [Sahu].

537. While some portion of the gases sent to a flare is not combusted at all, another portion undergoes partial or incomplete combustion. Incomplete combustion in flares creates new chemical compounds, called "products of incomplete combustion" ("PICs"). 5-111:2 - 5-112:9 [Sahu]. PICs can be toxic or hazardous. 5-112:11-15 [Sahu]; PX 462, pp. 13, 27 [Sahu report]. NO_x and 1,3-butadiene are two examples of products of incomplete combustion that are created in the Baytown Complex's flares and released into the atmosphere. PX 462, pp. 13, 27-28.

538. Exxon does not identify, or estimate the amounts of, all the products of incomplete combustion ("PICs") emitted during a flaring event, and does not include all PICs in STEERS Reports or lists of recordable emission events. PX 462, p. 28.

4. Regulations that dictate how Exxon reports flare emissions are based on assumptions about flare efficiency.

539. When estimating the amount of pollutants released from flares during emission events, Exxon follows EPA regulations 40 C.F.R. §§ 60.18 and 63.11. These regulatory provisions allow Exxon to make certain assumptions about how efficient a flare is in burning waste gases. However, as discussed below, these assumptions do not match what actually happens in Exxon's flares. PX 462, p. 24.

540. The percentage of chemical compounds that are destroyed in a flare – *i.e.*, the percentage of chemical compounds that are fully combusted and converted into other compounds – is called the "destruction efficiency" or "removal efficiency." 5-109:22-25 [Sahu]. For example, if a flare has a destruction efficiency of 95%, 5% of the mass of original chemicals sent to the flare would remain in their original form and be emitted into the atmosphere. Tr. 5-110:6-24 [Sahu]; PX 462, pp. 10, 18.

541. Dr. Sahu gave this example at trial: If 5,000 pounds of ethylene are sent to a flare per hour, and the flare's destruction efficiency is 99%, 50 pounds per hour Of ethylene (1% of 5,000) will be emitted from the flare; the remaining 99% should be emitted as carbon dioxide and water. If the destruction efficiency of the flare dropped to 93%, then 450 pounds of ethylene would be emitted from the flare: a sevenfold increase in pollutant emissions. Tr. 5-113:25 - 5-114:16 [Sahu]. In short, the higher the destruction efficiency, the lower the emission rate of the substance in question. And a seemingly small drop in destruction efficiency can have a large impact on the rate and amount of pollutants emitted from the Complex's flares.

542. EPA and TCEQ regulations allow Exxon to assume a 99% or 98% destruction efficiency if certain conditions are satisfied. Tr. 5-122:5-23; 5-125:9-22. [Sahu]. These conditions include: the flare must be properly designed and operating properly; the "heat content" of the flare gas must be

above a certain threshold (to provide the chemical potential for most of the gas to burn); and the velocity of the gas moving through the flare must be sufficiently slow (to allow a long enough "residence time" in the hot flame region to give most of the gas a chance to burn). Tr. 5-122:5 – 125:8 [Sahu].

543. If these conditions are not met, a destruction efficiency of 93% is to be assumed and used in reporting flare emissions. Tr. 5-134:5-10 [Sahu].

544. If the pilot flame is out, a destruction efficiency of 0% is to be assumed. Tr. 5-123:5-9 [Sahu].

545. There are thus only four possible rates for destruction efficiency that Exxon uses to calculate and report its flare emissions: 99%, 98%, 93%, or 0%. Tr. 5-116 - 5-117:4 [Sahu]; PX 462, pp. 12, 17.

5. The efficiency of Exxon's flares is worse than what the regulations allow Exxon to assume, so more pollutants are actually emitted than reported pursuant to the regulations.

546. While Exxon's practice of estimating and reporting the amount of pollutants released from flares may be in accordance with EPA regulations, that does not mean the amounts Exxon reported are accurate. PX 462, pp. 19, 24-25. As explained by Dr. Sahu, the real-world efficiency of the Complex's flares is worse than what the regulations (40 C.F.R. §§ 60.18 and 63.11) allow Exxon to assume for purposes of reporting flare emissions.

547. First, the open, elevated flare flames that burn the gases flutter or bend when the wind blows; they are not stationary flames. The effect of wind is not taken into account in 40 C.F.R. §§ 60.18 and 63.11. When the flame bends, the gases pass through the flame much more rapidly, and they do not have sufficient "residence time" in the flame area to be burned with 99% or 98% efficiency. Tr. 5-140:5 – 5:141:3; 5-142:21 – 5-143:4 [Sahu].

548. Recent studies have shown that cross-winds can dramatically reduce flare destruction efficiency. A study conducted by the University of Texas at Austin found that destruction efficiency dropped to 72% in a 7 mile per hour cross-wind, and down to 38% in a 22 mph cross-wind. PX 463, pp. 7-9; Tr. 5-159:6 – 5-162:16 [Sahu]. Wind speeds during emission events at the Baytown Complex have exceeded 5 to 7 mph even at ground level, where wind speeds tend to be lower than at the several hundred-foot height of Exxon's flares. PX 462, pp. 21-22.

549. Second, although the regulations set a minimum heat content for the gases going to the flare, not all chemicals burn at the same temperature. Some burn at a higher temperature than the minimum set by regulation, so for those chemicals destruction efficiency is not 99% or 98%. Tr. 5-141:4-12 [Sahu].

550. Third, when Exxon adds steam to the flares (to reduce the smokiness of the flare emissions, promote turbulence to mix the gases, and

cool some of the hardware inside the flare) the temperature of the gas in the flare is lowered. Over-steaming lowers the temperature to such a degree that destruction efficiency is poor. Tr. 5-141:16- 5-142:12 [Sahu]. Excessive injection of steam can quench the flare flame entirely, which results in 0% destruction efficiency. PX 462, p. 23.

551. Dr. Sahu testified that a steam-to-gas ratio of approximately 0.4 parts steam to 1 part flare gas would yield an ideal destruction efficiency. Tr. 5-148:4-19; 5-150:7-10 [Sahu]. This amount of steam is sufficient to promote mixing of flare gases, cooling of flare equipment, and prevention of smoking. Tr. 5-103:14-17 [Sahu].

552. Destruction efficiency of a flare drops dramatically, however, when the ratio of steam to flare gas increases above a certain level – for example, it is less than 70% when the ratio is around 6 or 7 to 1. PX 462, pp. 6, 22-23. However, complete quenching of a flare flame has been shown to occur at ratios as low as 2.37 to 1. PX 463, p. 7; Tr. 5-150:4-20 [Sahu].

553. Dr. Sahu reviewed steam-to-gas ratios for selected emission events involving flares at the Complex, as reflected in Plaintiff Exhibit 473. Tr. 5-150:22 - 5-152:7 [Sahu]. The steam-to-gas ratios varied not just from emission event to emission event, but also during the course of individual emission events. Tr. 5-151:23- 5-152:7 [Sahu]. Dr. Sahu saw very high steam-to-gas ratios that indicate poor destruction efficiency, and thus much higher levels of

emissions than those Exxon reported. Tr. 5-156:7-23 [Sahu]. Steam-to-gas ratios reached more than 100 to 1, which likely quenched the flame. Tr. 5-152:8-12 [Sahu].

554. EPA and TCEQ are currently revisiting the validity of the assumptions underlying 40 C.F.R. §§ 60.18 and 63.11. EPA issued a report in April 2012 summarizing recent studies of actual combustion rates at industrial flares. EPA is in the process of identifying parameters that are better predictors of flare performance than the parameters used in EPA's current regulations, 40 C.F.R. §§ 60.18 and 63.11. PX 463, pp. 3-4; Tr. 5-143:21 - 5:146:22 [Sahu].

555. TCEQ has recently commissioned studies of actual combustion rates at refinery and chemical plant flares, to determine whether or not compliance with the flare operating requirements contained in 40 C.F.R. §§ 60.18 and 63.11 is sufficient to ensure that the high combustion rates assumed by the regulations are achieved in practice. In a February 2012 publication, TCEQ stated that these studies concluded that "operating a flare in compliance with 40 CFR 60.18 does not ensure that the flare will achieve 98 percent" efficiency in destroying air contaminants. PX 463, pp. 5-6. A TCEQ study shows that as the ratio of steam to gas in the flare increases, destruction efficiency decreases. Tr. 5-148:19 - 5-150:20 [Sahu]; PX 463, p. 7.

556. No study of elevated flares has demonstrated that it is possible to consistently maintain the conditions that would be required in order to achieve destruction efficiency at a specified threshold such as 98% or 99%. And numerous recent studies call into question the uniform application of 98% and 99% combustion efficiency in calculating flare emissions. PX 462, pp. 21-23; PX 463, pp. 5-6.

557. In sum, Exxon's consistent use of a 98% or 99% value for destruction efficiency, while legal, is factually incorrect and likely results in significant underestimates of actual emissions during flaring events. Tr. 5-162:18 - 5-163:14 [Sahu].

558. A more accurate default value for destruction efficiency for Baytown Complex flares would be 93%, although this figure would still be far too high for instances when the steam to waste gas ratio was very high, when the flares were smoking, when there were pilot flame outages, and when there were cross-wind velocities of 7 mph or greater. Tr. 5-163:15-18; 5-164:7-20; 5-165:9 – 5-166:7 [Sahu]; PX 462, pp. 25-26.

559. Had Exxon assumed 93% destruction efficiency instead of its consistent assumption of 98% or 99% destruction efficiency, the amount of VOC emissions from flares during emission events would have been 3.5 to 7 times higher than what Exxon actually reported, and the amount of hydrogen

sulfide emissions from flares would have been 3.5 times higher. PX 462, p. 26.

6. Understatement of emissions from petrochemical facilities is a well-known problem.

560. The Texas Air Quality Study ("TexAQS Study") found that emissions of light olefins from petrochemical refining were under-reported by as much as 10 to 100 times. PX 476, p. 25.

561. The TexAQS study revealed underreporting of approximately 200 tons/day in olefin emissions at industrial facilities in the 8-county Houston-Galveston-Brazoria ozone non-attainment area. PX 476, p. 25.

XI. Air Pollutants Emitted From The Baytown Complex Go Beyond The Complex's Fenceline.

562. Air pollutants emitted from the Complex can travel beyond the fenceline of the Complex, and even go significant distances. Tr. 8-198:12-18 [Cabe].

563. Air pollutants emitted from a source are carried in the direction the wind is blowing. Tr. 8-215:8-10 [Cabe].

564. Wind blows from all directions at the Baytown Complex during the course of a year, and can change direction during a single day. Tr. 8-46:19-24; 8-225:14-17 [Cabe]. The wind can change direction hour to hour or even minute to minute. DX 165, Attachment X.

565. Wind speed can vary during the course of a day. DX 165, Attachment Y.

566. When the wind carries pollutants from a point source, a plume of air pollutants is formed. Tr. 8-215:13-16 [Cabe].

567. A plume of pollution from a point source tends to be narrower the closer it is to the emission source and wider the further the plume travels. Tr. 8-215:21-24 [Cabe].

568. Under certain conditions, such as when emissions come from an elevated source such as a flare, the highest ground level concentration of pollutants can occur farther away from the source than the area closest to the emission point. Tr. 8-217:13-17 [Cabe].

XII. The Air Contaminants Exxon Has Illegally Emitted Are Harmful To Human Health.

569. At trial, Plaintiffs proved that the various chemicals emitted by Exxon from the Baytown Complex are known to be harmful to human health.

A. The types of evidence that prove Exxon's illegal emissions are harmful to human health.

570. Plaintiffs presented four types of evidence to prove that the pollutants released during Exxon's emission events are harmful to human health.

1. Government documents.

571. At trial, the parties stipulated to the admissibility of certain government documents relating to the human health effects of various chemicals emitted by Exxon from the Baytown Complex.

2. Expert testimony: Dr. Edward Brooks.

572. Plaintiffs' expert Dr. Edward Brooks, a medical doctor from the University of Texas Health Science Center in San Antonio, testified to the human health effects of the various chemicals emitted by Exxon from the Baytown Complex.

573. The Court finds Dr. Brooks qualifies as an expert to provide this testimony.

574. Dr. Brooks has expertise regarding the mechanisms by which air pollutants can affect human health (Tr. 7-21:24-7-22:1 [Brooks]), the health effects that can result from exposure to various types of air pollutants (Tr. 7-22:2-4 [Brooks]), and the field of toxicology (Tr. 7-20:10-11 [Brooks]).

575. Dr. Brooks has a medical degree from Texas Tech University School of Medicine. Tr. 7-11:7-8 [Brooks]. He graduated medical school in 1985. Tr. 7-11:7-10 [Brooks]. He did post doctoral work at the University of Texas in Galveston and at Harvard University. Tr. 7-16:21 [Brooks]. He is licensed to practice medicine in Texas. Tr. 7-14:6-8 [Brooks].

576. One of the areas Dr. Brooks specializes in is the field of allergy and immunology. Tr. 7-12:13-14 [Brooks]. That field encompasses the effects of environmental toxicants on both immune functioning and the respiratory system. Tr. 7-12:13-19 [Brooks].

577. Dr. Brooks is board certified in allergy and immunology. Tr. 7-13:12-14 [Brooks]. Immunology is the study of the immune system. Tr. 7-11:22-24 [Brooks].

578. Dr. Brooks is a full time employee of the University of Texas Health Science Center in San Antonio. Tr. 7-13:2-6 [Brooks]. His duties are split between teaching, clinical duties, and research. Tr. 7-13:8-11 [Brooks]. He spends approximately 40% of his time providing clinical care to patients; 50% conducting research; and 10% teaching medical students. Tr. 7-14:25-7:15:1-6 [Brooks].

579. Dr. Brooks sees approximately 1,000 patients annually. Tr. 7-16:5-9 [Brooks]. Most are children, though he also sees adults (Tr. 7-12:5-8 [Brooks]) and he testified that in May 2014 he was to start an adult clinic at the university (Tr. 7-16:10-15 [Brooks]). Dr. Brooks was trained in both pediatrics and adult medicine. Tr. 7-12:5-8 [Brooks]. His clinical practice focuses on asthma, respiratory disorders, allergic disease, and immune deficiencies. Tr. 7-15:21-7:16-4 [Brooks]. He was the medical director of a children's asthma program for eleven years. Tr. 7-18:9-20 [Brooks].

580. Dr. Brooks is a full professor of pediatrics at the University of Texas Health Science Center in San Antonio. PX 479, p. 1 (Brooks c.v.); Tr. 7-12:24-7:13:1; 7-14:15-17 [Brooks]. From 1993-2000 he was an assistant professor at the University of Texas Medical Branch in Galveston. PX 479, p. 2. From 2000-2009 he was an associate professor there. PX 479, p. 2. Dr. Brooks has fellows and residents working for him. Tr. 7-19:22-7:20:1 [Brooks].

581. Dr. Brooks has authored peer-reviewed articles on the toxicological effects of air pollutants. PX 479, p. 11, 14 (Brooks c.v.). He is a reviewer for the journal Environmental Epidemiology and Toxicology. PX 479, p. 28. He had an appointment in the Division of Toxicology in the Department of Preventative Medicine. Tr. 7-20:10-13 [Brooks]. For years Dr. Brooks taught a toxicology class at the medical school. Tr. 7-19:15-16 [Brooks]; PX 479, p. 4. He employs toxicological principles in his research. Tr. 7-20:17-19 [Brooks]. Toxicology is relevant to assessing the health impacts of exposures to air pollutants. Tr. 7-20:14-16 [Brooks].

582. Dr. Brooks has performed research relating to the health impacts of exposure to air pollutants, including industrial air pollutants. Tr. 7-20:21 – 7-21:4 [Brooks]. Dr. Brooks has published his research in peer-reviewed journals many times. Tr. 7-21:5-23 [Brooks]; PX 479, pp. 11-18.

583. In preparing his opinion in this case, Dr. Brooks reviewed government reports and findings (Tr. 7-24:1 – 7-25:3; 7-31:6-12 [Brooks]), toxicological and epidemiological information (Tr. 7-32:8-14 [Brooks]), and regulatory and other standards (Tr. 7-37:16-25 – 7-39:17 [Brooks]) to determine the potential effects of pollutants illegally emitted from the Baytown Complex (Tr. 7-23:16-25 [Brooks]). Dr. Brooks uses both toxicological and population-based (epidemiological) studies in his medical practice and in his research. Tr. 7-36:5-10 [Brooks].

584. With that information, Dr. Brooks assessed the likelihood that particular emission events at the Complex created any risk of adverse health effects in the surrounding communities. Tr. 7-25:4-8 [Brooks].

585. Dr. Brooks did not conduct a medical examination of Plaintiffs' standing witnesses. Dr. Carman, the Clean Air Director of the Lone Star Chapter of the Sierra Club and a person who has been involved in dozens of citizen suits for Sierra Club, testified that he was not aware of any citizen suits where medical testimony regarding standing witnesses was presented. Tr. 2-146:12-16; 2-148:5-8 [Carman]. Indeed, as noted above, there are many reported citizen suit decisions where Plaintiffs prevailed without presenting testimony of a doctor who has conducted a medical examination of standing witnesses. E.g., Sierra Club v. TVA, 430 F.3d at 1345; Concerned Citizens v. Murphy Oil, 686 F. Supp. 2d at 671; Chalmette Refining, 354 F. Supp. at 702;

Cmtys. for a Better Envt. v. Cenco Ref. Co., 180 F. Supp. 2d 1062, 1075 (C.D. Cal. 2001); see Laidlaw, 528 U.S. at 181-182.

3. Testimony of Exxon's own personnel and expert witnesses.

586. Exxon's own personnel and expert witnesses testified about the harm caused by the Complex's illegal emissions.

4. Testimony of Plaintiffs' members.

587. Four members of the Plaintiff organization testified about their own experience of adverse impacts from Baytown Complex emissions.

B. Overview of the harm caused by air pollution.

588. Air pollution can cause or contribute to a variety of harmful outcomes, ranging from subtle biochemical and physiological changes, to acute symptoms like headaches, eye and throat irritation, wheezing and coughing, difficulty breathing, and aggravation of existing respiratory and cardiovascular conditions. PX 476, Initial Report of Edward G. Brooks, p. 7.

589. Industrial air pollution contributes to worsening asthma. PX 476, p. 7; Tr. 7-26:11-21 and 7-47:12-15 [Brooks].

590. Studies show an association of worsening chronic obstructive pulmonary disease with higher levels of air pollutants. PX 476, p. 7.

591. Exposure to air pollution is correlated with cardiovascular disease. PX 476, p. 12.

592. Although the most obvious effects of air pollution are typically on the respiratory and cardiovascular systems, many air pollutants can also harm developmental processes and some are toxic to the nervous, reproductive, immune, digestive, urinary and endocrine systems. PX 476, p. 7.

593. Numerous air pollutants emitted by Exxon at the Complex are known or suspected human carcinogens. PX 476, p. 7; PX 542; PX 543, p. 6 [ETSC 018159]; PX 544; PX 546; PX 555, p. 88 [ETSC 082122].

1. Both short-term ("acute") and long-term ("chronic") exposure to air pollution can harm health.

594. An individual person's acute exposures to air pollutants can have long-lasting health impacts. Tr. 7-45:6 – 7-46:5 [Brooks]. Acute exposure can make a person more sensitive to a subsequent exposure. Tr. 7-45:21 – 7-45:5 [Brooks].

595. In the context of emission events, in order to assess the likelihood of an effect from repeat exposures, one would need to look at exposure to emission events as a group rather than one at a time. Tr. 7-47:16-20 [Brooks].

596. Chronic exposure to lower levels of pollutants may not induce the acute symptoms listed above, but can cause more subtle and thus less noticeable symptoms that can nonetheless lead to respiratory disease, cancer, and premature death. PX 476, p. 7.

2. Breathing carcinogens carries a lifetime risk.

597. The risk of getting cancer increases the more carcinogens a person breathes. That risk does not dissipate or lessen over time. Tr. 7-121:9-24; 7-122:21 - 7-123:12; 7-128:16 - 7-130:3; 7-131:4-23 [Brooks].

598. Moreover, there is no safe threshold level below which exposure to carcinogens is benign, because each "hit" by a mutagenic carcinogen carries a finite risk of causing a mutation in a cell's DNA, and once a mutation has occurred it is irreversible. PX 476, p. 21; Tr. 7-123:2-16 [Brooks].

3. Air pollution is particularly bad for vulnerable populations.

599. Estimating safe levels of exposure to air pollutants is imprecise and varies with many factors such as genetics, socioeconomic status, access to healthcare, other health-related habits such as diet and exercise, and pre-existing health conditions. PX 476, p. 9; Tr. 7-30:7-15; 7-89:14-24; 7-140:7-18 [Brooks].

600. Vulnerable populations (the young, the elderly, those with pre-existing illness, the medically disadvantaged, etc.) demonstrate health effects at lower air pollution exposure levels than the overall population. PX 476, p. 9; Tr. 7-89:14-21 [Brooks].

601. Children, the elderly, those with pre-existing illnesses such as cardiovascular disease, lung disease, asthma or chronic obstructive pulmonary

disease, and pregnant women and their fetuses are particularly vulnerable to the adverse effects of air pollution. PX 476, p. 9; Tr. 7-47:12-15 [Brooks].

4. Being exposed to multiple pollutants ("co-pollutants") at once is harmful.

602. In assessing the health impacts of short-term exposures to emission event pollutants, it is relevant to know all of the pollutants that are released during the event, and the types of pollutants that were already in the air at the time of a particular release. Tr. 7-48:6-16 [Brooks].

603. Multiple pollutants present at the same time in the atmosphere are called "co-pollutants." Tr. 7-34 [Brooks].

604. The adverse health effect of a pollutant can be increased when a person breathes other pollutants at the same time. Put another way, breathing co-pollutants can have a "synergistic" effect, in which the overall harmful effect of one's exposure to the pollutants is larger than the effect of the exposure to each pollutant would be individually. Tr. 7-34:14 - 7:35:24 [Brooks].

605. When a person is simultaneously exposed to two or more pollutants, the threshold level of exposure necessary for either pollutant to produce illness is reduced because of the presence of the other pollutant(s). PX 476, p. 20; Tr. 7-35:19-24 [Brooks].

606. For example, in a study of adults with asthma, the influence of prior exposure to ozone amplified subsequent responses to sulfur dioxide. PX 476, p. 20.

607. As another example, concurrent exposures to low levels of SO_2, smoke, and particulates have been associated with symptoms of respiratory effects, increased frequencies of respiratory illness, excess mortality, and worsening of respiratory disease. PX 476, p. 20.

608. As another example, fine particles (particulate matter) present in the air in industrial environments like Baytown may be a vehicle for the delivery of toxic substances to humans, primarily through the inhalation route. PX 476, p. 20.

609. The amounts of particular pollutants that were already in the air at the time of a pollution release are known as "background levels" of those pollutants. Tr. 7-48:11-19 [Brooks].

610. The ambient air in the Houston area routinely contains a large number of hazardous air pollutants, criteria air pollutants, and other air pollutants. Tr. 7-49:24 – 7-50:5; 7-50:19 – 7-52:11; 7-54:20 – 7-55:8. As a result, individual petrochemical facilities in the area add air pollutants to an atmosphere already fairly saturated with background levels of pollutants. Tr. 7-57:6-16.

611. Often, toxicological studies evaluate the harmful effects of a particular pollutant individually, without considering the cumulative or synergistic effects of that pollutant in combination with co-pollutants (other pollutants to which a person is exposed). Accordingly, government standards that are derived from such studies tend to be under-protective of human health. PX 476, p. 20.

612. In heavily industrialized areas like Baytown, the population is exposed to a veritable "soup" of chemical agents in the air, water, and soil. PX 476, p. 20.

5. Living near a refinery increases the risk of getting cancer.

613. Studies show that living near a refinery increases the risk of getting cancer. Tr. 7-131:24 - 7:132:12 [Brooks]; PX 487 [ETSC 074289] and 494 [ETSC 083455].

6. Epidemiological studies are important in evaluating the harm of pollutants.

614. An epidemiological study is a population-based study, in this case, of the impact of air pollutants. PX 476, p. 20. Epidemiological studies of air pollutants involve observations of real people in real-world settings rather than controlled environments, thus taking into account the effects of the many things people are exposed to in addition to the particular pollutant(s) being

studied. Tr. 7-33:20-25; PX 477, pp. 5-6 (Nov. 2013 Supplemental Report of Edward G. Brooks).

615. It is important to consider the findings from epidemiological studies when evaluating the harm of releases from emission events at the Complex. Tr. 7-42:21 - 7-43:12 [Brooks]; PX 477, p. 5.

C. Overview of various government standards set to protect public health and the environment.

616. Government agencies set standards in a variety of ways to protect public health and the environment. However, releases of pollutants from the Complex during an emission event can still cause harm to the public even if the standards are not violated.

1. National Ambient Air Quality Standards.

617. The EPA has defined "criteria pollutants" as carbon monoxide, lead, nitrogen dioxide, ozone, $PM_{2.5}$, PM_{10}, and SO_2. The EPA has set National Ambient Air Quality Standards ("NAAQS") for all criteria pollutants. PX 476, pp. 22-23; PX 496.

618. NAAQS are not set at a zero-risk level. PX 476, pp. 22-23.

619. NAAQS are not intended to be protective in all situations. PX 476, pp. 22-23.

2. Minimal Risk Levels.

620. The Agency for Toxic Substances and Disease Registry (ATSDR) at the U.S. Centers for Disease Control is a federal public health agency of the U.S. Department of Health and Human Services. PX 497.

621. The ATSDR has developed Minimal Risk Levels (MRL) for many toxic substances. PX 476, p. 24; PX 499.

622. The MRL is a screening level. It is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse, non-cancer health effects over a specified duration of exposure. MRLs are categorized as acute (1-14 days), intermediate (15-365 days), and chronic (lifetime) exposures. PX 476, p. 24; PX 499.

623. For carcinogenic substances, such as benzene, 1,3-butadiene, ethylbenzene, toluene, and n-Hexane, the ATSDR set MRLs based on the substances' carcinogenic potential. PX 476, p. 24.

3. Reference concentrations.

624. Through the Integrated Risk Information System (IRIS), the EPA provides reference concentrations (RfC) for chronic exposures to toxic agents. PX 476, p. 24; PX 501-502.

625. The RfC is an estimate of a daily inhalation exposure of the human population that is likely to be without an appreciable risk of deleterious effects. PX 476, p. 24; PX 501-502.

4. Effects screening levels.

626. TCEQ has established effects screening levels (ESLs) for all Hazardous Air Pollutants (HAPs). PX 476, p. 24; PX 503. The TCEQ sets air quality guideline concentrations to protect human health and welfare. PX 476, p. 24.

627. TCEQ sets ESLs at levels below which the agency believes adverse health effects are likely to occur. Tr. 7-38:22 - 7-39:7 [Brooks].

628. ESLs are screening levels used in TCEQ's air permitting process to evaluate the likely impacts of pollutant levels predicted by air dispersion modeling. PX 476, p. 24; PX 503.

629. ESLs are based on health effects, the potential for odors to be a nuisance, and effects on vegetation. PX 476, p. 24; PX 503.

630. Short-term ESLs are levels for a one-hour averaging period. Short-term ESLs are also called "acute" ESLs. PX 476, p. 24; PX 503.

631. Long-term ESLs are levels for an annual averaging period. PX 476, p. 24; PX 503.

632. Because the calculation of ESLs involves using a generic risk factor or safety factor, ESLs for pollutants for which epidemiological data is scarce, such as hydrogen chloride (hydrochloric acid), may underestimate the risk of exposure for vulnerable populations. PX 476, p. 32.

D. The harm that can be caused by the particular pollutants emitted by Exxon.

633. The pollutants emitted without authorization by the Baytown Complex are harmful for the reasons set forth below.

1. Hydrogen sulfide.

634. Hydrogen Sulfide ("H_2S") is a poisonous, colorless gas with a characteristic odor of rotten eggs or fecal matter. PX 476, p. 38; PX 540, p. 1 [ETSC 021564]; Tr. 7-91:1-9 [Brooks]; 9-161:24 – 9-162:1, 9-162:-8 [Fraiser].

635. H_2S gas is flammable. PX 476, p. 38; PX 540, p. 1 [ETSC 021564].

636. H_2S is also known as "sewer gas" and "stink damp" (Tr. 9-163:5-6 [Fraiser]; PX 540, p. 1 [ETSC 021564]), and as "poison gas" (PX 476, p. 38).

637. H_2S is heavier than air. It sinks when released from a height, travels easily along the ground, and builds up in low-lying, confined, and poorly ventilated areas. PX 476, p. 38.

638. When released as a gas, H_2S remains in the atmosphere for an average of 18 hours, and eventually changes into sulfur dioxide and sulfuric acid. PX 540, p. 2 [ETSC 021565].

639. People usually can smell hydrogen sulfide at concentrations in the air lower than one part per billion, ranging from 0.0005 to 0.3 parts per million (ppm). PX 476, p. 38; Tr. 7:91:3-7; PX 540, p. 1 [ETSC 021564].

640. H_2S enters the body primarily through breathing. PX 540, p. 3[ETSC 021566].

641. H_2S is a chemical asphyxiant and mitochondrial poison. Its behavior through inhalation exposure is similar to that of cyanide and carbon monoxide, which prevent the use of oxygen. Tr. 7-89:25 - 7-90:9 [Brooks]; PX 476, p. 38.

642. According to the American Conference of Governmental Industrial Hygienists (ACGHI), hydrogen sulfide is an extremely hazardous gas. PX 476, p. 38.

643. Individuals exposed to high concentrations of H_2S can be rendered unconscious, and can suffer persistent neurological effects including headaches, poor concentration ability and attention span, impaired short-term memory, and impaired motor function. PX 540, p. 10 [ETSC 021573].

644. Individuals exposed to lower concentrations of H_2S can suffer incoordination, poor memory, hallucinations, personality changes and anosmia (loss of sense of smell); the respiratory effects include nasal symptoms, sore throat, cough, and dyspnea. PX 540, p. 10 [ETSC 021564]; Tr. 7-90: 11-14 [Brooks]. Low concentrations of H_2S can also cause fatigue, insomnia, headaches, vomiting, and nausea. Tr. 7-90:14-25 [Brooks].

645. H_2S is a pollutant for which the presence of other pollutants in the air can have synergistic effects. Tr. 7-92:10-14; 7-109:1-23 [Brooks].

646. In 1983, 949 cases of acute illness consisting of headache, dizziness, blurred vision, abdominal pain, myalgia, and fainting were reported in children exposed to H_2S gas at concentrations of 40 ppb. PX 476, p. 39. As discussed below, the HRM 7 air monitor near the Baytown Complex has measured H_2S levels as high as 48 ppb.

647. Neurological abnormalities were found to be associated with average ambient levels of H_2S at 10 ppb, with peaks of 100 ppb, in a neighborhood of exposed residents. This study included the presence of co-pollutants, including dimethyl sulfide at 4 ppb, mercaptans at 2 ppb, ethane at 500 ppb, and propane at 500 ppb, in addition to vanadium, and thiodiglycolic acid, which were detected in the air and soil. PX 476, p. 39; Tr. 7-91:24 - 7-92:9 [Brooks].

648. The North Carolina Scientific Advisory Board reported that symptoms such as headache, nausea, and eye and throat irritation were found in communities with ambient levels of H_2S as low as 7 to 10 ppb. PX 476, p. 39.

649. In an epidemiological study conducted at a large petrochemical complex in Beijing, China, women exposed only to H_2S (but not other petrochemical pollutants) experienced a 2.3-fold increased risk of spontaneous abortion. PX 476, p. 39.

650. EPA scientists have recommended that levels of H_2S be no higher than 15 ppb at residential property lines, and have recommended that the chronic exposure limit for H_2S be set at 0.7 ppb. PX 476, p. 41.

651. In 2003, EPA published information suggesting that children and neonatal animals could be selectively susceptible to neurological effects from chronic H_2S concentrations of 0.44 ppb. Subsequently, EPA staff has recommended that the chronic safe exposure limits be set at 0.14 ppb to protect sensitive people such as children and the elderly. PX 476, p. 39.

652. EPA set a recommended limit for long-term exposure (an "RfC") to H_2S at 1.4 ppb. PX 476, p. 25; Tr. 7-94:12-25.

653. There is no NAAQS or ESL standard for hydrogen sulfide. Tr. 7-92:22 - 7-93:4 [Brooks].

654. TCEQ regulations set an H_2S property line standard for property used for residential, business or commercial purposes at 0.08 ppm, or 80 ppb, and a property line standard for property used for industrial property and vacant tracts and range lands at 0.12 ppm, or 120 ppb. PX 480.

655. Ten states have set an acute H_2S exposure threshold of 30 ppb or lower. PX 480; Tr. 7-93:8 - 7-94:11 [Brooks].

2. Carbon Monoxide.

656. Carbon Monoxide (CO) can cause harmful effects by reducing oxygen to the body's organs (like the heart and brain) and tissues. PX 517, 520.

657. CO stays in the air for about 2 months. PX 518, p. 1 [ETSC 081436].

658. CO in the air rapidly enters all parts of the body, including blood, brain, heart, and muscles when one breathes. It takes a full day to leave the body. PX 518, pp. 2-3 [ETSC 081437-38].

659. CO contributes to the formation of ground level ozone. PX 520.

660. Exposure to CO can cause respiratory irritation and other respiratory health effects. PX 519, 520. Inhaling CO can cause headache, nausea, vomiting, dizziness, blurred vision, confusion, chest pain, weakness, heart failure, difficulty breathing, seizures, and coma. PX 519, p. 2 [ETSC 081548].

661. Breathing CO can be permanently harmful to the heart and brain. PX 519, p. 1 [ETSC 081547].

662. People with ongoing cardiovascular and/or respiratory disease may be particularly vulnerable to CO. PX 518; PX 519, p. 1 [ETSC 081547].

663. Children with asthma may be more vulnerable to respiratory effects associated with CO exposure. PX 518; PX 519.

664. According to the ATSDR, breathing "lower" levels of CO during pregnancy can cause slower than normal mental development of the child. PX 518; PX 519.

665. Breathing high levels of CO during pregnancy can cause miscarriage. PX 518; PX 519.

666. The EPA has set NAAQS for CO. PX 476, p. 23.

667. The primary 1-hour NAAQS for CO is 35 ppm, and the primary 8-hour NAAQS for CO is 9 ppm. PX 476, p. 23.

3. Nitrogen oxides.

668. Nitrogen Oxides (NO_x) are one of the primary gases involved in the formation of ground-level ozone. PX 521, p. 2, [ETSC 081564]; PX 522, [ETSC 083222].

669. NO_x also reacts in the air to form nitrates, acid aerosols, and nitrogen dioxide (NO_2), all of which cause respiratory problems. PX 521, p. 1 [ETSC 081564]; PX 522 [ETSC 083222-23]. NO_x also reacts to form toxic chemicals. PX 522 [ETSC 083222].

670. Low levels of NO_x in the air can irritate eyes, nose, throat, and lungs, possibly causing coughing, shortness of breath, tiredness, and nausea. PX 521, p. 2 [ETSC 081565].

671. Exposure to low levels of NO_x can result in fluid buildup in the lungs one to two days after exposure. PX 521, p. 2 [ETSC 081565].

672. Breathing high levels of NO_x can cause rapid burning, spasms, and swelling of tissues in the throat and upper respiratory tract, reduced oxygenation of body tissues, a build-up of fluid in the lungs, and death. PX 521, p. 2 [ETSC 081565].

673. According to the EPA, current scientific evidence links short-term NO_2 exposures, ranging from 30 minutes to 24 hours, with adverse respiratory effects including airway inflammation in healthy people and increased respiratory symptoms in people with asthma. PX 523.

674. As of October 2010, the EPA set a primary 1-hour NO_2 NAAQS of 100 ppb. PX 476, p. 23.

675. The EPA has also set a primary annual NO_2 NAAQS of 53 ppb. This standard has remained unchanged since 1971. PX 476, p. 23.

4. Sulfur dioxide

676. Sulfur dioxide (SO_2) is a colorless gas with a pungent odor that smells like rotten eggs. PX 476, p. 31; PX 524; PX 526, p. 1 [ETSC 022649]; Tr. 7-76:18-22 [Brooks].

677. SO_2 enters the body primarily through breathing. PX 476, p. 31; PX 524; PX 526, p. 2 [ETSC 022650].

678. Through the lungs, SO_2 can easily and rapidly enter the bloodstream. PX 476, p. 31; PX 526, p. 2 [ETSC 022650].

679. Repeated exposures to SO_2 have an additive effect. Tr. 7-76:23 - 7-77:1 [Brooks].

a. Types of health problems caused by SO_2.

680. Exposure to SO_2 can decrease lung function, increase airway resistance, and decrease volumetric expiratory flow rate, among a variety of other respiratory health effects. PX 525.

681. SO_2 can cause health problems that mimic or enhance allergic and asthmatic conditions, including shortness of breath, difficulty breathing, wheezing and coughing. PX 476, p. 31; Tr. 7-75:24 – 7:76:17 [Brooks].

682. Exposures to SO_2 ranging from 5 minutes to 24 hours can result in adverse respiratory effects, such as bronchoconstriction and increased asthma symptoms. PX 525.

683. Long-term studies surveying large numbers of children indicate that children who have breathed SO_2 may develop more breathing problems as they get older, may make more emergency room visits for treatment of wheezing fits, and may get more respiratory illnesses than other children. PX 524; PX 526, p. 5 [ETSC 022653].

684. Short-term exposure to SO_2 is related to increased visits to emergency departments and hospital admissions for respiratory illnesses. This relationship is particularly strong in at-risk populations, including children, the elderly, and asthmatics. PX 524, 525.

685. At elevated ventilation rates (*e.g.*, while exercising or playing), individuals with asthma are particularly sensitive to short-term (5 minutes to 24 hours) exposure to SO_2. PX 524, 525, 526, p. 30 [ETSC 022678].

686. When SO_2 combines with water in the atmosphere, sulfuric acid is formed. Tr. 7-77:2-6 [Brooks]. Sulfuric acid can induce additional health effects, including a bronchospastic effect. Tr. 7-77:7-12 [Brooks].

687. SO_2 is part of a larger group of gaseous sulfur oxides called "SO_x." PX 525.

688. SO_x can react with other compounds in the atmosphere to form small particles. PX 525.

689. The small particles formed when SO_x react with other compounds can penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and can aggravate existing heart disease, leading to increased hospital admissions and premature death. PX 525. A single exposure to very high concentrations of SO_2 can result in severe bronchial hypersensitivity, or reactive airway dysfunction syndrome (RADS). PX 476, p. 31; PX 526, p. 33 [ETSC 022681].

b. Low levels of SO_2 cause health problems.

690. As of October 2010, compliance with the primary NAAQS standard for SO_2 is determined by comparing the three-year average of the fourth-highest 1-hour SO_2 readings at an air monitoring station to a limit of 75

ppb. The three highest short-term SO_2 levels each year, at each monitor, are thus not considered in this calculation. PX 476, p. 23; Tr. 7-81:16-25 [Brooks].

691. However, studies show that SO_2 levels below 75 ppb cause health problems:

- Asthmatics are sensitive to the respiratory effects of low concentrations of SO_2. PX 524; PX 525; PX 526, p. 5 [ETSC 022653].

- Rates of hospitalization and emergency room visits for children aged two to four increased when SO_2 levels increased. There were increased hospitalizations and emergency room visits when SO_2 levels were as low as 15 ppb. This study, the "Smargiassi study," was conducted near a petrochemical plant. Tr. 7-78:24 - 7-79:20 [Brooks]; PX 488.

- Lung inflammation and decreased lung function were worse for a population living near a petrochemical plant with SO_2 levels averaging 10 ppb than for a population that lived 20 miles farther from the plant and exposed to lower SO_2 levels. This study, the "Sardinia study," showed that adverse health effects occurred with SO_2 levels averaging just 10 ppb. Tr. 7-79:24 - 7:80:2; 7-89:24 - 7-81:15 [Brooks]; PX 489.

- Each 5 ppb increase in SO_2 levels, where ozone and NO_2 were also present, was associated with a 12% increase in the number of emergency room visits for wheezing episodes in children. PX 476, p. 32; PX 526, p. 34 [ETSC 022681].

- Following several acute air pollution episodes (such as one day of a mean daily concentration of 170 ppb SO_2 and particulate pollution), significant lung function decreased in children from the day after the pollution episode through 1-2 weeks later. PX 476, p. 31-32; PX 526, p. 81 [ETSC 022729].

- There was an association between SO_2 and reduced lung function in children after they lived in high air pollution areas for 5-10 years. The polluted areas studied had SO_2 levels ranging from 24-27 ppb, as well as

elevated levels of suspended sulfates and NO_2. PX 476, p. 32; PX 526, p. 34 [ETSC 022682].

- For children who lived for three years in areas with concentrations of SO_2 ranging from 24-100 ppb, there was an increased incidence of respiratory infections. PX 476, p. 32; PX 526, p. 43 [ETSC 022691].

- In children exposed to SO_2 and particulate sulfate where annual average SO_2 concentrations were between 5 and 40 ppb (and intermittently higher), there was a significant correlation between pollution levels and persistent coughing. PX 476, p. 31; PX 526, p. 81 [ETSC 022729].

692. The ATSDR acute (1-14 day) MRL for SO_2 is 10 ppb. PX 476, pp. 25, 32.

c. Adverse health effects from SO_2 releases can occur even if the NAAQS standard is not violated.

693. As discussed, studies show that SO_2 levels below 75 ppb are harmful to human health, so compliance with the NAAQS standard for SO_2 does not necessarily mean the public is protected.

694. In addition, since the NAAQS standard disregards the highest three daily SO_2 releases in a year, short-term concentrations of SO_2 could be at dangerously high levels and still not contribute to a finding of a NAAQS violation.

695. Further, an SO_2 air monitoring station used to determine NAAQS compliance may not pick up an SO_2 plume from the Complex, so the effects of emission events at the Baytown Complex can miss being included in a determination of whether the NAAQS standard is being met.

5. Ozone.

696. Ozone is a constituent of smog. Tr. 7-147:19-21 [Brooks]; PX 527.

697. Ozone is formed as a result of a chemical reaction in the atmosphere. Tr. 7-147:22 - 7:148:1 [Brooks].

698. Volatile organic compounds (VOCs) are defined by the EPA as certain compounds of carbon which participate in atmospheric photochemical reactions. PX 527.

699. VOCs form ground-level ozone by reacting with sources of oxygen molecules in the atmosphere, such as nitrogen oxides (NO_x) and carbon monoxide (CO), in the presence of sunlight. PX 527. VOCs, NO_x, and CO are known as ozone "precursors."

700. One reason EPA regulates emissions of VOCs to the ambient air is to prevent the formation of ozone. PX 527.

701. The predominant predictor of ozone formation in the Houston area is the presence of "highly reactive VOCs" (or "HRVOCs," which are VOCs that are particularly susceptible to forming ozone). Refineries produce HRVOCs. Tr. 7-143:17-7-144:1 [Brooks]; Tr. 8-205:12-19 [Cabe]; PX 476, p. 25.

702. Exxon's proffered air modeling expert David Cabe admitted that the best way to prevent the occurrence of elevated ozone levels is to reduce the overall levels of ozone precursors in the air. Tr. 8-205:2-5 [Cabe].

703. Ozone creates reactions in lung tissues and other human tissues, usually mucous membranes. Tr. 7-148:17-19 [Brooks].

704. Breathing elevated levels of ozone can trigger serious respiratory and health problems such as chest pain, coughing, and throat irritation. Ozone can worsen bronchitis, emphysema, and asthma. PX 522.

705. The Institute for Health Policy at the University of Texas School of Public Health concluded that short-term exposure to ambient ozone is likely to contribute to premature deaths. PX 476, p. 8.

706. The EPA has set NAAQS for ozone. In 2008, the EPA set the primary and secondary 8-hour NAAQS for ozone at 75 ppb. From 1997-2008, the 8-hour NAAQS for ozone was 80 ppb. The 1-hour NAAQS for ozone is 120 ppb, and has been 120 ppb since 1979. PX 476, p. 23; PX 528.

707. Emissions of volatile organic compounds – including propylene, ethylene, isoprene, formaldehyde, acetaldehyde, butenes, 1,3-butadiene, toluene, ethyltoluene, pentene, trimethybenzene, and xylenes – from petrochemical refining play a major role in ozone formation in the Houston Ship Channel area. PX 476, p. 25.

708. The TCEQ has targeted highly reactive VOCs – ethylene, propylene, 1,3-butadiene, and butenes – for significant reductions. PX 476, p. 25; Tr. 8-205:12-19 [Cabe].

709. TCEQ enacted an HRVOC Rule that limits industrial facilities to no more than 1,200 pounds per hour of HRVOC emissions, from all sources combined. Tr. 8-205:12-15 [Cabe].

710. The emissions of ozone precursors from the Baytown Complex would not always be expected to induce increased ozone levels in the immediate vicinity of the Complex. Ozone may form miles away from the source from which ozone precursors were released, as soon as conditions are right. Studies have shown that ozone can be formed well downwind of point source emissions of HRVOCs and NO_x, because of the nature of the chemical reactions and climatic conditions that produce ozone. Tr. 7-144:14 – 7:145:5 [Brooks]; PX 476, pp. 5-6; PX 484.

711. Ozone formed as a result of industrial releases of ozone precursors forms a plume. Once formed, ozone can travel great distances. Tr. 7:145:2 - 7-146:5 [Brooks]; 8-203:21 - 8-204:1 [Cabe].

712. Mr. Cabe testified that emissions of ozone precursors from Baytown can travel and affect other parts of Harris County. Tr. 8-209:10-16 [Cabe].

713. Families and children are advised not to play or exercise outdoors when ozone is peaking. Tr. 7-36:25 - 7-37:2 [Brooks].

6. Hazardous air pollutants

714. The Baytown Complex emits hazardous air pollutants during emission events.

715. Hazardous air pollutants (HAPs) are pollutants that are "known or suspected to cause cancer or other serious health effects, such as reproductive or birth defects, or adverse environmental effects." PX 530; 40 U.S.C. § 112(a)(6), (b)(1) & (2).

716. HAPs are also called "air toxics." PX 530.

717. The health effects of HAPs "can include damage to the immune system, as well as neurological, reproductive (e.g., reduced fertility), developmental, respiratory and other health problems." PX 530.

718. Congress established an initial list of HAPs in the CAA, 42 U.S.C. § 7412(b)(1), which is a congressional finding that these chemicals are particularly harmful to human health.

719. As reflected in the STEERS Reports and the list of recordable emission events, the following HAPs have been released without authorization during Baytown Complex emission events: 1,3-butadiene, benzene, carbon disulfide, carbonyl sulfide, cumene, cyanide compounds, ethylbenzene, hexane, hydrochloric acid, hydrogen chloride, hydrogen cyanide, methyl ethyl ketone, methanol, methyl chloride, methyl tert-butyl ether, methyl isobutyl ketone, naphthalene, phenol, styrene, toluene, and xylene.

a. Carbon disulfide

720. The carbon disulfide that is used in industrial processes is a yellowish liquid with an unpleasant odor like that of rotting radishes. PX 532, p. 1; PX 533.

721. Carbon disulfide easily explodes in air and also catches fire very easily. PX 532, p. 1; PX 533.

722. Carbon disulfide stays close to the ground because it is heavier than the surrounding air and it remains in the air for approximately 12 days. PX 532, p. 2.

723. Carbon disulfide enters the body primarily through breathing. PX 532, p. 3; PX 533.

724. The TCEQ acute (1-hour) ESL for carbon disulfide is 10 ppb. The TCEQ long-term (1-year) ESL for carbon disulfide is 1 ppb. PX 476, p. 25.

b. Carbonyl sulfide

725. Acute (short-term) inhalation of high concentrations of carbonyl sulfide may cause narcotic effects in humans. PX 534.

726. Carbonyl sulfide may also irritate the eyes and skin in humans. PX 534.

727. The TCEQ acute (1-hour) ESL for carbonyl sulfide is 55 ppb. The TCEQ long-term (1-year) ESL for carbonyl sulfide is 1.1 ppb. PX 476, p. 25.

c. Hydrogen chloride

728. Hydrogen chloride (HCl), or hydrochloric acid, is an irritant, causing irritation of the eye, nose, throat, and respiratory system. PX 478, p. 3; PX 535; PX 536; Tr. 7-138:21-25 [Brooks].

729. HCl has a strong, irritating odor. PX 478, p. 3; PX 535, 536.

730. HCl is corrosive to the eyes, skin, and mucous membranes. PX 478, p. 3; PX 535, 536.

731. Brief exposure to low levels of HCl causes throat irritation. PX 478, p. 3; PX 535, 536.

732. Exposure to higher levels of HCl can result in rapid breathing, narrowing of the bronchioles, blue coloring of the skin, accumulation of fluid in the lungs, swelling and spasm of the throat, suffocation, and even death. PX 478, p. 3; PX 535, 536.

733. Inhalation of HCl gas at sufficiently high concentrations can also produce acute tracheobronchitis (characterized by cough, sore throat, chest pain), bronchoconstriction, and pulmonary edema. PX 478, p. 3.

734. Exposure to concentrated HCl vapor can cause corneal cell death, cataracts, and glaucoma in humans. PX 478, p. 3.

735. Inhalation of acidic gases such as HCl and sulfuric acid can cause Reactive Airways Dysfunction Syndrome (RADS), a condition in which a

single or repeated exposure to an irritant gas induces immediate respiratory symptoms resembling asthma. PX 478, p. 3; PX 535; Tr. 7-139:1-6 [Brooks].

736. Inhalation of acidic gases such as HCl and sulfuric acid can cause Cough and Airways Irritancy Syndrome (CAIS), a condition in which a single or repeated exposure to an irritant gas induces a persistent cough and respiratory symptoms. PX 478, p. 4.

737. The EPA reference concentration (RfC) for HCl is 13 ppb. PX 476, p. 25.

738. The TCEQ acute (1-hour) ESL for HCl is 130 ppb. Tr. 7-139:15-16 [Brooks]; PX 476, p. 25. The TCEQ long-term (1 year) ESL for HCl is 5.7 ppb. PX 476, p. 25.

d. Hydrogen cyanide

739. Hydrogen cyanide is a colorless gas with a faint, bitter, almond-like odor. PX 537, 538, 539, p. 2 [ETSC 021199].

740. The half-life (the amount of time needed for half of the material to be removed) of hydrogen cyanide in the atmosphere is about 1 to 3 years. PX 537; PX 539, p. 3 [ETSC 021200].

741. ATSDR reports that workers who inhaled low levels of hydrogen cyanide over a period of years experienced breathing difficulties, chest pain, vomiting, blood changes, headaches, and enlargement of the thyroid gland. PX 537.

742. Hydrogen cyanide can irritate the skin and produce sores. PX 537; PX 539, p. 7 [ETSC 021204].

743. Acute exposure to low concentrations (6-49 milligrams per cubic meter) of hydrogen cyanide will cause effects such as weakness, headache, nausea, increased rate of respiration, and skin and eye irritation in humans. PX 537; PX 538; PX 539, p. 15 [ETSC 021212].

744. Acute (short-term) inhalation of 100 milligrams per cubic meter or more of hydrogen cyanide will cause death in humans. PX 538, 539, pp. 27, 40 [ETSC 021224, 021237].

e. Benzene

745. Benzene can have a sweet, perfume-like smell. PX 542; PX 543, p. 1 [ETSC 018154]; Tr. 7-120:16-18 [Brooks].

746. It takes a few days for benzene to break down in the air. PX 542; PX 543, p. 2 [ETSC 018155].

747. About half of the benzene that a person breathes enters his/her bloodstream. PX 543, p. 4 [ETSC 018157].

748. There is no safe exposure level for benzene. Tr. 7-123:7-16 [Brooks].

749. Benzene is a human carcinogen. PX 476, p. 44; PX 542; PX 543, p. 6 [ETSC 018159]; Tr. 3-44:19-20 [Kovacs].

750. A high dose of benzene over a short period of time poses a cancer risk. A low dose of benzene over a longer period of time also poses a cancer risk. Tr. 7-121:9-24 [Brooks].

751. Long-term exposure to benzene causes neurological disorders and disorders of the blood, such as leukemia and anemia. PX 476, p. 45; PX 542; PX 543, p. 5 [ETSC 018158].

752. The body experiences the toxic effects of benzene after metabolizing benzene, producing metabolites. PX 476, p. 44; PX 543, p. 8 [ETSC 018161].

753. Benzene metabolites inhibit the function of a key enzyme for maintaining the structural integrity of DNA that may also induce secondary cancers such as acute myeloid leukemia (AML). PX 476, p. 44; PX 543, p. 12 [ETSC 018165].

754. Metabolites formed from benzene are toxic to all types of hematopoietic stem cells in the bone marrow and can result in a decrease in cell numbers in bone marrow, cell death, anemia, and aplastic anemia. PX 476, p. 44-45; PX 543, p. 85 [ETSC 018238].

755. Humans, non-human primates, rodents, and human cells exposed to benzenes can experience genetic toxicity of chromosome breaks, translocations, and other DNA defects, similar to various leukemias. PX 476, p. 44; PX 543, p. 201 [ETSC 018354].

756. At low concentrations, benzene exposure can lead to reduced numbers of circulating white blood cells, immune suppression, and an increased susceptibility to infections. PX 476, p. 45.

757. Short-term exposure to benzene may cause drowsiness, dizziness, and headaches, as well irritation of the eyes, skin, and respiratory tract. PX 476, p. 45; PX 542; PX 543, p. 228 [ETSC 018381].

758. Short-term exposure to benzene at high levels can cause unconsciousness. PX 476, p. 45; PX 542; PX 543, p. 5 [ETSC 018158].

759. Women exposed to high levels of benzene inhalation experience reproductive effects, including disturbances of the menstrual cycle. PX 476, p. 45; PX 542; PX 543, p. 6 [ETSC 018159].

760. In animal tests, higher levels of benzene cause adverse effects on the developing fetus. PX 476, p. 45; PX 542; PX 543, p. 6 [ETSC 018159].

761. Benzene exposure can result in bone marrow toxicity, leading to disrupted growth of bone marrow stem cells, bone marrow failure, and/or leukemia. PX 476, p. 44-45; PX 543, p. 85 [ETSC 018238].

762. Epidemiological studies link benzene to acute myeloid leukemia (AML). PX 543, p. 6 [ETSC 018159].

763. In addition to AML, benzene exposure is also linked to elevated risks of other types of leukemia. PX 476, p. 45; PX 542; PX 543, p. 97-98 [ETSC 018250-51].

764. Benzene can cause excessive bleeding and can affect the immune system, increasing the chance of infection. PX 542; PX 543, p. 5, [ETSC 018158].

765. Long-term exposure to benzene can harm bone marrow and cause a decrease in red blood cells, leading to anemia. PX 476, p. 44-45; PX 542; PX 543, p. 85, [ETSC 018238].

766. The ATSDR acute duration inhalation exposure (14 days or less) MRL for benzene is 9 ppb. PX 476, p. 25; PX 543, p. 21 [ETSC 018174].

767. The ATSDR intermediate duration inhalation exposure (15-365 days) MRL for benzene is 6 ppb. PX 543, p. 23 [ETSC 018176].

768. The ATSDR chronic inhalation exposure (more than 365 days) MRL for benzene is 3 ppb. PX 543, p. 24 [ETSC 018177].

769. The EPA RfC for Benzene is 0.9 ppb. PX 476, p. 25; PX 543, p. 311 [ETSC 018464].

770. The TCEQ acute (1-hour) ESL for Benzene is 54 ppb. The TCEQ long-term (1-year) ESL for Benzene is 1.4 ppb. PX 476, p. 25, 45-46; Tr. 7-125:4-6 [Brooks].

771. The EPA has estimated a lifetime cancer risk of 1 in 100,000 at benzene exposure levels of 0.41-1.41 ppb. PX 476, p. 46; PX 543, App. B-2 [ETSC 018555].

772. The California Office of Environmental Health Hazard Assessment set the lifetime benzene exposure level at 0.011 ppb, for producing a cancer risk of 1 in 1,000,000. PX 476, p. 46.

f. Toluene

773. Toluene is a clear, colorless liquid with a sweet, pungent odor. PX 548; PX 549; PX 550, p. 1 [ETSC 022888].

774. Toluene is also called methylbenzene, methylbenzol, phenyl methane, and toluol. PX 548.

775. Toluene occurs naturally in crude oil and is also produced in the process of making gasoline and other fuels from crude oil and making coke from coal. PX 549; PX 550, p. 1 [ETSC 022888].

776. Toluene affects the nervous system. PX 548; PX 549; PX 550, p. 6 [ETSC 022893]; PX 551.

777. Low to moderate levels of toluene may cause tiredness, confusion, weakness, memory loss, nausea, loss of appetite, hearing loss, and color vision loss. PX 548; PX 549; PX 550, p. 7 [ETSC 022894].

778. Cardiac arrhythmia can occur in humans acutely exposed to toluene. PX 550, pp. 12, 46-47 [ETSC 022899, 022933-34]; PX 551.

779. Acute exposure of animals to toluene affects the nervous system and decreases resistance to respiratory infection. PX 550, p. 6 [ETSC 022893].

780. The EPA reports that a person died from a severe depression of the nervous system after the ingestion of toluene. PX 550, p. 93 [ETSC 022980]; PX 551.

781. Short-term inhalation exposure to high concentrations of toluene can result in fatigue, sleepiness, headache, and nausea. PX 548; PX 549; PX 550, p. 58 [ETSC 022945]; PX 551.

782. Long-term inhalation exposure to high concentrations of toluene can result in irritation of the eyes and respiratory system, sore throat, dizziness, and headache. PX 548; PX 549; PX 550, p. 60 [ETSC 022947]; PX 551.

783. Inhaling high levels of toluene during a short period of time may cause light-headedness, dizziness, and sleepiness, as well as unconsciousness or even death. PX 549.

784. High levels of toluene may affect the kidneys. PX 549; PX 550, p. 5 [ETSC 022892]; PX 551.

785. Studies of rodents have found that chronic inhalation of toluene can lead to slight adverse effects on the liver, kidneys, and lungs, as well as high-frequency hearing loss. PX 550, p. 5 [ETSC 022892]; PX 551.

786. Breathing very high levels of toluene during pregnancy can result in children with birth defects and retard children's mental abilities and growth. PX 549; PX 550, p. 7 [ETSC 022894].

787. The TCEQ acute (1 hour) ESL for toluene is 1,200 ppb. The TCEQ long-term (1-year) ESL for toluene is 330 ppb. PX 476, p. 25.

g. Ethylbenzene.

788. Ethylbenzene is a colorless, flammable liquid that smells like gasoline. PX 544; PX 546.

789. Upon entering the air, it takes ethylbenzene three days to be broken down into other chemicals. PX 546.

790. The International Agency for Research on Cancer has determined that ethylbenzene is a possible human carcinogen. PX 544; PX 546.

791. Exposure to high levels of ethylbenzene in the air for short periods of time can cause eye and throat irritation. PX 544-46.

792. The EPA reports that respiratory effects, such as throat irritation and chest constrictions, irritation of the eyes, and neurological effects such as dizziness have occurred because of acute inhalation exposure to ethylbenzene in humans. PX 544-46.

793. Short term exposure to high levels of ethylbenzene in the air can result in dizziness, vertigo, eye and throat irritation. PX 544-46.

794. Animals exposed to relatively low concentrations of ethylbenzene in the air for several days to weeks have experienced irreversible damage to the inner ear and hearing. PX 546.

795. Animals exposed to relatively low concentrations of ethylbenzene in the air for months to years have experienced kidney damage. PX 544-46.

796. Long-term inhalation exposure to high concentrations of ethylbenzene may affect the kidneys in humans. PX 544-46.

797. The ATSDR set MRLs for ethylbenzene of 5 ppm for acute duration inhalation exposure (14 days or less), 2 ppm for intermediate duration inhalation exposure (15–364 days), and 0.06 ppm for chronic duration inhalation exposure (365 days or more). PX 476, p. 25.

h. Xylene.

798. Xylene is a carcinogen. Tr. 3-46:4-16 [Kovacs].

799. Xylene can have a semisweet smell. PX 552.

800. Xylene enters the body primarily through breathing. PX 552.

801. Short-term exposure of people to high levels of xylene can cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; impaired function of the lungs; delayed response to a visual stimulus; impaired memory; stomach discomfort; and possible changes in the liver and kidneys. PX 552.

802. Both short- and long-term exposure to high concentrations of xylene can also cause a number of effects on the nervous system, such as headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. PX 552.

i. 1,3,-butadiene.

803. 1,3-Butadiene is "carcinogenic to humans by inhalation." PX 476, p. 50; PX 555, p. 88 [ETSC 082122]; Tr. 3-45:25 – 3-46:1 [Kovacs]; 7-125:8-13 [Brooks].

804. Observed effects of 1,3-butadiene include death, neurological dysfunction, reproductive and developmental effects, hematological and lymphoreticular effects, and cancer. PX 476, p. 50; PX 555.

805. 1,3-butadiene is also a highly reactive volatile organic compound (HRVOC). PX 476.

806. The ATSDR acute (1-14 day) MRL for 1,3-butadiene is 100 ppb; the intermediate (15-365 day) MRL 6 ppb; the chronic (lifetime) MRL is 3 ppb. PX 476, p. 25; PX 555, p. 12-14 [ETSC 082046-48].

807. The EPA RfC for 1,3-butadiene is 0.9 ppb. PX 476, p. 25; PX 555, p. 15, [ETSC 082049].

808. The TCEQ acute (1 hour) ESL for 1,3-butadiene is 230 ppb. The TCEQ long-term (1-year) ESL for 1,3-butadiene is 4.5 ppb. PX 476, p. 25; PX 555, p. 15, [ETSC 082049].

809. Chronic exposure to levels of 1,3-butadiene of 1.33 ppb translates to a risk of hematopoietic cancers of 1 in 10,000. Chronic exposure to levels of 1,3-butadiene at 0.133 ppb translates to a risk of hematopoietic cancers of 1 in 100,000. PX 476, p. 51.

810. Studies in humans link 1,3-butadiene exposure with an increase in leukemia and non-Hodgkin's lymphoma and higher rates of hemato-lymphopoietic, stomach, and respiratory cancer mortality. PX 476, p. 51.

811. In humans, workers exposed to higher levels of 1,3-butadiene experience lower levels of red blood cells, hemoglobin platelets, and neutrophils. Lower levels of red blood cells are associated with changes in normal bone marrow function. PX 476, p. 50.

j. Isoprene.

812. Isoprene is a carcinogen. It is chemically very close to, and has effects on cancer induction that are similar to, 1,3 butadiene. Tr. 7-137:2 - 7-138:15 [Brooks].

k. Napthalene.

813. Napthalene is a carcinogen. Tr. 3-46:21-25 [Kovacs].

l. Methylbenzene.

814. Methylbenzene is a carcinogen. Tr. 3-46:21-24 [Kovacs].

7. Particulate matter.

815. Particulate matter, which consists of very fine air-borne particles, is a respiratory hazard. Tr. 3-48:8 - 3-49:1 [Kovacs].

8. Propane.

816. Exposure to propane can cause reaction time deficits, vertigo, disorientation, headaches and general central nervous system depression. DX 195, p. 21.

XIII. The Air Contaminants Exxon Has Illegally Emitted Have In Fact Adversely Affected Plaintiffs' Members And Members Of The Community.

817. Exxon admits that reducing the amount of air pollutants emitted from the Baytown Complex would improve air quality and public health in the area. Jeffrey Kovacs, a manager in the Exxon Security, Safety, Health, and Environmental Department, testified that although he lives in Houston, he shops and banks in Baytown (Tr. 3-252:19-22), just as Sierra Club member Marilyn Kingman does. Mr. Kovacs testified that the quality of the air is important to him during these activities:

> Q: And you want as little pollution in the air when you breathe when you're shopping and banking in Baytown, right?
>
> A: Yes, sir.
>
> Q: You want to breathe as clean air as possible in Baytown all year round, right?
>
> A: I want to breathe clean air.
>
> * * *
>
> Q: Every hour you're out shopping, every hour you're out banking, you want the air you're breathing to be as clean as possible, right?

THE COURT: Is that correct?

A: Yes, sir.

Tr. 3-253:4-9 and 18-22 [Kovacs]. Mr. Kovacs further testified that reducing emissions from the Complex is beneficial to the community:

Q: And it [reducing Complex emissions] helps people outside the fence line, right? That's what your point is or is that not the point?

A: That is the point. It helps the environment, yes, sir.

Q: It helps the environment. It helps public health, too, right?

A: Yes.

Q: Less emissions, better public health, agreed?

A: Yes, sir.

* * *

Q: All right. So emissions [at the Complex] should still come down because it's more protective of public health, right?

A: Yes, sir.

Tr. 3-255:15-22; 3-256:21-23. And in an Exxon brochure entitled "2012 Environmental Progress Report – ExxonMobil Baytown," the company states that reducing "air incidents" (emission events) at the Baytown Complex helps "deliver emission reductions and cleaner air for our local community and the greater Houston area." PX 453, p. 2.

A. Air quality is poor, and health risks are high, in the Houston area.

1. Many people live close to the Baytown Complex, including many who are part of "high risk" populations.

818. According to the EPA, the total population within a 1-mile radius of the Olefins Plant is 1,244 (which includes 295 minors age 17 and under and 147 seniors, over the age of 65). PX 507.

819. According to the EPA, the total population within a 3-mile radius of the Olefins Plant is 36,399 (which includes 10,426 minors age 17 and under and 3,883 seniors, over the age of 65). PX 505.

820. According to the EPA, the total population within a 5-mile radius of the Olefins Plant is 82,943 (which includes 31,931 minors age 17 and under and 8,027 seniors, over the age of 65). PX 506.

821. According to the EPA, the total population within a 1-mile radius of the Refinery is 1,943 (which includes 748 minors age 17 and under and 199 seniors, over the age of 65). PX 510.

822. According to the EPA, the total population within a 3-mile radius of the Refinery is 39,143 (which includes 11,577 minors age 17 and under and 3,866 seniors, over the age of 65). PX 508.

823. According to the EPA, the total population within a 5-mile radius of the Refinery is 74,620 (which includes 28,454 minors age 17 and under and 7,541 seniors, over the age of 65). PX 509.

824. According to the EPA, the total population within a 1-mile radius of the Chemical Plant is 1,244 (which includes 389 minors age 17 and under and 147 seniors, over the age of 65). PX 513.

825. According to the EPA, the total population within a 3-mile radius of the Chemical Plant is 19,869 (which includes 5,662 minors age 17 and under and 2,253 seniors, over the age of 65). PX 511.

826. According to the EPA, the total population within a 5-mile radius of the Chemical Plant is 82,943 (which includes 31,931 minors age 17 and under and 8,027 seniors, over the age of 65). PX 512.

2. Cancer, neurological, and respiratory risks in Harris County are high.

827. The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing comprehensive evaluation of air toxics in the U.S. PX 514; PX 516.

828. State and local agencies collaborated with EPA to develop the information that is contained in the NATA tool. PX 514.

829. The EPA Office of Air and Radiation used data from the 2005 National-Scale Air Toxics Assessment (NATA) Cancer Risk Estimates and Non-Cancer Hazard Index Scores to determine cancer risk percentile rankings of counties and states from 0 (lowest) to 100 (highest). PX 515.

830. According to the EPA – and based on NATA data – the cancer risk for Harris County is 60.23 persons per million. This puts Harris County in the

97.9th percentile when compared to counties and states nationally, meaning that 97.9% of U.S. counties have a lower cancer risk than Harris County. PX 565.

831. According to the EPA – and based on NATA data – the neurological hazard risk for Harris County puts Harris County in the 90.8th percentile when compared to counties and states nationally. PX 565.

832. According to the EPA – and based on NATA data – the respiratory hazard risk for Harris County puts Harris County in the 93.8th percentile when compared to counties and states nationally. PX 565.

832A. Unauthorized emissions of carcinogens, which have no safe exposure threshold, respiratory irritants, and contaminants that can cause neurological impacts (such as hydrogen sulfide) from the Baytown Complex during emission events that exceed *hourly* emission limits would thus contribute to the already heightened risk levels for these health problems in Harris County, even if, as Exxon points out, the Complex's annual emission totals for these pollutants may be below *annual* permit limits.

3. Harris County does not attain national ozone standards.

833. Harris County has been designated as "nonattainment" of the 1-hour ozone NAAQS every year from 1992 to the present. PX 529.

834. Harris County has been designated as "nonattainment" of the 8-hour ozone NAAQS every year from 2004 to the present. Tr. 2-123:12-20,

2:124:14-20 [Carman]; PX 529. Thus, unauthorized emissions of ozone precursors from the Baytown Complex during emission events that exceed *hourly* emission limits would contribute to the Houston area's non-attainment status for ozone, even if, as Exxon points out, the Complex's annual emission totals for these pollutants may be below *annual* permit limits.

4. Houston area studies show air quality is poor.

835. Studies of air quality in the Houston area show that a number of pollutants in the Houston area's air pose risks to human health. The Baytown Complex directly releases, or indirectly contributes to the formation of, these pollutants. PX 476, p. 8.

a. Mayor Bill White Task Force study.

836. A task force on the health effects of air pollution in Houston that was convened by the Institute for Health Policy at the University of Texas School of Public Health at the request of the then-Mayor of Houston, Bill White ("the Task Force"), concluded that 12 substances in Houston's air represent a "definite risk to human health." These substances include 1,3-butadiene, benzene, formaldehyde, and acrolein. PX 476, p. 8.

837. The Task Force found that nine agents in Houston's air represent a probable risk to human health; these include ethylene dichloride, naphthalene, ethylene oxide, and 1,1,2,2,tetrachloroethane. PX 476, p. 8.

838. The Task Force "found that existing and projected ambient concentrations of two criteria pollutants, ozone and PM2.5, are almost certainly causing respiratory and cardiopulmonary effects in some individuals, as well as contributing to premature death." PX 476, p. 8.

839. The UT task force also concluded that airborne concentrations in the Houston area of three carcinogens – 1,3-butadiene and benzene (which are directly released from the Baytown Complex) and formaldehyde (formed as a result of emissions from the Baytown Complex) – pose an unacceptable increased cancer risk. PX 476, p. 8-9.

840. The UT task force also concluded that 1,3-butadiene, acrolein, and formaldehyde (formed as a result of emissions from the Baytown Complex) are present at ambient concentrations that represent an unacceptable increased risk for chronic disease in Houston. PX 476, p. 9.

b. Studies in peer-reviewed journals.

841. A 2011 study published in the journal *Environmental Health* reported a 37% increased risk of childhood leukemia associated with residence in census tracts close to the Houston Ship Channel. PX 476, p. 13.

842. A 2008 study published in the journal *Environmental Science and Technology* found that, for residents of the eastern portion of the Houston Ship Channel (where the Baytown Complex is located), the greatest contributor to

an increased risk for cancer is point source emissions from petrochemical refineries. PX 476, p. 13.

B. Air dispersion modeling by Exxon's own consultants shows emission events caused off-site pollutant levels to exceed regulatory standards.

1. Background on Exxon's air dispersion modeling.

843. Exxon commissions "air dispersion modeling" of certain pollutants emitted during reportable emission events (*i.e.*, those with STEERS Reports) when directed by TCEQ to do so. TCEQ requests this modeling when it wants information about the off-site impacts of an emission event. Sage Environmental Consulting ("Sage") performs this modeling. Tr. 6-102:4-7 [Parmley]. Sage generates a report on the modeling results. Tr. 6-102:4-12 [Parmley].

844. In addition, Exxon had Sage and a testifying expert, David Cabe, conduct additional modeling of emission events for the purposes of this litigation.

845. Air dispersion modeling does not involve an actual measurement of pollutants in the air. Rather, a computer model generates predictions of pollutant concentrations in the ambient air based on information and assumptions fed into the model.

846. Air dispersion modeling provides an estimate of the concentration of pollutants at specified ground-level locations, called "receptors,"

surrounding an emission source. Tr. 6-98:14-17; 6-99:2-21 [Parmley]. Ground-level concentrations are of interest because that is where the people are. Tr. 6-136:2-15 [Parmley].

847. The air dispersion modeling done for the Baytown Complex predicts the maximum off-site concentration of an individual pollutant, such as sulfur dioxide, or carbon monoxide, or hydrogen sulfide. Tr. 6-104:17 - 6-106:1 [Parmley].

848. Air dispersion modeling is performed by inputting information into computer programs. Tr. 6-99:17-21 [Parmley]. "SCREEN3" is the computer model that was used for most of the modeling of the Complex's emission events. Tr. 106:23-25; 6-107:21-24 [Parmley]. Much less frequently, the "industrial source complex" model was run. Tr. 6-107:15-24 [Parmley]. Both programs were developed by EPA. Tr. 6-135:8-17 [Parmley].

849. The air dispersion models requires the user to input data. Once the required data is input, the model performs calculations and produces a result. Tr. 6-109:12-21 [Parmley].

850. The expression "garbage in, garbage out" applies in the air dispersion modeling context. The quality of the inputs to the model determines the quality of the predictions of air pollutant concentrations. Tr. 6-109:22 – 6-110:9 [Parmley]. As discussed below, the inputs that Sage and Cabe used in

their air dispersion modeling understated the emission rate of pollutants that were being modeled.

851. Exxon provided Sage and Cabe with the inputs: the quantity of pollutants emitted during an emission event, and the time period over which the emissions occurred. This information was fed in to the air dispersion computer models. Tr. 6-116:13-18; 6-117:4-9 [Parmley].

852. Once predicted maximum off-site concentrations were generated by the computer model, Sage and Cabe compared the results to "air comparison values" ("ACVs"), which refers to the various government-set standards or levels for air pollutants, or to some other numerical value. Tr. 6-106:2-8 [Parmley].

853. In some cases, the Sage and Cabe modeling expresses both pollutant concentrations and the regulatory thresholds they are compared to in terms of micrograms per cubic meter ($\mu g/m^3$); in other cases, concentrations and regulatory thresholds are expressed in parts per billion (ppb). PX 374-394; PX 610-611.

854. Exxon did not commission air dispersion modeling for every emission event. Only 153 of the 345 total reportable emission events during the Claims Period (of which 240 remain in the case) were modeled. Tr. 9-39:22-24 [Cabe].

2. Exxon's modeling shows levels above regulatory standards.

855. The modeling of selected Baytown Complex emission events performed by Sage and Cabe predicted off-site ambient concentrations of pollutants at levels that exceeded regulatory standards or levels, such as NAAQS and ESLs, for a number of these emission events. PX 374-75; PX 377-84; PX 386-88; PX 391-93; PX 610-11. This is so even though, as set forth in detail in the following section, Exxon's modeling may greatly *understate* actual pollution levels.

856. Mr. Cabe's modeling of reportable emission events focused primarily on events for which Exxon claims that the affirmative defense to penalties should apply. Tr. 9-39:12-21 [Cabe]. Yet the results of modeling by Mr. Cabe showed that 14 of these so-called "affirmative defense events" caused an offsite pollutant concentration that exceeded an applicable air comparison value. Tr. 9-39:22 – 9-40:3 [Cabe].

857. Mr. Cabe's modeling of recordable emission events showed that another 130 emission events caused an offsite pollutant concentration that exceeded an applicable air comparison value. Tr. 8-192:22 - 8-193:1, 9-37:13-18, 9-23:19 – 9:25:15 [Cabe]; 10-7:13-18 [Fraiser].

858. The magnitude by which these air comparison values were exceeded ranged as high as 21 times the regulatory threshold. In 75 instances,

the predicted off-site concentration was *more than twice* the regulatory threshold.

859. More than 100 of the exceedances of air comparison values involved VOCs (including such hazardous air pollutants as xylene, benzene, isoprene and hexane, which are carcinogens); 18 involved particulate matter; and 11 involved hydrogen sulfide.

860. Exceedances of air comparison values predicted by Sage modeling include the following:

861. Exxon released 1,648 lbs of benzene during an emission event (STEERS 68364) at the Olefins Plant lasting from 11/22/2005-12/15/2005. Sage's modeling predicted the peak offsite 24-hour concentration of benzene to be 14.9 micrograms per cubic meter ($\mu g/m^3$), which is approximately 1.24 times the TCEQ ESL for this averaging period (12 $\mu g/m^3$). PX 375 [EOMCS 00006516-24].

862. During a 5/31/2006-6/1/2006 emissions event at the Refinery (STEERS 76531), Exxon released 25,336.00 lbs of heptane over a period of 15 hours and 50 minutes. Sage's modeling predicted the 1-hour concentration for n-heptane to be 24,891 $\mu g/m^3$, or approximately 7.1 times the TCEQ short-term ESL for this chemical (3,500 $\mu g/m^3$). According to Sage, "impacts of this magnitude may have occurred between 2 p.m. and 4 p.m. on May 31 and

between 9 p.m. May 31 and 3 a.m. June 1, 2006." PX 377 [EOMCS 00015634].

863. For a 10/16/2010 Olefins Plant emission event (STEERS 146174), Sage's modeling predicted exceedances of ESLs for toluene, "VOC Other" (as distillates), m-xylene, indene, and cumene. Sage's modeling predicted that: the "worst-case chemical," toluene, reached a concentration of 821% of the ESL at the Baytown Olefins Plant property line and a concentration of 760% of the ESL at the nearest residential area; the peak property line concentration of VOC Other (distillates) was 293% of the ESL and the peak non-industrial receptor concentration of VOC Other (distillates) was 271% of the ESL; the peak property line concentration of m-xylene was 234% of the ESL and the peak non-industrial receptor concentration of m-xylene was 217% of the ESL; the peak property line concentration of indene was 117% of the ESL and the peak non-industrial receptor concentration of indene was 108% of the ESL; the peak property line concentration of cumene was 116% of the ESL and the peak non-industrial receptor concentration of cumene was 108% of the ESL. DX 459 [EOMCS 00051729].

864. Sage's modeling of STEERS event 147380, which occurred on 10/16-17/2010 at the Refinery, predicted that at the property line, "crude" concentrations were 160% of the 1-hour ESL and naphtha concentrations were 289% of the 1-hour ESL. At the nearest non-industrial receptor, crude was

modeled at 128% of the 1-hour ESL and naphtha at 232% of the 1-hour ESL. PX 382, p. 3.

865. During a 12/23/2009 emission event (STEERS 133644), Exxon released 48,937 lbs. of SO_2 over the course of 12 hours. Sage's modeling predicted the peak offsite 1-hour concentration of SO_2 was 265 ppb, and the peak 3-hour concentration was 238 ppb. The current NAAQS standard for SO_2 uses a 1-hour concentration threshold of 75 ppb. PX 386 [EOMCS 00004792-97].

866. During an 8/4/2006 emission event (STEERS 79486), Exxon released 414 lbs. of H_2S over the course of 18 minutes. Sage's modeling predicted the peak offsite 1-hour concentration of H_2S was 238 ppb (259 ppb at the fenceline). The TCEQ residential and commercial property line standard is 80 ppb. PX 389, pp. 3-5.

867. During an emission event on 2/21/2009 (STEERS 120401), Exxon released 1,928 lbs. of H_2S over the course of 3.5 hours. Sage modeling predicted the peak offsite 1-hour concentration of H_2S was 226 ppb, which is 287% of the 1-hour residential and commercial property line standard. Sage concluded that the plume likely impacted a small residential area east of the refinery complex, which is where Environment Texas member Stuart Halpryn and his family lived at the time. PX 391 [EOMCS 00023801-04]; PX 476, Att. B.

868. During an emission event that began at 6:10 p.m. on 7/2/2006 (STEERS 78040), Exxon released 46,681 lbs. of hydrogen chloride (HCl) over the course of 22 hours. Sage's modeling predicted the peak offsite 1-hour concentration of HCl was 1,689 ppb. The health-based 1-hour ESL for HCl is 130 ppb. PX 374 [EOMCS 00051559-63].

869. During an emission event that took place from 5/14/2007 to 5/18/2007 (STEERS 91125), Exxon released 132,538 lbs. of hydrogen chloride. The event was modeled by Sage in two periods: Period 1 lasted 5.25 hours and Period 2 lasted 13.75 hours, for a total of 19 hours. Sage modeling predicted the peak offsite 1-hour concentration of HCl for Period 1 was 957 ppb, and for Period 2 was 656 ppb. The health-based ESL for HCl is 130 ppb. PX 478, pp. 4-5.

870. During an emission event on 3/29/12, Exxon released 20,501 lbs. of HCl over the course of 10 hours. The average HCl emission rate was approximately 2,050 lbs/hr. The average HCl emission rate during the 7/2/06 emission event (which produced a predicted offsite concentration well over 10 times the ESL) was approximately 2,120 lbs/hr. PX 478, p. 5.

871. During an emission event on 11/9/2006 (STEERS 83713), Exxon released 3,663 lbs. of methyl chloride over the course of 12 minutes. Sage's modeling predicted the peak 1-hour concentration of methyl chloride at the

fenceline was 24% higher than the 1-hour ESL for methyl chloride. PX 393, pp. 3-5.

872. Sage also performed modeling of a number of emission events at the Refinery that the Court has removed from the case because they were subject to an earlier EPA consent decree. Although Plaintiffs are no longer seeking relief for violations associated with these events, Dr. Brooks testified that they were relelvant to his assessment of health impacts because repeated exposures to pollutants can exacerbate the health effects of later exposures. Tr. 7-87:8 – 7-88:3 [Brooks]. A description of the modeling results from one of those events follows.

873. During a 6/24/06 emission event (STEERS 77600), Exxon released 159,999 lbs. of SO_2 over the course of 18 hours. Sage modeled this event as two discrete time periods, and therefore predicted two peak concentrations for all pollutants modeled. Sage's modeling predicted two different peaks of offsite concentrations of SO_2: peak 1-hour concentrations of 1,137 and 567 ppb, and peak 3-hour concentrations were 379 and 282 ppb. The current NAAQS standard for SO_2 uses a 1-hour concentration threshold of 75 ppb. The plume of SO_2 drifted eastward from the Baytown Complex, which is where much of the Baytown population resides. PX 384 [EOMCS 00016364-71].

874. Also during the 6/24/06 emission event (STEERS 77600), Exxon released 3,293 lbs. of H_2S. Sage's modeling predicted two different peaks of offsite 1-hour concentrations of H_2S, of 67 ppb and 23 ppb. Sage used the more precise Industrial Source Complex (ISC3) model for this event. PX 384 [EOMCS 00016364-71].

875. Also during the 6/24/06 emission event (STEERS 77600), Exxon released 275 lbs. of carbonyl sulfide (COS). Sage's modeling predicted two different peaks of offsite 1-hour concentrations of COS, one that was 809.1% of the 1-hour ESL and another that was 151.7% of the 1-hour ESL. PX 384 [EOMCS 00016365-70].

876. The following examples of off-site concentrations that exceeded an air comparison value are from the modeling performed by Exxon's expert, David Cabe, of both STEERS events and recordable emission events.

877. Cabe's modeling of a reportable emission event occurring on 4/15/11, involving a release of 125 lbs of benzene, a human carcinogen, over less than 10 minutes, predicted an off-site concentration that was 3.2 times the regulatory threshold for benzene. PX 610, p. 1.

878. During two recordable emission events, one beginning 8/1/07 and lasting 16 hours, in which 58 lbs of n-methyl-2-pyrrolidone ("NMP") were released, and one beginning 9/10/07 and lasting 13 hours, in which 61.5 lbs of NMP were released, Cabe's modeling predicted the peak off-site

concentrations of NMP were 110 and 140 ppb, respectively. The health-based ESL for n-methyl-2-pyrrolidone is 100 ppb. PX 611, pp. 3-4.

879. There were 12 additional large releases of NMP in which Cabe's modeling predicted peak off-site concentrations exceeded regulatory limits: 12/24/06 (85.8 lbs over 0.3 hours), 8/5/08 (70.1 lbs over 2 hours), 1/17/10 (62.2 lbs over 2 hours), 1/21/11 (60.70 lbs over 15 hours), 1/4/06 (28.8 lbs in 5.5 hours), 8/10/06 (80.8 lbs in 10 hours), 2/18/07 (17.6 lbs in 4 hours), 8/1/07 (58 lbs in 16.25 hours), 9/10/07 (61.5 lbs in 10 hours), 2/24/09 (9.8 lbs in 18 hours), 11/24/09 (222.30 lbs in 249.5 hours), and 4/6/10 (154.66 lbs in 134 hours). PX 611, pp. 1-4.

880. During a recordable emission event on 3/16/06 that released 15.9 lbs of sulfolane, Cabe's modeling predicted the peak off-site concentration of sulfolane was 9 ppb. The health-based ESL for sulfolane is 4 ppb. PX 611, p. 1.

881. During a recordable emission event on 7/6/06, 2,729 lbs of HCl was released in 1 hour. Cabe's modeling predicted the peak off-site concentration of HCl was 860 ppb. The health-based ESL for HCl is 130 ppb. In another recordable emission event, on 3/1/11, in which 443.7 lbs of hydrogen chloride was released over 1.1 hours, Cabe's modeling predicted an off-site concentration of HCl that was 9.6 times the regulatory threshold. PX 611, p. 1.

882. During two recordable emission events, one on 1/26/07 (lasting 2 hours and releasing 17.5 lbs of isoprene) and one on 9/1/09 (lasting almost 4 hours and releasing 49.39 lbs of isoprene), Cabe's modeling predicted the peak off-site concentrations of isoprene, a carcinogen, were 170 and 46 ppb, respectively. The odor-based ESL for isoprene is 5 ppb. PX 611, p. 1.

883. Cabe's modeling of a reportable emission event occurring on 2/21/12, involving a release of 80.3 lbs of isoprene, over 2 hours, predicted an off-site concentration that was over 13 times the regulatory threshold for isoprene. PX 611, p. 1.

884. Cabe's modeling of a reportable emission event occurring on 7/18/11, involving a release of 7.5 lbs of xylene, a carcinogen and hazardous air pollutant, over 1 hour, predicted that the off-site concentration was 3.1 times the regulatory threshold for xylene. PX 611, p. 2.

885. Cabe's modeling of a reportable emission event occurring on 2/27/12, involving a release of 810 lbs of hexane, a carcinogen and hazardous air pollutant, over 1.5 hours, predicted an off-site concentration that was 2.69 times the regulatory threshold for hexane. PX 611, p. 1.

C. Exxon's air dispersion modeling actually understates the pollutant levels caused by Exxon's emission events.

886. Sage and Cabe each used an air dispersion model called "SCREEN3." DX 165, p. 17; DX 166, p. 13 and attachments D, E, F, and G; DX 167, attachment H; DX 187, p. 4; DX 188A, Exhibits A-E.

887. As Plaintiffs' expert Dr. Sahu explained, although the SCREEN3 air dispersion model employs "conservative" meteorological inputs, its use by Sage and Cabe in this case yields results that are not conservative, for a number of reasons. Tr. 5-166:13 – 5-169:3 [Sahu].

888. First, when modeling emission events involving flares, Sage and Cabe used flare emission rates provided by Exxon as inputs to the model. Tr. 5-168:4-12 [Sahu]; 6-116:25 - 6-117:3 [Parmley]; 9-9:12 - 9-10:7 [Cabe]. Because Exxon's estimates of flare emissions are greatly underestimated, the model's results significantly underestimate the actual pollutant concentrations resulting from flaring events. Tr. 5-175:16-23 [Sahu]. For example, if Exxon underestimated flare emissions by a factor of 3.5, then the actual off-site pollutant concentrations were 3.5 times *higher* than the predicted concentrations generated by the Sage and Cabe modeling. Tr. 5-168:18 - 5-169:3; PX 462, pp. 25-26.

889. Because Sage and Cabe relied on Exxon's under-estimates of flare emissions as inputs to their modeling, their characterization their SCREEN3

modeling as generating "conservative" results must be rejected. Tr. 5-175:16-23 [Sahu].

890. If the modeling of flare emission events done by Sage and Cabe had instead used more accurate (higher) flare emission rates as inputs, the points of predicted maximum offsite could also have changed. For example, a point of maximum impact Sage or Cabe predicted as occurring over water may actually have occurred in a populated neighborhood. Tr. 5-176:7-25 [Sahu].

891. Second, when modeling Baytown Complex emission events, Sage did not add background levels of the pollutant in question to his predicted pollutant concentrations, except in the case of the NAAQS criteria pollutants (such as SO_2 and NO_x). Tr. 6-119:25 – 6-120:6 [Parmley].

892. And when Sage did include background concentrations for criteria pollutants, he did not use background concentration data from HRM monitoring stations, which are closer to the Baytown Complex, Tr. 6-120:14-24 [Parmley], but rather used data from monitoring stations that are further away (sometimes many miles away) from the Complex. Tr. 6-120:25 - 6:121:1 [Parmley].

893. Sage *did not* include background concentrations at all when comparing pollutant levels to ESLs (such as in the modeling of VOCs and hazardous air pollutants) or to state property line standards (in the case of H_2S),

and thus Sage's predicted concentrations of those pollutants understate the actual levels present in the air. Tr. 6-119:14-24 [Parmley].

894. Third, the Sage and Cabe modeling of Baytown Complex emission events did not include any simultaneous emissions from any of the hundreds of other emission points at the Baytown Complex that were not involved in the emission event being modeled. Tr. 5-177:4-10 [Sahu]; 6-118:16 - 6-119:1 [Parmley]; 9-7:20 - 9-9:11 [Cabe]. Thus, the modeling understated the levels of pollutants that would actually be present in the atmosphere at the time of the emission event. Tr. 5-177:11-20 [Sahu].

895. Fourth, the modeling done by Sage and Cabe of emission events involving flares do not include predictions for many pollutants that are created by the flare itself, which are known as "products of incomplete combustion." As these pollutants are often toxic, their omission from the modeling means that the modeled impacts understate the actual impacts from such flaring events. Tr. 8-16 [Sahu]; PX 462, pp. 27-28.

896. Fifth, when Cabe modeled emission events, he assumed a steady rate of emissions over the entire duration of the emissions event. He did not account for a variation of emission rates over the course of an event, even though higher hourly emission rates cause higher ambient concentrations of pollutants. Tr. 9-10:8-22 [Cabe].

897. Sixth, when Cabe compared the results of modeling he or Sage performed to an air comparison value, he did not change the comparison value to take into account the presence of other co-pollutants that were also released during the emission event. Tr. 8-194:13-20 [Cabe]. Dr. Brooks testified that the presence of co-pollutants can lower the threshold level for experiencing health effects.

D. Data from existing air monitoring stations understate the pollutant levels caused by Exxon's emission events.

898. The air monitoring station data that Exxon relies on for its assessment of the impact of the Complex's emission events does not accurately measure the concentrations of the pollutants emanating from those emission events. There are too few monitoring stations, too widely scattered, to detect episodic plumes of pollution; many of those monitoring stations do not conduct monitoring every day; and many of the monitoring stations are unable to detect all the different types of pollutants emitted. Tr. 5-180:14 – 5-182:4 [Sahu].

1. Stationary air monitors are best suited for measuring background pollution levels, and not for detecting episodic plumes of pollution from emission events.

899. Air monitoring stations can only measure pollutants that are present in the air that reaches the station's air intake tube. Tr. 8-218:13-16 [Cabe]. Air monitoring stations in the Baytown area collect air samples through an intake tube with a one-inch opening. Tr. 8-218:1-3 [Cabe].

900. Stationary monitors are typically used to provide background levels of pollutants that originated from numerous sources and that have dispersed and are present throughout the ambient air. *E.g.*, Tr. 6-120:25 – 6-121:2 [Parmley].

901. But an air monitor must be directly downwind of a specific emission point if it is to measure a plume of pollutants from that emission point. Tr. 7-71:7-10 [Brooks]; Tr. 8-220:20-23 [Cabe].

902. A plume of air pollutants must actually hit the exact intake location of an air monitor in order for the monitor to measure those pollutants. Tr. 5-183:10-17 [Sahu]; 8-221:9-13 [Cabe]; 9-145:1-4 [Fraiser]. Put another way, a monitor only measures what comes to it. Tr. 5-183:10-17 [Sahu].

903. In addition, a monitor will not register the maximum concentration level of a pollutant plume unless the center line of the plume happens to hit the intake of the monitor. Tr. 8-221:14-17 [Cabe].

904. The air monitor also must be at the right height in order to measure pollutants from an emission plume. Tr. 7-71:7-15 [Brooks]. For instance, because flares at the Baytown Complex are elevated, pollutant plumes from flares can pass right over a monitoring station located directly downwind without being detected, before reaching ground level further away. Tr. 8-222:5-8 [Cabe].

905. The evidence presented at trial establishes that it is unlikely that the few stationary air monitors in the vicinity of the Baytown Complex will happen to be in the right spot to detect the relatively short-lived plume of pollution from a single emission point, or a few emission points, involved in an emission event at the Complex. One recent study of precisely this question found that the supposedly "dense concentration" of stationary air monitors in the Houston area is inadequate to detect ozone plumes resulting from industrial flares. Tr. 5-184:17 - 5-185:2 [Sahu]; PX 463, pp. 11-12.

906. A set of "fence-line" monitors ringing the Complex would have a higher likelihood of measuring the impacts of emission events at the Complex, but no such system of monitors has been installed there. Tr. 5-184:1-16 [Sahu].

2. Almost all of the existing stationary air monitors are located miles from the Complex, and they monitor for only a limited number of pollutants.

907. Although the Baytown Complex is ringed by homes (DX 1012A) and tens of thousands of people live within a three-mile radius of the Complex, there is only one monitor located on the Complex fence line and only three monitors within three miles of the Complex.

908. The West Baytown ("HRM 7") monitor is located near the north fence line of the Complex, near the Chemical Plant. Tr. 8-222:17-19 [Cabe]; PX 456. That means it is several miles away from some parts of the Complex.

Tr. 8-224:10-13 [Cabe]. It is also the only air monitoring station within an 8-mile radius of the Baytown Complex that monitors for hydrogen sulfide. PX 457.

909. Pollutants from the Complex do not hit HRM 7 unless the wind blows from the south. Tr. 9-148:3-10 [Fraiser]; DX 196, Figure 3.

910. The monitor at the Baytown Wetlands Center ("CAMS552") is a mile from the fenceline of the Complex. Tr. 8-223:9-11 [Cabe]; PX 456. However, it measures ozone but no other pollutants. Tr. 8-223:12-13 [Cabe]; PX 457.

911. The East Baytown monitor ("HRM 11") is about five miles east of the Complex. Tr. 8-223:2-5 [Cabe]; PX 456.

912. HRM7 and HRM11 are the only air monitoring stations within an 8-mile radius of the Baytown Complex that monitor for SO_2. PX 457.

913. The Baytown monitor ("CAMS0148") is located 2.5 miles from the Complex. PX 456. The only pollutants monitored by CAMS0148 are PM2.5 and VOCs. PX 457.

914. The Lynchberg Ferry monitor ("CAMS0615") is 3 miles west of the complex. PX 456.

915. A monitor in Wallisville is located about four miles northeast of the Complex. 8-224:14-24 [Cabe]; PX 456.

916. The LaPorte ("HRM8") and LaPorte Sylvan Beach ("CAMS556") monitors are located in Laporte, about five miles south of the Complex. Tr. 8-223:14 – 8-224:9 [Cabe]; PX 456. These are the closest monitors to the Complex when the wind blows north to south. Tr. 9-148:712 [Fraiser]; DX 196, Figure 3.

3. One type of monitoring device in use near the Baytown Complex is particularly unsuited to detect or measure the impacts of emission events.

917. The existing air monitoring stations in the Baytown area use one of two types of monitoring equipment: a canister or a gas chromatograph. The three HRM monitoring stations closest to the Baytown Complex (HRM7, HRM8, and HRM11), and the TCEQ monitoring station closest to the Baytown Complex (CAMS0148), all use canister-type devices to measure VOCs. DX 165, pp. 6, 16, and Table 5-1; PX 456; PX 457.

918. Canisters are the size of a one-gallon container, similar in shape to the one-gallon mayonnaise container that was displayed at trial. Tr. 8-219:7-10 [Cabe]; PX 618.

919. Canisters are poorly suited to detect and measure the impact of pollutants released in emission events for two reasons.

920. First, canister-type monitors collect samples over a 24-hour period, and the concentration levels they provide for the pollutants they detect are

given in the form of a single 24-hour average. Tr. 8-219:14- 16; 8-220:3-6 [Cabe].

921. This day-long average has the effect of flattening out, and hiding, the higher levels of acute exposure caused by a short-term release of a large amount of pollutants, as happens in many emission events. Tr. 8-220:17-19 [Cabe].

922. Second, canister-type monitors take samples only once every six days. Tr. 7-68:1-3 [Brooks]; Tr. 8-219:14-21 [Cabe]. On the other five days, these monitoring stations do not take samples. Tr. 7-68:5-6 [Brooks].

4. Examples of large emission events at the Baytown Complex that the stationary air monitors were unable to detect.

923. During an emission event at the refinery from 12/30/09 through 1/1/2010 (STEERS 133845), 516.5 lbs. of H_2S, 47,614.6 lbs. of SO_2, and other pollutants were released (including 1,703.7 lbs of unspeciated VOCs). Two citizen complaints were made to Harris County Public Health and Environmental Services, and odors were confirmed. The HRM7 monitor, however, was upwind during this event. PX 8, pp. 243-244; DX 196, p. 49.

924. During an emission event at the refinery beginning 4/24/2009 (STEERS 123381), 824.37 lbs. of H_2S, 3,978.68 lbs. of SO_2, and over 12,800 lbs. of other pollutants were released. Three citizen complaints were made to

Baytown and TCEQ. The HRM7 monitor, however, was upwind during this event. PX 8, pp. 214-216; DX 196, p. 50.

925. Although these two events have been removed from the case because they were subject to an earlier U.S. EPA consent decree, they illustrate the point that even vary large emission events can go undetected by the existing network of stationary air monitors.

E. Even the inadequate existing network of air monitoring stations shows high levels of pollutants from the Baytown Complex.

926. From 2005 through 2010, monitor readings at HRM7, the monitoring station located near the north fence line of the Complex, show a steady, elevated background level of 1-hour H_2S concentrations of 3 to 7 ppb or above, with a high of 48 ppb. Tr. 7-98:24-7-99: 7 [Brooks]; DX 165, Initial Report of David Cabe, Att. U.

927. Exxon's expert Mr. Cabe calculated that each year from 2005 through 2010, the HRM 7 monitor at the north fenceline of the Baytown Complex registered higher SO_2 levels, using the former 24-hour NAAQS standard, than the HRM 11 monitor located 5 miles to the east. Tr. 7-84:9-7-85:1; 7-83:2-7 [Brooks]; PX 490.

928. And for each 3-year period from 2005 through 2010, the HRM 7 monitor registered higher SO_2 levels, using the current 1-hour NAAQS standard, than the more distant HRM 11 monitor. PX 477, p. 10; PX 490.

929. The HRM 7 monitor has measured 1-hour SO_2 concentrations as high as 98 ppb when downwind of the Baytown Complex during emission events. On 1/9/2006, during one such event at the Complex, the HRM7 monitor registered three separate hourly readings above 75 ppb. DX 165, Att. P.

930. A 16-day-long emission event (STEERS 68364) occurred at the Olefins Plant from 11/22/2005 through 12/6/2005. During this event, over 22 tons of VOCs, including 1,648 lbs. of benzene and 1,519 lbs. of 1,3-butadiene, were released from a cooling tower at the plant. PX 17, at ETSC 000270-71. On 11/30/2005, during the midst of this emission event, and again on 12/6/2005, the last day of the event, the East Baytown HRM 11 monitor recorded 24-hour average benzene concentrations that were above the annual Texas regulatory threshold (the "air monitoring comparison value," or "AMCV") for benzene. The highest monitored 24-hour concentration during this period was 5.86 ppb, which is more than 4 times the AMCV of 1.4 ppb. No benzene readings were taken at HRM11 on any of the 5 days preceding Nov. 30, on any of the 5 days between Nov. 30 and Dec. 6, or on any of the 5 days following Dec. 6. Tr. 9-182:13-9:188:10 [Fraiser].

931. The HRM 11 monitor is located approximately 5 miles due east of the Baytown Complex and the HRM 8 monitor is located approximately 5 miles south of the Complex, with populated areas located in between the

Complex and each of those monitoring stations. The closer to the source of the benzene leak in STEERS 68364, the higher the ground-level concentrations of benzene would generally be expected to be. Tr. 9-186:16 – 9-187:19 [Fraiser].

932. Exxon's own expert witnesses identified numerous instances in which pollutant levels measured at a stationary air monitor in the vicinity of the Baytown Complex exceeded an air comparison value at the same time that an emission event was taking place at the Complex. Tr. 9-142:5-9 [Fraiser].

F. Specific pollutant emissions from the Baytown Complex cause significant threats to human health.

1. Sulfur Dioxide.

933. The Baytown Complex reported releasing a total of 2,543,820 pounds of SO_2 during emission events from 2006-2012. Many additional millions of pounds of SO_2 were released during normal, routine plant operations over this period. PX 609.

934. Based on his review of air dispersion modeling conducted by Exxon expert David Cabe, Dr. Brooks concluded that people living in the communities surrounding the Complex likely suffer acute and chronic health effects as a result of the Complex' emissions of SO_2 during emission events. Tr. 88:12 - 7:89:24 [Brooks]; PX 477, pp. 9-12.

935. Populations immediately adjacent to the Baytown Complex are particularly vulnerable to these SO_2 emissions, as very short-term (5-10 minute) exposures to SO_2 have substantial negative impacts on individuals with asthma, especially in areas, such as this one, where the population is simultaneously exposed to other pollutants as well. PX 476, p. 35.

936. SO_2 can cause adverse health effects even if the National Ambient Air Quality Standards (NAAQS) for SO_2 in the region are not violated. Compliance with those standards is determined by a three-year average of the fourth-highest levels measured at certain monitoring stations, and therefore compliance can be achieved even as significant short-term exposures occur. Tr. 7:81 - 7-82:10 [Brooks].

937. Repeated short-term exposures to elevated levels of SO_2 in the communities surrounding the Complex make individuals more susceptible to subsequent exposures to respiratory irritants. PX 476, p. 35; Tr. 7-87:17 – 7-88:3 [Brooks].

938. The air monitoring station nearest the Complex – but not stations further away – showed levels of SO_2 that were similar to the SO_2 levels found to be harmful in two peer-reviewed studies of populations living in close proximity to oil refineries. Tr. 7-83:25 – 7-85:1 [Brooks]; PX 477, pp. 11-12.

939. The Court finds it is likely that SO_2 emissions from the Baytown Complex cause or contribute to health effects for the general population in the

surrounding neighborhoods, such as worsening lung function, asthma, and COPD, and increased emergency room visits for people with asthma. PX 476, p. 35; PX 526 [at ETSC 022653].

2. Hydrogen sulfide.

940. The Court finds it is likely that H_2S emissions from the Baytown Complex cause or contribute to significant adverse health effects among populations immediately adjacent to the Baytown Complex. PX 476, p. 40; Tr. 7-108:13-25 [Brooks].

941. H_2S concentrations measured at an air monitoring station near the Complex (station "HRM 7") consistently ranged from a minimum of 3 ppb to a peak of 10 ppb or higher throughout the Claim Period. These concentrations are all significantly higher than the EPA-recommended long-term health threshold of 1.4 ppb. Tr. 7-98:18 - 7-99:13 [Brooks].

942. Exxon's own data, as reported on STEERS Reports and modeled by Sage Environmental, show that ambient H_2S concentrations from H_2S released during emission events at the Complex were above the EPA-recommended long-term health threshold of 1.4 ppb, and above health thresholds for acute H_2S exposure set in other states. PX 476, pp. 40-41; PX 604; Tr. 7-99:17 – 7-101:12 [Brooks].

943. Exxon's own data, as reported on STEERS Reports and modeled by Sage Environmental, also show that on occasion ambient H_2S

concentrations from H_2S released during emission events at the Complex were above even the 318 ppb reference value created by defense expert Dr. Lucy Fraiser. Tr. 7-105:23 and 7-106:25 – 7:108:3 [Brooks]. A release above that amount, according to Dr. Brooks, will definitely have respiratory and neurological effects. Tr. 7-108:2-8 [Brooks].

944. Background levels of H_2S in the ambient air in the communities surrounding the Complex are higher than the level EPA considers safe for long-term exposure. When emission events at the Complex release additional H_2S, this adds to those already high levels and exacerbates concomitant health problems. Tr. 7-108:13-21 [Brooks].

945. The levels of H_2S released during emission events at the Complex have been high enough to induce, at a minimum, neurological symptoms and respiratory complaints. Tr. 7:108:13-25 [Brooks].

946. The level of H_2S released during a February 21, 2009, emission event, in combination with the level of propane also released during that event, were high enough to cause neurological insomnia, restlessness, headaches, nausea, vomiting, and easy fatigability. Tr. 7-113:2-16 [Brooks].

947. Dr. Brooks reviewed a declaration by Stuart Halpryn, a neighbor of the Complex and a member of Plaintiff Environment Texas, who described symptoms he and his family experienced at the time of H_2S releases during emission events at the Complex. Tr. 7-109:25 – 7-110:4; 7-119:19 – 7-120:3

[Brooks]. The respiratory and neurological symptoms described by Stuart Halpryn are consistent with exposure to high levels of H_2S. Tr. 7-120:4-10 [Brooks].

3. Benzene and 1, 3-butadiene.

948. There is no safe threshold for exposure to carcinogens such as benzene and 1,3-butadiene. PX 477, p. 7. Emissions of benzene and 1,3-butadiene from emission events at the Baytown Complex contribute to elevated levels of these pollutants in the ambient air surrounding the Complex. An increased cancer risk, above the 1-in-1 million standard used by U.S. EPA, is likely from long-term exposure to these carcinogens even at concentrations well below the Texas ESLs of 1.4 ppb for benzene and 9.1 ppb for 1,3-butadiene. PX 476, pp. 8-9, 25; PX 477, pp. 7-9.

949. On a number of occasions, benzene releases during emission events were modeled to be above a regulatory threshold. Tr. 7-136:22-25 [Brooks]. The Baytown Complex emitted benzene during emission events that were ten times the Texas ESL for an acute exposure, and 500 times the ESL for chronic exposure. Tr. 7-134:20 – 7-136:9 [Brooks]; PX 483.

950. The Court finds that Exxon's emissions of benzene, 1,3-butadiene and other carcinogens (such as xylene, isoprene, ethylbenzene and hexane) during emission events are likely to have increased lifetime cancer risks for populations living near the Baytown Complex.

4. Hydrogen chloride.

951. The Complex has released hydrogen chloride during emission events in amounts so large that they caused off-site concentrations levels well above the 130 ppb Texas ESL for HCl, levels which are high enough to cause healthy persons to cough, and to substantially exacerbate the symptoms of children who have asthma or poor lung function. Tr. 7-139:15 - 7-140:18 [Brooks]; PX 478, pp. 4-6.

952. Plaintiffs' expert Dr. Brooks explained why the ESL for hydrogen chloride may actually underestimate the potential risk for vulnerable populations. PX 477, pp. 3-4.

953. The Court finds that Exxon's large releases of HCl during emission events created a risk of significant, adverse health effects to exposed populations.

5. Ozone.

954. Harris County is in non-attainment of NAAQS for ozone levels. Tr. 8-196:19-23 [Cabe].

955. The Baytown Complex reported emitting hundreds of tons of HRVOCs (ethylene, propylene, 1,3-butadiene, and butenes) between 2005 and 2013 (from 6 to 88 tons per year) in emission events alone, and caused 18 violations of TCEQ's HRVOC Rule, which is specifically intended to prevent industrial emissions from causing violations of ozone standards. PX 3; PX

476, p. 5; PX 595; Tr. 8-206:18 – 8-207:4 [Cabe]. The Baytown Complex has also released thousands of tons of carbon monoxide and nearly 100 tons of nitrogen oxides, which are also ozone precursors, during emission events. PX 609.

956. The Court finds that Exxon's unauthorized releases of large amounts of ozone precursors during emission events contributed to the ongoing ozone problem in the Houston area.

957. The Court rejects the opinion of Defendants' expert David Cabe on this subject, finding that Mr. Cabe is unqualified to offer an opinion on whether Exxon's emissions contributed to elevated ozone levels.

958. Mr. Cabe testified that he is not an expert in the complex photochemistry of ozone. Tr. 8-200:4-8 [Cabe]. In fact, Mr. Cabe did not know that carbon monoxide, one of the pollutants emitted in the largest amounts during Baytown Complex emission events, is an ozone precursor and thus did not include emissions of carbon monoxide in his analysis at all. Tr. 8-200:9 – 8-201:10 [Cabe].

959. Mr. Cabe testified that he does not know how far ozone precursors can travel in the air before they *begin* to form ozone, and has not read the studies of ozone formation and transport in the Houston Ship Channel area. Tr. 8-202:14 – 8-203:20 [Cabe].

960. He does not know how far ozone formed in the Houston Ship Channel area can travel, although he is aware that ozone formed in other *states* reaches the Houston area. Tr. 8-203:21 – 8-204:4 [Cabe].

961. Although Mr. Cabe performed calculations of the relative size of Exxon's emissions as a percentage of the overall "soup" of ozone precursors in the air in Harris County, he admitted that he does not know what the threshold size must be before Exxon's emissions contribute to high ozone levels. Tr. 8-210:23 – 8-211:18 [Cabe].

962. And Mr. Cabe has no opinion on whether the ozone exposure standards were appropriately set. Tr. 8-189:7-10 [Cabe].

963. In sum, Mr. Cabe concedes he is not qualified on the subjects of how, where, and when ozone forms or how long it persists. Given this lack of knowledge, Mr. Cabe can provide no reliable basis or methodology regarding the ozone monitoring data on which he bases his conclusions: if he does not know when ozone forms after a release of ozone-forming pollutants, how long the ozone will persist in the ambient air once formed, how far it can then be transported, he cannot know which stationary air monitors, during which time periods, from which to gather and analyze ozone monitoring data. He also failed to consider releases of carbon monoxide, an ozone precursor, in his analysis, and admitted he does not know the extent to which Exxon's releases contributed to elevated ozone levels. It is thus not possible for Mr. Cabe to

offer a reliable opinion regarding the contribution of Exxon's emissions to ozone levels.

964. The Court notes, however, that Mr. Cabe did admit that all sources of ozone precursors in Harris Country contribute to the formation of ozone in the area (Tr. 8-204:5-14 [Cabe]), and that to prevent the occurrence of elevated ozone levels the emissions of ozone precursors should be decreased (Tr. 8-205:2-11 [Cabe]).

G. Citizens call the Baytown Complex and the Baytown City Council to complain about air pollution and flaring from the Complex.

965. During a presentation by Exxon at the October 24, 2013, Baytown City Council meeting, a councilman stated that his constituents observe and are concerned about flaring at the Baytown Complex, ask him questions about the flaring, and often call and re-call him about the flaring. DX 547, p. 12, line 17-22.

966. The Baytown Complex has received many calls from neighbors complaining about pollution during the Claim Period. PX 416.

967. Exxon maintains a log of complaints made by people calling in to the Complex. The complaint log is in the form of an Excel spreadsheet. Tr. 2-246:9-12 [Kovacs]; PX 416.

968. Exxon's Public Affairs group at the Complex is responsible for maintaining the complaint log. Tr. 2-247:2-8-18 [Kovacs]. No one in Exxon's

Environment Section, however, has any responsibility to review the complaint log. Tr. 2-247:19-21 [Kovacs].

969. Many times, Exxon personnel have noted on the complaint log that the date and time of a citizen complaint corresponds to the date and time of an emission event occurring at the Complex. PX 416.

970. For example, during an emission event at the refinery that began on 2/16/2008 and lasted four days, three hazardous air pollutants – benzene, ethylbenzene, and toluene – were released in a ground-level mist from a storage tank and a sewer drain. Exxon received 5 citizen complaints on 2/18, the third day of the event. PX 416 [EOMCS00166208-09].

H. Plaintiffs' members are harmed by Exxon's violations.

1. Diane Aguirre Dominguez.

971. Diane Aguirre Dominguez is a member of Environment Texas, and has been since she first joined the organization as a dues paying member in 2010. Tr. 1-192:13-22 [Aguirre]; PX 339.

972. Diane Aguirre Dominguez is also a member of Sierra Club, and has been since she first joined the organization as a dues paying member in June 2010. Tr. 1-192:2-12 [Aguirre]; PX 342.

973. Ms. Aguirre testified that, although she had been aware of the organizations before 2010, she decided to join them when she heard they were

working on this enforcement action and she "wanted to be a part of it." Tr. 1-192:23 – 1-193:7 [Aguirre].

974. Ms. Aguirre learned about the possibility of this lawsuit being filed after her mother, who lives in Baytown (Tr. 1-194:21-23[Aguirre]), spoke with an Environment Texas door-to-door canvasser about the organization's air quality work and she suggested that they contact her daughter (Tr. 1-211:24 – 1-212:9 [Aguirre]).

975. Ms. Aguirre grew up in Baytown and lived at 1016 Dailey Street with her parents, and younger sister and brother. Tr. 1-193:8-16; 1-194:21 – 1-195:1 [Aguirre]. Her family's home is about a mile and a half from the Baytown Complex. Tr. 1-194:14-16 [Aguirre]. Ms. Aguirre has other family who live in Baytown near her family's home (Tr. 1-195:2-11 [Aguirre]), and she attended Baytown schools and Lee College, which is less than two miles from the Complex (Tr. 1-195:12 – 1-196:7 [Aguirre]).

976. There are no industrial facilities as close to her home as the Baytown Complex. Tr. 1-194:17-20; 1-209:17-23 [Aguirre].

977. Ms. Aguirre transferred to the University of Houston, from which she graduated in 2010 with a bachelor of arts degree in English and a bachelor of science degree in political science. Tr. 1-196:16 – 1-197:1 [Aguirre]. During the time she attended the University of Houston, she spent every

summer, every holiday, and nearly every weekend at her parents' home in Baytown. Tr. 1-197:8-25 [Aguirre].

978. Ms. Aguirre lived and worked in Houston from 2006 until 2013. Tr. 1-197:3-7; 1-198:1-5; 1-198:23 – 1-199:9 [Aguirre]. One of Ms. Aguirre's jobs after graduating from college was as a field organizer for a group called the Texas Campaign for the Environment. She testified that she decided to work for an environmental group because of the effects of air pollution she had experienced growing up in Baytown. Tr. 198:1-22 [Aguirre].

979. In March of 2013, Ms. Aguirre moved to Oakland, California, where she works as a travel writer. Tr. 1-199:6-9 [Aguirre]. Now that she is living in Oakland, Ms. Aguirre still returns to Baytown with regularity to visit her family, and stays at her parent's home during these visits. She plans to continue these visits in the future, including a planned visit home for the holidays in 2014. Her most recent visit, apart from staying with her parents for this trial, was when she spent the last week of December 2013 with her family in Baytown for the holidays. Tr. 1-199:10-25 [Aguirre].

980. Ms. Aguirre is 25 years old. Tr. 1-195:1 [Aguirre].

981. Growing up in Baytown, Ms. Aguirre often smelled air pollution from the Baytown Complex. She noted "sulfury" and "gasoline" smells that she testified could not have come from any source other than the "huge complex" that was closest to where she grew up. Tr. 1-200:1-17 [Aguirre].

982. Ms. Aguirre testified that she can smell these odors at her parents' home, at Lee College, and at Bicentennial Park (which is near the Complex). Tr. 1-200:22 – 1-201:15 [Aguirre]. She testified that there are days when the odors are more pronounced and noticeable than on other days. Tr. 1-201:16-19 [Aguirre].

983. While living in Baytown, Ms. Aguirre developed "allergy-like symptoms," characterized by running nose, watery eyes, and chest constriction. Tr. 1-205:6-18 [Aguirre]. When she lived at her parents' home she took medications for these conditions, such as Claritin and Benadryl. Tr. 1-205:22-25; 1-219:1-14 [Aguirre]. These symptoms improved when she moved away from Baytown and she has been able to stop taking those medications, but she experiences them again whenever she goes home to visit her family in Baytown. Tr. 1-205:19 -1:206:11 [Aguirre].

984. On her trips home to Baytown, Ms. Aguirre sees and smells air pollution from the Baytown Complex. While visiting her family, she often sees "smoke coming out" of the Complex, and she sees a "brownish haze" over the Complex when driving in Baytown and on Spur 330, which runs by the plant. Tr. 1-202:2-17 [Aguirre]. She sees flare flames at the Complex "really often every time you drove by." Tr. 1-203:1-8; 1-218:6-17 [Aguirre]. She finds these sights and smells worrisome because they indicate that Exxon is emitting chemicals, including cancer-causing chemicals into the air; she is also

concerned about physical safety and the risk of explosion from an emergency condition at the Complex. Tr. 1-203:9 – 1-204:2 [Aguirre].

985. Odors from Exxon are a concern for Ms. Aguirre because "since I'm smelling it, I'm obviously breathing in whatever it is; and like I said, I know that they emit chemicals that are harmful. And so the smell to me is associated with something harmful." Tr. 1-204:4-9 [Aguirre]. Ms. Aguirre testified that the cancer-causing chemicals that Exxon emits during emission events are of particular concern to her. Tr. 1-203:13 – 1-204:2 [Aguirre].

986. One of the recreational activities that Ms. Aquirre enjoys is running outdoors. She would like to run when she is visiting Baytown, but she refrains from doing so because she finds that when she runs outdoors in Baytown the quality of the air causes her to have labored breathing and an abrasive feeling in her throat and lungs. Were the air in Baytown less polluted, she would go running and exercise outdoors more frequently during her visits to Baytown. Tr. 1-204:10 – 1-205:5 [Aguirre].

987. Ms. Aguirre testified that, because she is aware that there have been approximately 4,000 emission events at the Baytown Complex since 2005, she has been exposed to pollution from emission events on many occasions. Tr. 1-208:20 – 1-209:6 [Aguirre]. She testified that she does not want to breathe unauthorized air pollution from the Baytown Complex when

she is visiting Baytown, and it would lessen her health concerns if this pollution were reduced. Tr. 1-207:4-9 [Aguirre].

988. Ms. Aguirre is concerned that the pollution from Exxon will harm her parents and her younger brother and sister, all of whom still live in the house in Baytown where Ms. Aguirre grew up. Tr. 1-206:12-22 [Aguirre].

2. Marilyn Kingman.

989. Marilyn Kingman is a member of Sierra Club, and has been an active member since 2008. Tr. 6-69:11-14 [Kingman]; PX 343. She joined the group because she is "interested in fresh air" and this is an issue that Sierra Club works on. Tr. 6-69:15-17 [Kingman].

990. Ms. Kingman has lived in the Baytown area since the 1970s, where she taught physical education and mathematics in the public schools. She is currently retired, and lives in Mont Belvieu, a town bordering Baytown. Tr. 6-69:20 – 6-71:3-19 [Kingman].

991. Ms. Kingman travels into Baytown many times every week. She goes into Baytown for all her shopping, banking, and doctor visits, to attend church services and meetings, and to go to the cleaners. Tr. 6-71:20-21; 6-72:9 – 6-73:17 [Kingman].

992. Ms. Kingman also volunteers at a thrift shop that is nearly adjacent to the Baytown Complex, and she attends every home basketball game at Lee College, which is also close to the Complex. Tr. 6-74:1-15 [Kingman].

993. On her way into Baytown, and at these locations, Ms. Kingman can often see the Baytown Complex, see flares at the Complex and a gray or brown haze hanging over or around it, and smell chemical odors coming from it. The chemical odors are sometimes very strong, and at other times not. Tr. 6-75:2 – 6-76:15 [Kingman].

994. Ms. Kingman testified that she always tries to be aware of wind direction, because the wind carries emissions from industrial plants. For this reason, she testified, she is aware of when the odors she smells are coming from the Baytown Complex. Tr. 6-80:6 – 6-83:10 [Kingman].

995. The odors Ms. Kingman smells emanating from the Baytown Complex cause her to be concerned for her health. Tr. 6-76:16-23, 6-83:6-12 [Kingman]. For health reasons, Ms. Kingman would prefer not to breathe the air that she smells from the Baytown Complex. Tr. 6-76:16-23; 6-83:6-12 [Kingman]. One of health concerns she has from breathing Exxon's emissions is getting cancer. Tr. 6-78:1-7 [Kingman].

996. Sometimes the flare flames she sees at the Complex are very large, and she has frequently seen dark smoke coming from the flares. Flaring events concern and frighten her, as she is worried that they signify the release of harmful chemicals, and she is worried for her physical safety because she knows flaring is often done because something is going wrong at a unit. Tr. 6-78:13 – 6-80:5 [Kingman].

997. Because of concerns for her health, Ms. Kingman limits her activities in Baytown when she smells odors from the Complex, or when she sees the haze above the Complex. She also limits her outdoor activities with her grandchildren in Baytown at such times, because of her concern about their health. Tr. 6-77:1-24 [Kingman].

998. Ms. Kingman testified that she continues to experience offensive odors coming from the Baytown Complex. On February 6, 2014, four days before trial commenced, she smelled a chemical odor emanating from the Complex while she was driving on Highway I-10. Tr. 6-94:23 – 6-95:9 [Kingman].

999. Six days later, on February 13, 2014, three days after trial commenced, Ms. Kingman smelled a strong, unpleasant chemical odor coming from the Complex while she was at a grocery store in Baytown. Tr. 6-94:2-22 [Kingman]. This latter incident can be correlated with an emission event at the Baytown Complex. Exxon's records show that an emission event occurred from February 12-14, 2014, and released, among other chemicals, 605 pounds of benzene. PX 20A.

3. Richard Shae Cottar.

1000. Richard Shae Cottar has lived in Baytown for 38 years, since he was three years old, with the exception of the time he spent in college. He has

a bachelor's degree in communications from East Texas Baptist University. Tr. 1-100:23 – 1-101:1; 1-101:18 – 1-102:2 [Cottar].

1001. Mr. Cottar is a member of Sierra Club, and has been a dues paying member since he joined in October 2010. Tr. 1-98:18 – 1-99:13 [Cottar]; PX 345.

1002. Mr. Cottar joined Sierra Club because he was interested in joining an environmental group, he believes Sierra Club's pursuit of improving air quality is important, and he wanted to invest himself in the cause. Tr. 1-99:14 – 1-100:4 [Cottar].

1003. He learned about the possibility of this lawsuit being filed in September or October of 2010, when he was working as the communications director for an organization called Air Alliance Houston. The executive director of that organization told Mr. Cottar that the Plaintiff groups were considering legal action against Exxon, because he was aware that Mr. Cottar had just moved to a residence across the street from the Baytown Complex and had concerns about the location. Tr. 1-100:10 – 1-101:13 [Cottar].

1004. From April 2010 through September 2012, Mr. Cottar and his wife and children lived across the street from the Baytown Complex's refinery and olefins plant, at 3206 Briar Court (in the Shady Hill subdivision). Tr. 1-102:7 – 1-103:6 [Cottar]. In September 2012, Mr. Cottar and his family moved to 1008 Wright Boulevard in Baytown, approximately two miles east of

the Complex, and he has lived there since that time. Tr. 1-102:3-4; 1-106:5-11 [Cottar]. Mr. Cottar lives with his wife and with his three children from a former marriage, who live with him every other week. Tr. 1-106:23 – 1-107:5 [Cottar].

1005. While living at the Briar Court address, Mr. Cottar regularly saw and heard flaring events at the Baytown Complex from his home. Tr. 1-109:12-20 [Cottar]. About once a week while living there, Mr. Cottar saw or heard flaring events that were audibly disruptive, that involved plumes of black smoke, that involved flames nearly as large as the flare stacks themselves, that sometimes rattled the windows his house, and which lasted for several hours in duration. These experiences interfered with his enjoyment of his home, and caused him to be concerned about his own health and safety and that of his family. Tr. 1-108:17-20; 1-118:13-24; 1-121:7 – 1-123:18 [Cottar].

1006. Mr. Cottar has taken video recordings of flaring events and air pollution that he has seen coming from the Baytown Complex. Tr. 1-123:19 – 1-128:7 [Cottar]; PX 398, 400. One of these recordings, taken inside and just outside his home, included a portion of a flaring event whose noise woke him in the middle of the night. Tr. 1-128:2 – 1-129:23 [Cottar].

1007. On another occasion, Mr. Cottar recorded large plumes of black smoke coming from two flares during a flaring event that continued from approximately 9:30 p.m. on May 22, 2012, until after midnight. The visible

emissions and "very, very strong odors" during this event, and his inability to obtain any information from Exxon during the event despite many calls, caused him great concern for his and his family's health and safety. Tr. 1-134:23 – 1-142:5.

1008. Mr. Cottar was been able to correlate approximately a half dozen particularly noticeable pollution incidents that adversely affected him with specific emission events at the Baytown Complex reported by Exxon using the STEERS system, including the two events that he video-recorded. Tr. 1-120:2 – 1-121:6; 1-129:14-23; 1-140:24 – 1-141:19 [Cottar]. In addition, Mr. Cottar testified that there were numerous other instances in which he experience adverse impacts from Baytown Complex emissions for which he did not create a record of specific dates and times. Tr. 1-188:3-23 [Cottar].

1009. On many occasions, Mr. Cottar has smelled strong, pungent chemical odors from the Complex that he found offensive and that, on occasion, caused physical pain when he breathed them. Tr. 1-109:21 – 1-112:3; 1-118:17 – 1-119:18; 1-128:4-7; 1-131:5 – 1-132:4; 1-142:4-5 [Cottar]. Mr. Cottar knows when odors are caused by the Baytown Complex because when the wind is blowing away from him during flaring events, he does not smell them; when the wind is blowing toward him during flaring events, he does smell them. Tr. 1-119:5-18 [Cottar].

1010. On one occasion, he and his children smelled a sweet, powerful chemical odor while in the car driving approaching the Baytown Complex that Mr. Cottar attributed to Exxon's emissions. The odor became more intense the closer the car got to the Complex. Mr. Cottar testified that the odor caused pain in his sinus cavity when he inhaled it. Tr. 1-109:21 – 1-110:20 [Cottar].

1011. When he was living with his family at the Briar Court residence, the odors from the Complex were sometimes so strong that they awakened him from sleep in the middle of the night. Tr. 1-176:6-9 [Cottar].

1012. Mr. Cottar, his wife (a life-long Baytown resident), and two of his children are asthmatics. Tr. 1-147:17-20 [Cottar]. Mr. Cottar has observed that his, his wife's, and children's asthma symptoms are exacerbated by Exxon's air emissions; when they were living at their home in Briar Court, virtually every time there was a flaring event at the Complex one or more of them experienced an asthmatic reaction. Tr. 1-149:10-19; 1-187:12-24 [Cottar]. While living at Briar Court, Mr. Cottar and his family required a nebulizer for their asthma symptoms. Tr. 1-148:3 – 1-149:14 [Cottar]. Mr. Cottar believes, based on his experience, that emissions from Exxon exacerbated his and his family's asthma symptoms. Tr. 1-187:4 – 1-188:1 [Cottar].

1013. It was concern for his and his family's health and safety that motivated Mr. Cottar to move his family further away from the Baytown

Complex. Tr. 1-144:21-1-145:17 [Cottar]. Now that they are living further away from Exxon's air emissions, Mr. Cottar and his family no longer need a nebulizer for their asthma. Tr. 1-148:3 – 1-149:14 [Cottar].

1014. Mr. Cottar has often called TCEQ to complain about Exxon emissions, but found TCEQ's responses unhelpful. If TCEQ sent an investigator, it would typically not be until three days after the event had ended, and sometimes as long as five or six days later. At times, Mr. Cottar could not even reach anyone who would take a report. Tr. 1-113:5 – 1-116:25 [Cottar].

1015. On one occasion in early summer 2010, Mr. Cottar called Harris County Pollution Control at 9:45 p.m. on a Friday night to complain about an emission event. The investigator who answered was at home in Galveston, without his equipment, and could not get to the Complex until long after the event had ended. Tr. 1-113:9 – 1-114:19 [Cottar]. Because Exxon contends that Plaintiffs' members only took an interest in emission events after they had joined as members, the Court notes that Mr. Cottar made this complaint prior to joining Sierra Club on October 2010.

1016. Air pollution from the Baytown Complex interferes with Mr. Cottar's recreational activities. Because of concern for their health, Mr. Cottar currently limits his and his family's outdoor activities (running, biking, skateboarding, and playing at parks near the Complex) during times when

there are ozone alerts, and at times when he notices an emission event occurring at the Baytown Complex. They would engage in these activities more often were it not for the odors emanating from the Baytown Complex. Tr. 1-152:11-21 [Cottar].

1017. Most recently, he and his family cut short a January 2014 visit to the Baytown Nature Center (located very close to the Baytown Complex) when they saw black smoke billowing from a flare at the Complex. They left earlier than they had intended because of health and safety concerns about the flaring. Before leaving, Mr. Cottar photographed the smoke coming from the flare. Tr. 1-177:2 – 1-179:7 [Cottar]; PX 612.

1018. Mr. Cotter's concerns about air emissions from the Exxon facility have not been eliminated since moving to his current home on Wright Boulevard. Tr. 1-152:22 – 1-153:8 [Cottar].

1019. Mr. Cottar does not want to breathe pollutants that are illegally emitted, and his concerns about air quality would be lessened if Exxon were to reduce its emissions of unauthorized pollutants. Tr. 1-153:9-20 [Cottar].

4. <u>Sharon Sprayberry.</u>

1020. Sharon Sprayberry is a member of Sierra Club, and has been since August 2010. Tr. 6-5:20-23 [Sprayberry]; PX 344 .

1021. Ms. Sprayberry joined Sierra Club because she is concerned about air quality and the breathing difficulties she experiences while breathing

polluted air, and clean air is something Sierra Club works toward. Tr. 6-5:24-6-6:14 [Sprayberry].

1022. Ms. Sprayberry grew up in Baytown, and lived there from the time she was born until 1968, when she moved away from Baytown to attend college and then to pursue a career in the Navy. Tr. 6-6:18-19; 6-7:22 – 6-8:23 [Sprayberry].

1023. As a child in Baytown, Ms. Sprayberry developed severe asthma. However, after she moved away from Baytown, she became essentially free of respiratory symptoms. Tr. 6-6:15 – 6-7:20; 6-8:1-8; 6-10:2-6 [Sprayberry].

1024. After retiring from the Navy with a grade of Lieutenant Commander (Tr. 6-9:3-7), Ms. Sprayberry first settled in Corpus Christi, where her respiratory symptoms and asthma began to recur. She attributes this to the fact that she lived and worked in proximity to several refineries in Corpus Christi. Tr. 6-10:7-25 [Sprayberry].

1025. Ms. Sprayberry returned to Baytown in 2004 (Tr. 6-11:23-25), and moved to an address about one mile east of the Baytown Complex, where she lived until late May 2012. Tr. 6-12:18-6-13:13, 6-37:2-5 [Sprayberry].

1026. After her return to Baytown, Ms. Sprayberry found that her respiratory symptoms became even more severe. As a result, she took respiratory medication and started using inhalers and nebulizers to control her respiratory issues. Tr. 6-15:7-14 [Sprayberry]. She was prescribed the

medication Singulair to treat her respiratory problems. Tr. 6-68:6-7 [Sprayberry].

1027. While living at this address in Baytown, Ms. Sprayberry could hear the flares at the Exxon Complex from inside her Baytown home. Tr. 6-33:21 – 6-34:2 [Sprayberry]. During an emission event that began on April 19, 2009, the roar of the flares was so loud, and the flares lit up the night sky for so many days, that Ms. Sprayberry worried that they indicated that an explosion was imminent. Tr. 6-19:10 – 6-20:1 [Sprayberry].

1028. Ms. Sprayberry lodged a complaint with Exxon regarding this event at 3:40 a.m. on April 19, 2009. Tr. 6-17:17 – 6-18:23 [Sprayberry]; PX 416 [at EOMCS00166212]. Because Exxon contends that Plaintiffs' members only took an interest in emission events after they had joined as members, the Court notes that Ms. Sprayberry made this complaint prior to joining Sierra Club and prior to the date Plaintiffs sent the first notice of intent to sue in November 2009.

1029. While living at this address in Baytown, Ms. Sprayberry could see haze and smoke emanating from the Baytown Complex and its flares from many places in her neighborhood. Tr. 6-34:20-6-35:20 [Sprayberry].

1030. In late May 2012, in order to be able to breathe cleaner air and to alleviate her asthma symptoms, Ms. Sprayberry moved with her mother to McGregor, Texas (near Waco). Tr. 6-37:2-16 [Sprayberry].

1031. Ms. Sprayberry still has friends and professional connections in Baytown, which she considers her hometown. She wants to return to Baytown to visit her friends and attend events at the Baytown schools, but on her last visit the air quality there affected her breathing so strongly that she does not think she can come back unless the air quality improves. Tr. 6-38:2-19 [Sprayberry].

1032. Ms. Sprayberry finds the air in Baytown to be heavy, smoggy, and smoky, and that it sometimes has a chemical smell. Tr. 6-15:18 – 6-16:19 [Sprayberry]. Ms. Sprayberry can generally tell when the wind is blowing from the Baytown Complex because of the heightened chemical and sulfur smell in the air during those times. These smells concern her because of their potential to adversely affect her health. Tr. 6-36:1 – 6-37:1 [Sprayberry].

1033. Ms. Sprayberry has reviewed STEERS Reports filed by Exxon and understands that the Exxon Complex emits carcinogens during some emission events, which concerns her when she is in Baytown. Tr. 6-36:19 – 6-37:1 [Sprayberry].

1034. Ms. Sprayberry has contacted Exxon and the U.S. EPA to complain about or obtain information about specific emission events she has seen, heard or smelled at the Baytown Complex. Tr. 6-17:7-16, 6-20:2-19 [Sprayberry]; PX 416 [at EOMCS00166212]; PX 615-16.

1035. The last time Ms. Sprayberry visited Baytown, she experienced a difference in her breathing within just a few hours, because of the air quality, and she consequently cut her visit short to alleviate her respiratory symptoms. Tr. 6-38:11-19 [Sprayberry].

1036. Ms. Sprayberry would like to visit Baytown more often than she currently does, and would do so if the air quality were better. In fact, she testified that she would have retired in Baytown if the air quality were better. Tr. 6-38:20-22 [Sprayberry].

I. The testimony of Defendants' Baytown witnesses is not probative.

1037. Exxon offered the testimony of three Baytown residents. The Court does not find the testimony of these witnesses relevant to the issue of liability, or probative regarding the issues of Plaintiffs' standing to sue, injunctive relief, or the assessment of civil penalties. Moreover, as discussed below, each of these witnesses has financial or personal ties to Exxon that undermine the credibility of their testimony.

1. Fred Aguilar

1038. Fred Aguilar is President of the West Baytown Civic Association (Tr. 10-131:16-22 [Aguilar]), which meets monthly and has an Exxon representative present at every meeting (Tr. 10-135:8-18 [Aguilar]). Mr. Aguilar testified to his opinion about whether Exxon is a good corporate

citizen, which he based on the information he receives from the Exxon representative who attends the meetings. Tr. 10-154:10-17 [Aguilar].

1039. Members of the West Baytown Civic Association work at Exxon's Baytown Complex. Tr. 10-145:2-4 [Aguilar].

1040. Mr. Aguilar received the ExxonMobil Refiner of the Year Award on behalf of the West Baytown Civic Association. Tr. 10-146:1-5; 10-147:8-21[Aguilar].

1041. Exxon provides monetary remuneration to the West Baytown Civic Association by sponsoring an annual, end-of-school party for children. Tr. 10-148:15-23 [Aguilar].

1042. Mr. Aguilar admits that people feel safer because there is a green belt around the Refinery "if anything ever happened," but admits that the green belt does nothing to prevent any of the air pollution from Complex from coming over to the West Baytown area. Tr. 10-145:13-19; 10-149:5 – 10-150:5 [Aguilar].

1043. Mr. Aguilar also admits that because he has lived in Baytown for so long (35 years), he may no longer notice the odors coming from the Complex. Tr. 10-130:13-15; 10-152:3-18 [Aguilar].

1044. Mr. Aguilar does, however, often see smoke coming out of the Baytown Complex flares. Tr. 10-153:2-4 [Aguilar].

2. Gordon Miles

1045. Gordon Miles' sole knowledge regarding this lawsuit comes from what he has read in the local papers. Tr. 12-95:1-4 [Miles].

1046. After reading about the trial in the paper, Mr. Miles sent a letter to Exxon headquarters in Irving, Texas, volunteering his help in this lawsuit, because his livelihood is supported by the business Exxon brings into the community. Tr. 12-89:8-20; 12-95:23 – 12-96:6 [Miles].

1047. Mr. Miles testified that he usually stays home and does not go out much. Tr. 12-94:7-11 [Miles]. Though Mr. Miles has lived 2,000 yards from the Baytown Complex for almost 30 years (Tr. 12-88:3-6 [Miles]), he claims that he has not observed any odors coming from the Complex for 15 years (Tr. 12-93:1-7 [Miles]), nor has he heard any sirens going off at the Refinery (Tr. 12-93:8-10 [Miles]).

3. Billy Barnett

1048. Billy Barnett has lived in close proximity to the Baytown Complex for 37 years. Tr. 11-104:17-19 [Barnett]. In 1997, Exxon bought Mr. Barnett's house on Wooster Street in Baytown, along with all of the other houses in that former neighborhood next to the Complex. Tr. 11-121:25 – 11-122:19 [Barnett].

1049. Mr. Barnett has worked as a pipefitter at the Baytown Complex (Tr. 11-105:20-24 [Barnett]), and Mr. Barnett's father worked for Exxon for 42

years as a Chief Operator at the Baytown Complex (Tr. 11-113:12-19 [Barnett]).

1050. Mr. Barnett is president of the Baytown Nature Center. Tr. 11-107:18-20 [Barnett]. Exxon assists in the development of the Nature Center by donating money every year and by having Exxon employees participate in the annual United Way Day of Caring. Tr. 11-110:11-111:2 [Barnett].

1051. Like Mr. Aguilar, Mr. Barnett is a recipient of the ExxonMobil Refiner of the Year Award. Tr. 11-112:2-6 [Barnett].

J. The Court gives little weight to the opinion of Exxon's expert Dr. Lucy Fraiser that Exxon's violations did not harm Plaintiffs' members or the general public.

1052. Exxon offered Dr. Lucy Fraiser as an expert witness on the issue of whether Exxon's emissions created a condition of air pollution. Exxon's expert David Cabe, who provided air dispersion modeling results and stationary air monitoring data for Dr. Fraiser to evaluate, has no medical or toxicological training and offered no opinions regarding the health impacts of emissions. Tr. 8-186:24 – 8-187:17; 8-189:7-14 [Cabe].

1053. Dr. Fraiser is a toxicologist. She does not hold a medical degree, is not licensed to provide medical diagnoses or treatment to patients. 9-131:1-4 [Fraiser]. She represents industrial clients. Tr. 9-131:19 - 9-133:24 [Fraiser].

1. Dr. Fraiser opined on whether emission events caused or contributed to a "condition of air pollution."

1054. Dr. Fraiser testified that of the emission events she reviewed, not a single one could have caused or contributed to a "condition of air pollution."

1055. Dr. Fraiser used the definition of "condition of air pollution" that appears in the Texas Health and Safety Code. Tr. 9-134:4-6 [Fraiser]. Texas Health and Safety Code § 382.003(3) defines "air pollution" as "the presence in the atmosphere of one or more air contaminants or combination of air contaminants in such concentration and of such duration that: (a) are or may be injurious to or to adversely affect human health or welfare, animal life, vegetation, or property; or (b) interfere with the normal use or enjoyment of animal life, vegetation, or property." Tr. 9-133:25 – 9:134:15; 9-135:24 – 9-136:4 [Fraiser].

1056. Dr. Fraiser did not analyze all emission events at issue in the case. Dr. Fraiser only analyzed emission events for which modeling by Mr. Cabe or Mr. Parmley showed that an air comparison value was exceeded. Tr. 9-52:18-22 [Fraiser]. She did not analyze, and offered no opinion on, approximately100 reportable events that were subject to TCEQ penalties or occurred during Hurricane Ike. Tr. 9-149:19 - 9-150:8 [Fraiser].

1057. Dr. Fraiser admitted on cross examination that the following symptoms – most of which were reported in Plaintiffs' members' testimony or

in citizen complainants to Exxon and TCEQ – are all adverse effects on human health: nausea, headaches, difficulty breathing, a burning sensation in one's nose, dizziness, burning or watering eyes, and psychological injuries tied to something physical. Tr. 9-134:16 - 9-135:23 [Fraiser].

1058. Dr. Fraiser also testified that if pollutants released in an emission event awakened people in the night – as reported by Sierra Club member Shae Cottar – or caused someone to leave their backyard and go inside, that would constitute interference with a person's normal use or enjoyment of property. Tr. 9-136:12-25 [Fraiser].

2. Dr. Fraiser did not speak with anyone who lived near the Complex to determine whether Exxon created a condition of air pollution.

1059. In determining whether emission events caused adverse health effects or a condition of air pollution, Dr. Fraiser did not take any steps to determine whether particular individuals were made ill by particular events. Tr. 9-140:18-22 [Fraiser].

1060. In forming her opinion, Dr. Fraiser did not canvass the neighborhoods around the Complex to interview people who lived near the plant; did not contact people who had made complaints about air pollution in Baytown or about emission events at the Baytown Complex; did not speak with physicians at Baytown area hospitals or health clinics about health issues that may have an environmental component in the area; did not visit the homes

or neighborhoods of Plaintiffs' members who testified at trial. Tr. 9-138:24 - 9-139:10; 9-140:15-17; Tr. 9-167:9-11 [Fraiser].

1061. Dr. Fraiser took the position that "me talking to a complainant would not tell me anything about whether they were exposed to emissions from Exxon's plants. I have to look at the data that exists." Tr. 9-167:12-17 [Fraiser]. This position is not credible. The testimony of Plaintiffs' members who have lived near the Complex, for example, explains the ways in which they know they are exposed to Complex emissions. They can tell when the direction of the wind is coming from the plant, and can see pollutants drifting their way from the plant. They testified that they can frequently smell (and thus inhale) pollutants with characteristic odors, and testified about the immediate adverse respiratory effects and other symptoms they experienced as a result. Dr. Fraiser's willingness to completely rule out this type of information casts doubt on the credibility of her opinions and the validity of her methodology.

3. Dr. Fraiser's review of citizen complaint records and government investigations was flawed.

1062. Dr. Fraiser claimed that she reviewed TCEQ investigation reports to determine whether the public complained about any of the emission events at issue, particularly with respect to whether there were any odor complaints. Tr. 9-163:15-24 [Fraiser]. Dr. Fraiser testified that she factored in how an

investigator described the odor in the investigation report. Tr. 9-163:21-24 [Fraiser].

1063. However, Dr. Fraiser admitted that she did not know how quickly TCEQ inspectors arrived at the Complex after an odor complaint was made (Tr. 9-164:4-6), whether TCEQ personnel performed inspections in response to complaints made in the middle of the night or on weekends (Tr. 9-164:7-11 [Fraiser]), or whether TCEQ personnel canvassed the neighborhood and questioned people about odors (Tr. 9-164:14-17 [Fraiser]). On the other hand, one of Plaintiffs' members, Shae Cottar, testified about his numerous personal experiences with the delayed responses and inadequate investigations of the TCEQ after the agency has been contacted with a complaint. Tr. 1-113:5 – 1-116:2 [Cottar]. Dr. Carman of the Sierra Club testified that many people do not even know about the regulatory system and so do not call TCEQ. Tr. 2-172:2-13 [Carman].

1064. Dr. Fraiser's review of citizen complaints was too limited to provide meaningful information: she testified that she did not review any EPA complaint files, Harris County Pollution Control complaint files (she only saw references to them if they were referred to in TCEQ reports), calls to the Community Awareness and Emergency Response (CAER) line, citizen complaints lodged with City of Baytown officials or members of the state

legislature, or 911 logs (she only saw references to 911 calls if they were referred to in TCEQ reports). Tr. 9-165:21 – 9-166:15 [Fraiser].

1065. Dr. Fraiser also testified that she did not have the Complex's own citizen complaint log at the time she formed her opinions and wrote her first two reports. Tr. 9-165:20 [Fraiser]. She relied on defense counsel to check the log. Tr. 9-165:9-12 [Fraiser]. This caused problems in her analysis. For instance, the Exxon complaint log shows that five different complaints were called in regarding STEERS event 103838. Tr. 9-175:25 – 9-176:13 [Fraiser]. Because she did not have the complaint log, Dr. Fraiser did not know that there were any complainants, or where they lived. Tr. 9-177:18-24 [Fraiser]. Since she did not have the log, she could not and did not use it to determine which neighborhoods around the Complex are the most frequent source of complaints. Tr. 9-1:17 - 9-167:6 [Fraiser].

4. Dr. Fraiser's opinion is only as good as the data provided to her by Mr. Cabe and Sage Environmental.

1066. When modeling done by Mr. Cabe and by Sage Environmental predicted that there was no off-site pollutant concentration above an air comparison value, Dr. Fraiser made a blanket conclusion from that data that no condition of air pollution could have occurred. Tr. 10-6:16 – 10-7:12 [Fraiser]. Because the results of the Cabe and Sage modeling frequenty understated off-

site pollutant concentrations, as discussed above, Dr. Fraiser's opinion is based on flawed data that is skewed toward a conclusion of no adverse impacts.

5. Dr. Fraiser cannot justify her opinion that pollutant levels that exceeded regulatory thresholds are benign.

1067. In her report and on direct examination, Dr. Fraiser opined that even when air dispersion modeling showed the public was exposed to pollutant levels above Effects Screening Levels (set by TCEQ), Air Monitoring Comparison Values ("AMCVs") (set by TCEQ), or other Air Comparison Values, it was still not possible for the public to have suffered any adverse health effects. For a number of reasons, the Court gives this opinion little weight.

a. Permit limits are designed to protect human health; ESLs are used in setting those limits.

1068. Exxon admits that the limits in its CAA permits are designed to be protective of public health. Answer, Introduction and ¶¶ 49-51 (Docket Entry 37). According to Dr. Fraiser herself, ESLs are used by TCEQ to derive those limits. Tr. 9-53:14-18 [Fraiser]. The emission events Dr. Fraiser analyzed all involve pollutants emitted in violation of one or more ESL-based limits set to protect public health.

1069. Although Dr. Fraiser worked at TCEQ earlier in her career, she admitted that she does not know how ESLs are used "from an enforcement standpoint." Tr. 9-56:15-21 [Fraiser]. Dr. Fraiser did not work in enforcement

when she was at TCEQ and was not involved in enforcement issues. Tr. 9-56:20-21; 9-58:13-18 [Fraiser].

b. Dr. Fraiser ignores the margin of safety built built into ESLs and AMCVs.

1070. Both ESLs and AMCVs have built-in margins of safety. Tr. 9-153:10-13; Tr. 9-155:11-25 [Fraiser]. Margins of safety are incorporated into these standards for good reasons. By dismissing or giving no weight to margins of safety when evaluating pollution levels that exceeded air comparison values such as ESLs and AMCVs, Dr. Fraiser engaged in a highly flawed and unreliable analysis.

1071. Incorporating a margin of safety results in an ESL or AMCV being intentionally set at a level that is below the concentration of a pollutant that is *known* to cause health effects. Tr. 9-60:22 – 9-61:1 [Fraiser]. Dr. Fraiser admitted on cross-examination that the margins of safety in health-based ESLs serve several purposes. Tr. 9-153:10-13 [Fraiser]. She testified that an ESL for a particular pollutant builds in a margin of safety to account for: emissions of that air pollutant from other sources in the area; any uncertainty in the science regarding the health effects of that pollutant; the effect of cumulative exposures to the pollutant; and exposure to co-pollutants (pollutants other than the one for which the ESL is set). Tr. 9-154:6-25 [Fraiser].

1072. Nonetheless, Dr. Fraiser expressly ignored the margin of safety when evaluating pollutant concentrations, caused by Exxon emission events, that exceeded ESLs. For example, Dr. Fraiser concluded, without any reservation, that an off-site concentration of hydrogen chloride (hydrochloric acid) that was 3.4 times higher than the ESL did not cause a condition of air pollution "because there's a margin of safety in the ESL." Tr. 9-112:11 – 9-113:13 [Fraiser]. But according to Plaintiffs' expert Dr. Brooks, that margin of safety is built into the ESL precisely because the scientific studies on which the known effects level for HCL is based are not sufficiently robust to be relied upon. PX 477, pp. 3-4.

1073. Dr. Fraiser admitted that she did not take the margin of safety factors into account in any other ways when analyzing the impacts of emission events: she used the Cabe and Sage modeling data (Tr. 9-149:7 – 9-150:1 [Fraiser]), which, as discussed above, does not account for other emission sources; she considered each emission event individually, without accounting for cumulative exposures; she considered each pollutant individually, without accounting for co-pollutants (Tr. 9-144:12-25; 9-150:9-20 [Fraiser]); and nowhere in her testimony did she acknowledge making allowances in the direction of protecting public health for the uncertainty in the underlying science regarding a particular pollutant.

1074. For example, Dr. Fraiser testified that two separate emission events involving a concentration of isoprene, a carcinogen, in a residential neighborhood, each one more than *eight times* higher than the ESL, did not create a condition of air pollution. Tr. 9-103:5 – 9-104:6 [Fraiser]. According to Dr. Fraiser, because there was a large margin of safety built into the ESL for isoprene, it was safe to repeatedly exceed the ESL by more than 700%.

1075. Because margins of safety – and particularly large margins of safety – are included to protect human health for the very reasons Dr. Fraiser herself described, her uniformly consistent rejection of the idea is inconsistent, unscientific, and undermines the validity of her conclusions.

c. It is unreasonable for Dr. Fraiser to opine that emission events cause no harm at night.

1076. In Dr. Fraiser's opinion, emission events that occur at night, even if they create off-site pollutant concentrations above air comparison values, can never cause a condition of air pollution because people are in their houses at night and unlikely to be exposed. This opinion is unreasonable.

1077. To begin with, testimony was presented at trial that people *in* their houses experienced adverse effects from emission events.

1078. In addition, shiftworkers and other people are out and about at night in Baytown and can be exposed to emission event pollution from the Complex. The Complex operates 24 hours a day (Tr. 10-10:19-20 [Fraiser]),

so there is activity in and around the Complex at all hours of the night. Dr. Fraiser admitted that people may walk their dogs at night and come home from parties and bars late at night. Tr. 10-11:14-22 [Fraiser]. In addition, there is a hospital in Baytown (Tr. 10-25 - 10-11:6) and, as Dr. Fraiser admitted, people go in and out of the emergency room all night. Tr. 10-11:8-13 [Fraiser].

1079. Moreover, evidence was presented that nighttime emissions can be *more* harmful for certain individuals: Dr. Brooks provided evidence that asthmatics tend to have their worst symptoms from midnight to 4 a.m. PX 477, p. 4.

d. Harm can be caused even if the maximum off-site concentration of a pollutant is at a roadway or other point that does not contain a dwelling.

1080. Dr. Fraiser discounted any modeling that showed a maximum off-site pollutant concentration at a roadway or other point that does not contain a dwelling. Of course, an air comparison value for a pollutant can still be exceeded in a residential area even though the very highest point of an off-site concentration does not contain a dwelling. As Dr. Fraiser herself conceded, a residential area is sometimes adjacent to the roadway. Tr. 10-13:20 – 10-14:24 [Fraiser].

1081. Dr. Fraiser also admitted that TCEQ takes into account the type of land use around the facility when it sets permits limits. Tr. 9-57:9-19 [Fraiser]. It does not make sense to do that analysis again when a permit limit

has been violated, since the analysis has already been incorporated into the permit limit.

1082. The Court also notes that Dr. Fraiser's analysis, as she admits, is an exercise in hindsight. Tr. 10-15:10 – 10-17:1 [Fraiser]. The wind blows in all directions at the Complex, and can change day-to-day and hour-to-hour. Just because the wind happened to blow a cloud of hydrochloric acid from an emission event over the waters of the Ship Channel, nothing would prevent an unluckier breeze from carrying the next HCl release to the playground at Unidad Park, across the street from the Refinery, on a Saturday afternoon. Tr. 10-16:9 – 10-17:8 [Fraiser].

1083. Given that the interest of the citizen suit plaintiff, and therefore of this Court, is "primarily forward-looking," Gwaltney, 484 U.S. at 59, Dr. Fraiser's failure to consider the *potential* for harm from future violations of the same type undercuts the value to this Court of her opinion.

6. Dr. Fraiser cannot justify her rejection of government-set standards for hydrogen sulfide in favor of a standard she herself created for Exxon for this case.

1084. Dr. Fraiser created her own standard for exposure to hydrogen sulfide (Tr. 9-159:11-14) and, based on that standard, opined that no emission events involving hydrogen sulfide could have caused a condition of air pollution. Dr. Fraiser's H_2S standard is 318 parts per billion for a one-hour exposure. Tr. 9-159:21-22 [Fraiser].

1085. Dr. Fraiser did not create her hydrogen sulfide standard until after she had already reviewed the modeling and monitoring data on hydrogen sulfide provided to her by Exxon in this case. Tr. 9-161:6-19 [Fraiser].

1086. Dr. Fraiser based her hydrogen sulfide standard on only a single study, involving only 10 test subjects with asthma. Tr. 9-159:3-10 [Fraiser].

1087. No state environmental agency has adopted Dr. Fraiser's hydrogen sulfide standard. Tr. 9-161:20-23 [Fraiser].

1088. Federal and state governments, including the state of Texas, have set H_2S standards much lower than Dr. Fraiser's standard. Dr. Fraiser rejected all of these government standards; she claimed not to have understood the basis for any of them. Tr. 9-157:2 - 9-158:6 [Fraiser]. Dr. Fraiser's rejection of these standards, however, does not require this Court to ignore them.

1089. TCEQ set a property line standard of 80 parts per billion for downwind concentrations of H_2S that affect residential property. Tr. 9-156:4-9 [Fraiser]. In addition, the federal Agency for Toxic Substances and Disease Registry (ATSDR) set an acute "minimal risk level" for H_2S of 70 ppb, for a 1-14 day exposure. Tr. 9-156:10-14; 157:2-4 [Fraiser]. Many states have also issued short-term exposure thresholds for H_2S, often to guard against offensive odors. Tr. 9-157:21-24 [Fraiser].

1090. Dr. Fraiser, in arriving at her own H_2S standard, did not take into account co-pollutants or the effect of H_2S on sensitive populations, and

therefore her standard is simply not protective of public health. Tr. 7-97:16 - 7-98:11 [Brooks].

XIV. Exxon Gained An Economic Benefit By Failing To Take Measures Sufficient To Prevent Its Violations.

1091. Jonathan Shefftz, an economist with expertise regarding financial issues that arise in environmental enforcement cases such, testified that Exxon gained an economic benefit from avoiding or delaying the costs of measures needed to comply with its permit requirements. He has also testified that Exxon has the ability to pay a penalty far larger than the economic benefit it gained.

1092. Exxon did not file a Daubert motion challenging Mr. Shefftz's testimony and the Court finds it admissible.

1093. Mr. Shefftz has an undergraduate degree in economics and political economy from Amherst College, and a master's degree in public policy from Harvard University. Tr. 5-6:11-14 [Shefftz]; PX 557 (Shefftz c.v.).

1094. From 1992 to 2006, Mr. Shefftz worked as an economist at a firm called Industrial Economics, Inc. Since 2006, he has been self-employed. Tr. 5-7:16 – 5-8:6 [Shefftz]; PX 557.

1095. Mr. Shefftz has extensive experience performing work for government, industry, and non-profit group clients involving the types of

analysis he employed in forming his opinions for this case, and has been qualified to testify as an expert witness many times in federal environmental enforcement cases. He has also been hired by U.S. EPA to revise and modify the computer models the agency uses in performing economic benefit and ability to pay calculations. PX 556, p 2; PX 557; Tr. 5-8:7 – 5-15:2 [Shefftz].

A. The concept of "economic benefit."

1096. "Economic benefit" is a term used in the Clean Air Act and by U.S. EPA for the financial gains that accrue through delayed and/or avoided expenditures on environmental compliance. Tr. 5-9:3-15 [Shefftz]; DX 192, pp. 2, 5; PX 556, p. 4.

1097. Funds not spent on environmental compliance are available for financially productive economic activities; alternatively, the costs associated with borrowing additional funds for environmental compliance are avoided. PX 556, pp. 3-4.

1098. The economics experts for both sides in this case agree that economic benefit is hence the amount by which a company is financially better off as a result of not having complied with environmental requirements in a timely manner. Tr. 5-9:3-10 [Shefftz]; 12-137:18-25 [Maniatis]; PX 556, p. 4.

1099. The experts also agree that economic benefit is "no fault" in nature: a company need not have deliberately chosen to delay compliance (for financial or any other reasons) – or even have been aware of its noncompliance

– for it to have accrued the economic benefit of noncompliance. Tr. 5-20:3-11 [Shefftz]; 12-138:1-11 [Maniatis]; PX 556, p. 4.

1100. If a civil penalty fails to recover at least the economic benefit gained by a violator, then the violator – in this case, Exxon – will retain a gain from failing to undertake measures that were necessary to prevent noncompliance. Tr. 5-20:12-5-21:6 [Shefftz]; PX 556, pp. 4, 6.

1101. To prevent the violations at issue in this case, Exxon should have increased expenditures on operation and maintenance activities, and should have installed certain pieces of capital equipment. Tr. 5-45:3-7 [Shefftz]; PX 427, p. 18; PX 430, p. 16.

1102. By failing to incur such additional costs of operation and maintenance activities over a multi-year period, and by delaying the purchase and installation of the capital equipment over a multi-year period, Exxon has realized a financial gain, or "economic benefit." PX 556, pp. 3-4, 10, 13-16, 18-21.

1103. The funds that should have been expended to prevent the violations in this case were instead available to Exxon for other uses. Those funds were available for increased investment in financially productive ventures, at the Baytown Complex or elsewhere, to provide greater returns to Exxon's ownership for personal consumption, or for alternative investments. PX 556, p. 4.

B. How economic benefit is calculated.

1104. To calculate the net present value of Exxon's economic benefit from delayed and avoided expenditures, the effects of inflation and opportunity costs must be accounted for. Both effects are fairly accounted for by using Exxon's weighted-average cost of capital ("WACC") to adjust the value of cash flows. Tr. 5-26:10-23 [Shefftz]; PX 556, pp. 7-8, 15-16, 20-21.

1105. Adjusting past and future dollar amounts to a net present value enables an apples-to-apples comparison of past and future costs. Tr. 12-137:4-10 [Maniatis].

1106. The WACC is a concept widely used in financial economics and capital budgeting exercises when dollar figures from different years have to be adjusted to present value. Tr. 5-27:2-7 [Shefftz]. Federal courts have adopted the WACC as an appropriate interest rate to use in the economic benefit analysis. Tr. 12-139:23 – 12-140:1 [Maniatis].

1107. The WACC represents the return Exxon would have expected to earn on additional monies available to it – including those monies that would have been required to prevent the violations in this case. PX 556, pp. 7-8. The WACC is the cost of a company's debt and equity weighted by the value of each source of financing (Tr. 5-27:5-11 [Shefftz]), and represents the avoided after-tax costs of financing capital investments. PX 556, pp. 7-8.

1108. On average, a company must earn a rate of return that enables it to repay its debt holders (*e.g.*, banks, bondholders) and satisfy its equity owners (*e.g.*, partners, stockholders). Tr. 5-28:10-14 [Shefftz]. Using a "risk-free" rate, as advocated by Exxon, rather than the WACC would not accurately reflect the rate at which Exxon actually finances its capital structure, nor would it reflect the actual returns Exxon needs to generate over time to satisfy its investors. Tr. 5-33:21-5-34:2 [Shefftz].

1109. For each of the years 2005-2013, Plaintiffs' economist Mr. Shefftz used company-specific data to calculate Exxon's WACC and to discount each year's WACC to present value. Tr. 5-27:12-14; 5-30:16-24 [Shefftz]. Those annual rates range from 6.42% to 8.58%. PX 556, pp. 9-10, 15, 21.

C. Exxon's avoided costs of operation and maintenance, and delayed capital projects.

1110. As discussed above, Plaintiffs' engineering expert Mr. Bowers identified some of the avoided costs that, if spent, would have enabled Exxon to achieve compliance with its Title V permits: $90 million annually for increased labor and equipment costs associated with needed preventive maintenance activities (Tr. 5-42:19-25 [Shefftz]); an additional 400 LTPD Claus-type sulfur unit, including a Tail Gas Treating Unit, with an approximate capital cost of at least $100 million; a single additional sour gas flare and

interconnecting piping and instrumentation, with an approximate capital cost of $10 million; and two additional Booster Station 4-type compressor stations, with an approximate capital cost of $50 million. PX 427, pp. 2, 18, 19, 20; PX 430, p. 16; Tr. 5-49:15-19 [Shefftz].

1111. The economic benefit Exxon gained by avoiding $90 million per year in additional operation and maintenance spending, from October 2005 through the end of 2012, is approximately $556 million as of November 2013. Tr. 5-62:24 – 5-63:2; 5-49:1-4 [Shefftz]; PX 556, pp. 14-15.

1112. There is no evidence that Exxon lost money by failing to prevent emission events. For example, Exxon frequently reported on its STEERS reports that there was "no impact on production and all customer needs are being met." *E.g.*, PX 418; Tr. 3-21:3-19; 3-22:21 – 3-23:3 [Kovacs].

1113. The economic benefit Exxon gained by delaying (at least until December 2015, given that these projects have not yet been started) the installation of the capital equipment described above is approximately $78 million as of November 2013. Tr. 5-62:24 – 5-63:2 [Shefftz]; PX 556, pp. 14, 16.

1114. Exxon's total economic benefit, from both the avoided operation and maintenance costs and the delayed expenditure of capital costs for the identified projects, is $634 million as of November 2013. Tr. 5-63:8-13 [Shefftz]; PX 556, pp. 14-16.

1115. Until this economic benefit is disgorged in the form of a civil penalty payment, Exxon's economic benefit continues to grow at an annual rate of 6.4 percent (the most recent figure for Exxon's weighted-average cost of capital). This means that Exxon's economic benefit is increasing each month by approximately $2.89 million for the avoided operation and maintenance costs and by $405,000 for the delayed capital projects. Tr. 5-49:1-9; 5-52:6-10 [Shefftz]; PX 556, p. 14.

1116. Exxon's economics expert, Alexis Maniatis, using risk-free rates rather than the WACC rate to compute economic benefit, determined that Exxon's total economic benefit (from the same avoided operating and maintenance costs and delayed capital expenditures analyzed by Mr. Shefftz) is between $340.2 million and $344.9 million, as of the May 15, 2012, date of his initial expert report. DX 192, pp. 24-25 and Table 1.

D. Exxon Has The Ability To Pay A Penalty That Exceeds The Economic Benefit.

1117. As the largest publicly traded oil company in the world, with annual profits that exceeded $40 billion dollars in both 2011 and 2012, Exxon has the financial capability to pay a penalty far exceeding Plaintiffs' estimates of economic benefit. Tr. 5-61:6-13 [Shefftz]; Tr. 5-62:4-8 [Shefftz]; PX 556, p. 1.

1118. Depending on the fluctuations of the stock market and the variations in annual financial performance, ExxonMobil has in recent years been vying for the title of largest publicly traded company in the world, often with Apple by market capitalization (currently over $400 billion for ExxonMobil) and with Wal-Mart Stores and Royal Dutch Shell by revenue (over $450 billion for ExxonMobil in 2012). Tr. 5-60:9-25 [Shefftz]; PX 556, p. 25.

1119. ExxonMobil's after-tax profits in 2012 were over $44 billion. Tr. 5-61:10-13 [Shefftz]; PX 556, p. 25. Mr. Shefftz calculated that, on average in 2012, Exxon earned approximately $120 million per day. Exxon thus earned $90 million in net after-tax profits – the amount Mr. Bowers estimated the company is underspending on preventive maintenance – every 18 hours for the entire year. Tr. 5-61:10 – 5-62:3 [Shefftz]. Mr. Shefftz's total economic benefit estimate of $634 million thus represents just over five days' worth of Exxon's prorated 2012 profits.

1120. ExxonMobil's after-tax profits in 2011 were over $41 billion. Tr. 5-61:10-13 [Shefftz]; PX 556, p. 25.

1121. From 2005 through 2012, ExxonMobil's actual return on average capital employed ranged from a low of 16.3% (in 2009) to a high of 34.2% (in 2008). PX 556, p. 10.

1122. The average for Exxon's actual return on average capital employed was 25% (as calculated and presented by ExxonMobil in its 2012 annual report), which is approximately three times as high as the WACC rates that Plaintiffs' expert used in his economic benefit calculations. PX 556, p. 26.

1123. Exxon offered no evidence suggesting that it is not able to pay a civil penalty exceeding the economic benefit calculated by Plaintiffs, or that payment of such a penalty would have a significant adverse impact on the company.

XV. TCEQ's Enforcement Of Exxon's Permits Has Been Ineffective.

A. TCEQ has too few inspectors for too many facilities.

1124. There are 460,000 entities regulated by TCEQ statewide. TCEQ regulates gas stations, dry cleaners, landfills, refineries, chemical plants, tank farms, water treatment plants, power plants, and other facilities. PX 623, at 248:7-10; 248:24 – 249:19 [Sadlier].

1125. Thousands of emission events are reported each year in TCEQ Region 12, the region that covers Baytown and the Houston area. PX 623, at 250:20-24 [Sadlier].

1126. TCEQ has approximately 500 investigators for the entire state. According to John Sadlier, a former Deputy Director for the TCEQ Office of Compliance and Assistance (PX 623, at 7:13-16 [Sadlier]), most of these investigators' time is spent on compliance assistance, which is ensuring that a

regulated entity is aware of what TCEQ's requirements are (PX 623, at 18:22-24; 91:2-11; 250:19-21 [Sadlier]).

1127. Mr. Sadlier testified that TCEQ could benefit from more funding and more staff. Because there are so many major air emission sources within TCEQ Region 12, it is difficult for TCEQ to accomplish the number of inspections set as a goal by EPA. TCEQ has not met the EPA-set goal of inspecting 80% of major air pollution sources. PX 623, at 251:3-7; 251:22 – 252:8; 263:2-6 [Sadlier].

B. TCEQ enforcement policies are inconsistent.

1128. Exxon argues that TCEQ's Enforcement Initiation Criteria are intended to promote consistency and predictability for the regulated community. Such predictability would enable Exxon to plan for the economic cost of non-compliance, which Plaintiffs contend is a reason TCEQ enforcement is ineffective. In any event, TCEQ has amended its Enforcement Initiation Criteria 13 times since it was first developed in 1996. PX 623, at 55:20-21 [Sadlier].

1129. TCEQ's Enforcement Initiation Criteria relate only to the initiation of enforcement by staff. The outcome of any enforcement action is up to the Commissioners of TCEQ. PX 623, at 240:4-7 [Sadlier].

1130. It is within the TCEQ's discretion to fine or not fine a violator, and to address violations in the way it sees fit. PX 623, at 254:10-14 [Sadlier].

1131. At one time, TCEQ imposed multiple penalties for emission events that involved exceedances of multiple permit limits. When new Commissioners were appointed they changed that policy, imposing only a penalty for a single violation no matter how many emission limits were exceeded. PX 623, at 181:18 – 184:1; 185:14 – 187:23 [Sadlier].

1132. At one time TCEQ issued penalties for recordable emission events along with high priority violations. TCEQ changed that policy and now penalizes recordable emission events less often. PX 623, at 141:20 – 142:1, 142:2-13 [Sadlier].

C. The Baytown Complex violated its Title V permits many times, year after year, despite TCEQ oversight.

1133. The sheer number of Title V permit violations year after year during the Claim Period is strong evidence that TCEQ's oversight of the Baytown Complex has not been effective in halting, or reducing sufficiently, Title V permit violations there. PX 427, p. 9.

1. TCEQ penalties have been ineffective.

1134. Over the years, TCEQ has occasionally imposed a monetary penalty on Exxon for violations at the Baytown Complex involving emission events. Plaintiffs' representative at trial, Environment Texas Director Luke Metzger, oversaw the compilation of a summary chart describing the contents of TCEQ's various penalty orders. PX 337; Tr. 2-30:1 – 2-42:14. The total

amount of penalties assessed by TCEQ for emission events and Title V deviations that are also the subject of this lawsuit amounts to $1,146,132. PX 337 (column entitled "Net Penalty for Violations in Plaintiffs' Case"); Tr. 2-41:19 – 2-42:9 [Metzger].

1135. The monetary penalties were embodied in agreed orders, which are negotiated between Exxon and TCEQ. PX 253-306; PX 337; PX 623, at 240:8-17 [Sadlier]. The agreed orders are thus not the product of a formal adjudicative process, such as a hearing with evidence and a neutral fact finder.

1136. TCEQ did not impose multiple penalties when emission events during the Claim Period involved exceedances of multiple permit limits. Penalties were imposed assuming a single violation per emission event, no matter how many emission limits were exceeded. PX 253-336; Tr. 2-39:2-6 [Metzger].

1137. The agreed orders often provided that a significant portion of any penalty would be waived if Exxon complied with corrective action measures set forth in the agreements. PX 253-306; PX 337 (column entitled "Portion of Penalty Deferred/Waived").

1138. The current maximum administrative penalty per day that TCEQ can assess is $25,000. This penalty amount became effective September 1, 2011. Prior to that date, the maximum administrative penalty per day that TCEQ could assess was $10,000. By contrast, the maximum penalty under the

federal Clean Air Act is currently $37,500 per day of violation. PX 623, at 156:2-21 [Sadlier]; Tr. 2-42:19 – 2-43:5 [Metzger].

1139. One purpose of administrative penalties is to disgorge any economic benefit that was realized as a result of the violation and to deter future noncompliance. However, penalties paid under the agreed orders did not serve this purpose. PX 623, at 158:21 – 159:13, 190:20-22 [Sadlier]; 191:19-24.

1140. Under the agreed orders, Exxon was allowed to pay some portion of the assessed penalties to the Houston Regional Monitoring Corporation (HRM). Tr. 2-42:9-14 [Metzger]; PX 268 [ETSC 073273]; PX 272 [ETSC 073309]; PX 278 [ETSC 073365]; PX 281 [ETSC 073393]; PX 287 [ETSC 073449]; PX 288 [ETSC 073458]; PX 291 [ETSC 073489]; PX 295 [ETSC 073530]; PX 297 [ETSC 073549]; PX 303 [ETSC 073604]; PX 305 [ETSC 073625]; PX 306 [ETSC 073644]; PX 337.

1141. HRM is a consortium of industry partners that operate their own air monitoring stations in the Houston area. Exxon is one of the industrial partners that make up the consortium. Tr. 2-42:15-18 [Metzger]; 8-86:17 – 8-87:1 [Robbins].

1142. Agreed orders between Exxon and TCEQ provided that Exxon pay approximately $500,000 to HRM. Tr. 2-42:9-14 [Metzger].

1143. Exxon has provided employees to serve on the HRM board of directors and Exxon provides funding to the consortium. Exxon contributes funds to HRM annually to operate HRM's network of air monitoring stations. Tr. 8-87:4-10 [Robbins].

1144. According to Mr. Sadlier, the threat of TCEQ penalties does not motivate Exxon to comply with permits or TCEQ regulations. PX 623, at 190:20-22 and 191:19-24 [Sadlier].

D. A February 2012 Agreed Order between Exxon and TCEQ is an agreement *not* to enforce Exxon's permits.

1145. Exxon and TCEQ entered into an Agreed Order in February 2012 (the "2012 Agreed Order"). PX 306 [at ETSC 073619].

1146. Exxon approached TCEQ in 2010 after receiving Plaintiffs' notices of intent to sue and sought to enter into an agreed order. Tr. 12-235:6-17 [Baisden]. Exxon was looking for "certainty" around enforcement. Tr. 12-235:10-13 [Baisden]. Exxon proposed an agreed order that eventually became the February 2012 Agreed Order. According to Exxon's designated expert John Sadlier, who was chief of enforcement at TCEQ at that time and played a lead role in negotiating the order, Exxon created the first draft of the 2012 Agreed Order and provided it to TCEQ. The emission events that are the putative subject of the 2012 Agreed Order did not even occur until after most

of the terms of the Order had already been negotiated. PX 623, at 225:11-22; 227:9-10; 229:15-17; 231:23 – 232:1 [Sadlier].

1. The 2012 Agreed Order provides for a "stipulated penalty" structure that allows Exxon to make payments that wipe violations off its compliance record.

1147. In § III.3 of the 2012 Agreed Order, Exxon and TCEQ agreed to a sliding scale "stipulated penalty" structure, whereby Exxon pays between $7,000 and $25,000 per reportable emission event, with limited exceptions. PX 306 [ETSC 073634].

1148. Section III.5 of the 2012 Agreed Order states that emissions to which the stipulated penalties of § III.3 apply shall not be the subject of a notice of violation or be treated as violations under 30 Tex. Admin. Code Chapter 60. PX 306 [at ETSC 073635]; Tr. 2-44:4-7; 2-45:2-4 [Metzger].

1149. A violator's history of notices of violations and other enforcement actions increases the amount of a penalty when TCEQ takes an enforcement action. PX 623, at 169:7-18, 194:19-25, 195:23-25 [Sadlier]; Tr. 2-44:2-11 [Metzger].

1150. A poor compliance history also draws a higher level of scrutiny from TCEQ when a facility applies for a new permit, or seeks to amend an existing permit. PX 623, at 152:13 – 153:3 [Sadlier].

1151. Allowing violations to be, as Environment Texas' representative Luke Metzger put it, "scrubbed clean," gives the community and government

regulators a false impression of the Complex's compliance record. Tr. 2-45:11-13 [Metzger].

2. The 2012 Agreed Order's "Environmental Improvement Projects" do not require reductions in emission events or in overall emissions.

1152. "Environmental Improvement Projects" required by the 2012 Agreed Order do not mandate any particular reduction in either the frequency of emission events or the quantity of pollutants released during emission events. The Order states that any pollutant reductions from the projects would be "at the Baytown Complex, including emissions from emission events and MSS activities." It also states, "Identification of the Baytown Complex facilities that will be used to satisfy this reduction requirement rests solely with ExxonMobil." PX 306 [at ETSC 073636-073637]; PX 408. However, since Exxon contends that the purpose of these projects is nonetheless to reduce the number and frequency of reportable and recordable emission events – *i.e.*, to promote permit compliance – Exxon cannot also argue that, by agreeing to the 2012 Agreed Order, it is going above and beyond what is required by law.

1153. The 2012 Agreed Order states that the Environmental Improvement Projects will, by February 2017, result in a reduction of 126 tons of volatile organic compounds from a "baseline emission rate" – the baseline is the average of annual VOC emissions reported in Exxon's 2006-2010 Emissions Inventories. PX 306 [ETSC 073636].

1154. The "baseline emission rate" used in the 2012 Agreed Order is actually higher than Exxon's current level of VOC emissions. Exxon reported emitting a total of 4,582 tons of VOCs in 2006, 3,093 tons in 2007, 3,022 tons in 2008, 2,863 tons in 2009, and 3,139 tons in 2010. The average of these annual VOC emissions is 3,304.4 tons. A 126-ton reduction from this average is 3,178.4 tons of VOCs. Since Exxon is already below that level, the emission reduction mandated by the 2012 Agreed Order is a phantom reduction. PX 306 [ETSC 073636]; PX 408; Tr. 2-45:19 – 2-55:5 [Metzger].

1155. Moreover, the 2012 Agreed Order does not require this phantom reduction in VOC emissions until 2017. Exxon is free to increase its VOC emissions until then, and in 2017 Exxon can emit more VOCs from the Complex than it did in any of the years 2007, 2008, 2009, and 2010, and still be considered to have achieved the 126-ton "reduction" mandated by the Order. PX 306 [ETSC 073636]; PX 408.

1156. The 2102 Agreed Order does not require any reductions of HRVOCs, carbon monoxide, sulfur dioxide, hydrogen sulfide, or nitrogen oxide emissions. PX 306, [ETSC 073636].

1157. There are no stipulated penalties for failing to comply with §§ III.10 and III.12 of the order (regarding compliance measures). PX 306.

3. The 2012 Agreed Order's "Environmental Improvement Projects" could all have been implemented earlier.

1158. The "Environmental Improvement Projects" included in the 2012 Agreed Order are Exxon-proposed projects that Exxon could have been implemented earlier to achieve compliance with its permits.

1159. Under § III.12b of the 2012 Agreed Order, Exxon will conduct a Fuels North Flare System (FNFS) Monitoring/Minimization project. In this project, additional instrumentation will be installed and tools and procedures will be developed to more effectively monitor and troubleshoot the Baytown Refinery Fuels North Flare System. PX 306 [at ETSC 073638].

1160. The FNFS Monitoring/Minimization Project may include hydrogen sulfide analyzers on some of the flare lateral streams. This would help better understand and identify the source of flaring emissions, whether that source is routine or during an emission event. Exxon already has H_2S analyzers on flare lateral streams at other spots in the Complex; they are a well-proven technology. Tr. 3-37:10-3:39:5 [Kovacs].

1161. The FNFS Monitoring/Minimization project would also install additional flow meters on flare lateral pipelines. Flow meters are already being used at other flare lateral streams at the Refinery. Tr. 3-36:4-6 and 3-37:2-9 [Kovacs].

1162. Under § III.12c of the 2012 Agreed Order, Exxon will conduct a Baytown Olefins Plant and Baytown Olefins Plant Expansion Recovery Unit Simulators project (BOP/BOPX Recovery Unit Simulators project). These are training simulators. Tr, 3-39:13-18; PX 306 [at ETSC 073638].

1163. Simulators for olefins plant operators have been in use in the industry for decades. Tr. 4-146:9-14 [Bowers].

1164. Under § III.12d of the 2012 Agreed Order, Exxon will implement an Enhanced Fugitive Emissions Monitoring program. The program will use infrared imaging technology to locate potential VOC and HRVOC leaks at all three plants. PX 306 [at ETSC 073638 - 073639].

1165. Infrared imaging technology to detect leaks had been in use for years at the Complex and other Exxon facilities before the entry of the February 2012 Order. Tr. 8-46:2-9 [Kovacs].

4. Exxon gained an economic benefit by not implementing the Environmental Improvement Projects earlier.

1166. The cost for the Plant Automation Venture in the 2012 Agreed Order is approximately $3-4 million. There will be continuing costs associated with the this program as well. PX 556, pp. 19-20; Tr. 3-34:4-12 [Kovacs].

1167. The cost of the FNFS Monitoring/Minimization project will be approximately $12 million. There will be continuing costs associated with this project as well. PX 556, p. 20; Tr. 3-35:17-22 [Kovacs].

1168. The olefins simulator project will cost $3-4 million. PX 556, p. 20.

1169. For the infrared leak detection technology, capital costs are approximately $500,000 and recurring annual operating costs are approximately $500,000. PX 556, pp. 20-21.

1170. The economic benefit Exxon gained by not implementing the Environmental Improvement Projects at the beginning of the statute of limitation period (October 13, 2005) is $11.7 million, as calculated by Plaintiffs' expert Jonathan Shefftz. These examples are considered to be a subset of the types of preventive operation and maintenance and capital improvement projects contained in engineer Keith Bowers' recommendations. Accordingly, this economic benefit amount is considered to be subsumed in the calculation of overall economic benefit described above. PX 556, pp. 1, 18-19, 24.

5. Under the 2012 Agreed Order, emission events are treated as just a cost of doing business.

1171. The 2012 Agreed Order does not require Exxon to reduce the frequency of emission events. PX 306.

1172. The 2012 Agreed Order does not require Exxon to reduce the quantity of pollutants released during emission events by any particular amount. PX 306.

1173. The 2012 Agreed Order does not address in any way recordable emission events or any of the other types of violations of federal operating permits listed in Deviation Reports that are not associated with emission events. PX 306.

1174. The 2012 Agreed Order provides Exxon with certainty as to the consequences of violating emission limits. The pre-set penalties and treatment of emission events as non-violations enable Exxon to make cost-benefit determinations as to whether it should comply with its permits, by comparing the cost of preventing emission events with the amount of stipulated penalties. PX 306 [at ETSC 073634, ETSC 073643]. Under the 2012 Agreed Order, emission events have become just another cost of doing business for Exxon.

E. Former TCEQ upper management now works for Exxon via the regulatory "revolving door."

1175. The TCEQ's former Executive Director, Mark Vickery, and its former Director of Enforcement, John Sadlier, retired from the agency and formed a lobbying firm together that, soon after their retirement, was hired by Exxon. As Mr. Vickery testified, TCEQ has discretion in enforcing the Clean Air Act in Texas. Tr. 12-160:2-5 [Vickery]. Plaintiffs suggest that the revolving door nature of upper management at TCEQ undercuts Exxon's claim that the agency was diligent in enforcing the Complex's Title V permits. This Court agrees.

1176. Mark Vickery was the Executive Director of TCEQ from June 2008 to May 2012 (Tr. 12-146:9-14 [Vickery]), after having served many years at TCEQ in other capacities (Tr. 12-147:5 – 12-148:2 [Vickery]).

1177. Mr. Vickery announced his retirement on February 23, 2012, the day after the February 2012 Order was approved by the Commission; his last day at TCEQ was May 1, 2012. Tr. 12-185:11-23 [Vickery]. Mr. Vickery had been contemplating retiring from TCEQ before his February 23, 2012, announcement. Thus, Mr. Vickery knew he was going to retire from TCEQ at the time the agency was negotiating the February 2012 Order with Exxon.

1178. Mr. Vickery formed a lobbying and consulting firm, Vickery & Sadlier, in September 2012. Tr. 12-187:17-18 [Vickery]. Mr. Vickery is now a registered lobbyist. Tr. 12-188:25 – 12-189:1 [Vickery].

1179. Vickery and Sadlier were paid $10,000 in 2013 to help Exxon obtain a Clean Air Act permit from TCEQ for a proposed expansion of the Baytown Complex Olefins Plant. Tr. 12-148:20 – 149:4; 12-186:19 – 12:187:16; 12-189:24 – 12-190:2 [Vickery]. The job lasted 45 days. Tr. 12-188:2-10 [Vickery]. Both Mr. Vickery and Mr. Sadlier worked on the engagement. No time sheets were kept. Tr. 12-188:11-14 [Vickery]. According to Mr. Vickery, no actual work product was generated. Tr. 12-188:15-16 [Vickery]. Also according to Mr. Vickery, he and Mr. Sadlier "had

several meetings internally" and Mr. Sadlier "had some discussions with the agency" and "may have reported back to Exxon." Tr. 12-188:15-18 [Vickery].

1180. Mr. Vickery also testified that he advised Exxon "on what the process and how the review is undertaken at the agency," even though he admitted that Exxon has applied for permits many, many times. Tr. 12-191:6-12 and 17-19 [Vickery].

1181. Under Texas law, Mr. Vickery is barred from having discussions with the TCEQ commissioners or staff for two years after his retirement. Tr. 12-185:11-18 [Vickery]. However, the bar does not apply to Mr. Sadlier, and Mr. Sadlier had discussions with TCEQ staff. Tr. 12-189:20-21 [Vickery].

F. TCEQ was aware of Plaintiffs' dissatisfaction with the agency's enforcement efforts, but did nothing to address it.

1182. On November 30, 2009, before this suit was brought, Plaintiffs sent a letter to TCEQ notifying the agency that the Baytown Complex was in violation of its Title V permits and indicating that Plaintiffs were prepared to sue Exxon directly to enforce the permits. Tr. 12-149:16-23; 12-193:24 – 12-194:9; 12-209:22 – 12-210:2 [Vickery]. The letter provided the addresses and phone numbers of the Plaintiffs, as well as the phone numbers of Plaintiffs' attorneys. Tr. 12-150:7-15 [Vickery].

1183. Mr. Vickery's reaction to the letter was that "it was an effort that wasn't going to bring any additional value." Tr. 12-150:20-25 [Vickery]. Mr.

Vickery testified that he believed the agency was "in a good position to take enforcement when necessary" and does "a very good job of doing that." Tr. 12-150:25 – 12-151:2 [Vickery].

1184. Despite receiving a letter more than a year before this suit was brought, neither Mr. Vickery nor anyone else at TCEQ contacted Plaintiffs in response to the letter. Tr. 12-195:24 – 12-196:8 [Vickery].

1185. At the time Mr. Vickery received the November 30, 2009 letter from Plaintiffs, Mr. Vickery was aware that Plaintiffs had previously brought two other CAA citizen suits: one against Shell Oil Company and one against Chevron Phillips Chemical Company. Tr. 12-196:13-20 [Vickery]. He was also aware that Plaintiffs had entered into consent decrees with those companies to settle those cases. Tr. 12-196:21 – 12-197:8 [Vickery].

1186. At no time did TCQ contact Plaintiffs to complain about their bringing these lawsuits. Tr. 12-197:10-13 [Vickery]. No one from TCEQ told Environment Texas or Sierra Club that their suits against Exxon, or similar suits against Shell and Chevron Phillips, are inconsistent with or interfere with TCEQ enforcement activities, or that Environment Texas and Sierra Club should not file these types of suits. PX 623, at 247:16-25 [Sadlier].

1187. In fact, Mr. Vickery has never read the consent decrees entered in Plaintiffs' cases against Shell and Chevron Phillips and does not know what is in them. Tr. 12-197:20-21; 12-198:19-25. [Vickery]. Thus, Mr. Vickery's

criticism of Plaintiffs' efforts to enforce the CAA against petrochemical plants has no basis and is afforded no weight, because Mr. Vickery did not inform himself about what those efforts entailed or what the results were.

XVI. Exxon Did Not Meet Its Burden Of Proving That The Criteria For The Affirmative Defense To Penalties Were Satisfied For Reportable Emission Events.

1188. Exxon argued that the affirmative defense in 30 Tex. Admin. Code § 101.222(b) and (c), which provides a limited affirmative defense to penalties in enforcement actions involving unauthorized emissions from upset events, was satisfied with respect to violations during approximately 100 reportable emission events.

A. Exxon did not demonstrate that all of the affirmative defense criteria were met for each of the emission events.

1189. Exxon did not demonstrate that all of the eleven affirmative defense criteria were met for each of those approximately 100 emission events. PX 430, pp. 17-1 – 17-15; PX 446.

1190. Plaintiffs' engineering expert, Mr. Bowers, reviewed the STEERS reports and TCEQ investigation files for these events, and wrote an expert report rebutting defense expert Christopher Buehler's evaluations of them. PX 428. He summarized his findings regarding the engineering-related affirmative defense criteria in a chart introduced at trial. PX 446.

1191. For at least 41 of the emission events, Mr. Bowers concluded and this Court agrees that Exxon did not prove that each was "caused by a sudden, unavoidable breakdown of equipment or process, beyond the control of the owner or operator," as required by 30 Tex. Admin. Code § 101.222(b)(2), (c)(3), and (d)(2). PX 430, pp. 17-1 – 17-15; PX 446.

1192. Many of the emission events for which the affirmative defense was asserted involved leaks in pipes due to corrosion. PX 427, p. 11; PX 428, pp. 2-6, 10. Emission events caused by corrosion are not "sudden" breakdowns because, as both Mr. Bowers and Dr. Buehler agree, corrosion takes place over a relatively long period of time. Tr. 4-168:3-14 [Bowers]; 12-59:3-9 [Buehler].

1193. Moreover, an emission event caused by a failure to perform proper preventive maintenance, akin to engine trouble that ensues from failure to change the oil in one's car, cannot be considered a "sudden, unavoidable breakdown … beyond the control of the owner or operator." Tr. 12-57:6-14 [Buehler].

1194. For at least 39 of the emission events, Mr. Bowers concluded and this Court agrees that Exxon did not prove that each "did not stem from any activity or event that could have been foreseen and avoided or planned for, and could not have been avoided by better operation and maintenance practices or

technically feasible design consistent with good engineering practice," id. at § 101.222(b)(3), (c)(4), and (d)(3). PX 430, pp. 17-1 – 17-15; PX 446.

1195. In assessing this criterion (whether an emission event could have been avoided by better operation and maintenance practices), there is evidence that Exxon's engineering expert Dr. Buehler ignored or discounted relevant information. In one instance, the very same piece of equipment, a lube oil pump, that had failed in a previous emission event had gone unrepaired until *after* it caused a second emission event. Tr. 12-62:16 – 12-65:3 [Buehler]. Dr. Buehler nonetheless found that the second event could not have been avoided through better operation and maintenance.

1196. Yet even Dr. Buehler admitted that Exxon could have prevented numerous emission events by improving its performance (Tr. 12-53:17 – 12-55:5 [Buehler]), which is inconsistent with his finding that those events "could not have been avoided by better operation and maintenance practices or technically feasible design."

1197. For at least one of the emission events, Mr. Bowers concluded and this Court agrees that Exxon did not prove that "prompt action was taken to achieve compliance," id. at § 101.222(b)(5). PX 430, pp. 17-1 – 17-15; PX 446.

1198. For at least 3 of the emission events, Mr. Bowers concluded and this Court agrees that Exxon did not prove that "the amount and duration of the

unauthorized emissions were minimized," id. at § 101.222(b)(6). PX 430, pp. 17-1 – 17-15; PX 446.

1199. For at least 90 of the emission events, Mr. Bowers concluded and this Court agrees that Exxon did not prove that "the unauthorized emissions were not part of a frequent or recurring pattern indicative of inadequate design, operation or maintenance," id. at § 101.222(b)(9) and (d)(9). PX 430, pp. 17-1 – 17-15; PX 446.

1200. In assessing whether an emission event was part of a frequent or recurring pattern, Exxon's engineering expert Dr. Buehler failed to consider recordable emission events or Title V deviation reports in his analysis and failed to consider emission events occurring more than a year previously. Tr. 12-65:4-17; 12-75:21 – 12-76:13 [Buehler]. Rather than performing an actual engineering analysis, Dr. Buehler merely adopted TCEQ's practice of looking back one year, and only at reportable events, in determining whether there was a frequent or recurring pattern. Tr. 12-75:25 – 12:76:13 [Buehler].

1201. In contrast, Plaintiffs' expert Mr. Bowers performed an independent engineering analysis, and did consider the full body of emission events, making his analysis of this factor more reliable.

1202. For at least 40 of the emission events, Mr. Bowers concluded and this Court agrees that Exxon did not prove that "the percentage of a facility's

total annual operating hours during which unauthorized emissions occurred was not unreasonably high," id. at § 101.222(b)(10). PX 430, pp. 17-1 – 17-15; PX 446.

1203. In general, as demonstrated by the testimony of Mr. Bowers and Exxon's own personnel (and set forth in more detail above), emission events at the Baytown Complex are part of systemic, recurring problems that could have been prevented with a greater attention to (and spending on) proper operation, maintenance, and design. PX 430, p. 2.

1204. Exxon also failed to prove that the events did not "cause or contribute to…a condition of air pollution." 30 Tex. Admin. Code § 101.222(b)(11) and (c)(11). "Air pollution" is defined as "the presence in the atmosphere of one or more air contaminants or combination of air contaminants in such concentration and of such duration that:

> (A) are or may tend to be injurious to or to adversely affect human health or welfare, animal life, vegetation or property; or
>
> (B) interfere with the normal use or enjoyment of animal life, vegetation, or property."

Texas Health & Safety Code, §382.003(3)

1205. The evidence discussed in Section XIII.D and E, above, demonstrates that data from air monitoring stations, which are most appropriate for use in ascertaining background levels of air pollutants, cannot be used to affirmatively prove that episodic emissions from specific emissions

events did not cause or contribute to a condition of air pollution. The chances of air contaminants from a particular emission event at the Baytown Complex actually hitting one of the few monitors, which do not run every day or detect all the pollutants released in emission events, are low. PX 463, pp. 10-12.

1206. The evidence discussed in Section XIII.B and C, above, demonstrates that the air dispersion modeling conducted by Exxon's consultants, Sage Environmental Consulting and David Cabe, cannot affirmatively prove that emission events did not cause or contribute to a condition of air pollution. Among other problems, predicted offsite concentrations of pollutants were biased downward, because background pollutant levels were often not used, simultaneous emissions from other sources were not modeled, and inputs of emissions from flares were likely to be grossly underestimated. PX 462, pp. 29-32; PX 463, pp. 10-12.

1207. In addition to relying almost exclusively on this data as a basis for her opinions regarding "a condition of air pollution," the methodology of Exxon's toxicology expert Dr. Fraiser suffered from numerous other flaws discussed in Section XIII.J, above. Her testimony is not sufficient to meet Exxon's burden of proof on this affirmative defense criterion.

B. The Court does not find persuasive the opinion of Defendants' expert Dr. Christopher Buehler that Exxon satisfied the affirmative defense criteria in all cases.

1208. Exxon offered Dr. Christopher Buehler, a chemical engineer at a firm called Exponent, who testified about his review of a selected number of reportable emission events, the application of certain Texas affirmative defense factors to those events, and the opinion of Plaintiffs' expert Mr. Bowers. Tr. 11-224:21 – 11-225:4 [Buehler].

1209. The Court does not find credible the opinion of Dr. Buehler that Exxon satisfied every one of the affirmative defense criteria for every one of the 97 emission events he reviewed for that purpose. Tr. 11-234:19 – 11-235:3; 11-242:19-22 [Buehler]; DX 18-20.

1210. Dr. Buehler has never been employed by a refinery or chemical plant to work in any of those facilities. Tr. 12-39:5-10 [Buehler].

1211. In forming his opinion in this case, Dr. Buehler did not test any equipment, take any measurements, or take any photographs, and had only a single plant tour. Tr. 12-39:17 – 12-40:5 [Buehler].

1212. Dr. Buehler testified that he based his conclusions regarding the affirmative defense criteria on his opinion that Exxon incorporates recognized and generally accepted good engineering practices into its design requirements and operating practices, through internal standards known as global practices and Baytown area engineering supplements. Tr. 12-55:20 – 12-56:2 [Buehler].

1213. However, Dr. Buehler did not provide a sufficient basis for this opinion of Exxon's practices.

1214. At the time Dr. Buehler formed his opinion regarding Exxon's incorporation of generally accepted good engineering practices, he had taken no steps to determine how many global practices relating to design and fabrication apply to the Baytown Complex, even within an order of magnitude. Tr. 12-41:10-17 [Buehler].

1215. Dr. Buehler formed his opinion regarding Exxon's incorporation of good engineering practices after actually reading only two of Exxon's global practices and on the say-so of Mr. Robbins and Mr. Ranna. Tr. 12-41:20 – 12-42:18 [Buehler]. Dr. Buehler read only five more of these practices when preparing his supplemental expert report. Tr. 12-43:1-8 [Buehler].

1216. Dr. Buehler formed his opinion regarding Exxon's incorporation of good engineering practices without reading any of the Baytown-specific engineering supplements, aside from the table of contents for those supplements. Tr. 12-43:9 – 12-44:17 [Buehler]. He eventually read only two of them when preparing his supplemental report. Tr. 12-44:18-20 [Buehler].

1217. Dr. Buehler formed his opinion regarding Exxon's maintenance practices after reading only one of thousands of maintenance work practices in effect at the Baytown Complex. Tr. 12-46:17 – 12-47:12 [Buehler].

1218. Dr. Buehler testified that he did not review any of Exxon's risk analyses for specific types of equipment at the Baytown Complex, and does not even know how Exxon conducts its risk-based technique for ensuring mechanical integrity. Tr. 12-47:13 – 12-48:1 [Buehler]. Although Dr. Buehler believes that operator rounds form a part of Exxon's mechanical integrity program, he did not accompany any operators on their rounds, and he reviewed only a few blank operator log sheets. Tr. 12-48:2-19 [Buehler].

1219. Second, Dr. Buehler's analysis did not represent his own independent engineering judgment, and consequently it is not persuasive and not helpful to the Court in its resolution of the issues.

1220. Many of Dr. Buehler's opinions were not his own, but rather he adopted the opinions of Exxon personnel or the TCEQ. Rather than performing an engineering analysis, as mentioned abov, Dr. Buehler merely adopted TCEQ's practice in determining whether there were frequent or recurring patterns among emission events. Tr. 12-75:25 – 12:76:13 [Buehler].

1221. Dr. Buehler's analysis focused on the highly specific root cause of each emission event already conducted by Exxon personnel. Tr. 11-232:6-17 [Buehler].

1222. Dr. Buehler uniformly deferred to general industry practice codes as proof of good practice in specific cases, even though he conceded on cross-examination that if compliance with industry codes is insufficient to assure a

high level of compliance with CAA permits, then Exxon must go above and beyond. Tr. 12-55:2-5 [Buehler].

1223. Dr. Buehler's deferral to the opinions of others could lead to strange results: he found that the affirmative defense applied, for example, even when neither he nor Exxon could determine the cause of an emission event, as with STEERS numbers 72945 and 115825. Tr. 11-262:23-24, 11-264:22 – 11-265:7, 12-79:7, 12-80:23 – 12-81:1 [Buehler].

1224. And Dr. Buehler's opinion that corroded piping is an occurrence that is "beyond the reasonable control of the operator," under one of the affirmative defense criteria, cannot be squared with his belief that "corrosion is something that's expected in areas." Tr. 12-10:16-25 [Buehler].

1225. Most of Dr. Buehler's conversations with Exxon personnel regarding emission events were with Gary Robbins, Thomas Ranna, and Jeffrey Kovacs, Exxon's three primary witnesses at trial. Tr. 11-233:5-13 [Buehler]. Dr. Buehler's opinion that the Baytown Complex has sufficient flaring capacity was provided to him by Mr. Robbins and Mr. Kovacs. Tr. 12-28:2-13 [Buehler]. Dr. Buehler's opinion that the Baytown Complex does not need an additional Claus sulfur recovery unit was provided to him by Mr. Robbins. Tr. 12-32:17 – 12-33:4 [Buehler].

1226. Dr. Buehler's testimony is not sufficient to meet Exxon's burden of proof on this affirmative defense criteria he analyzed.

C. Exxon automatically claims the affirmative defense for every reportable emission event.

1227. Environment Section staff at the Baytown Complex who submit STEERS Reports are also responsible for informing TCEQ whether Exxon is claiming an affirmative defense. They do so by filling out the "Affirmative Defense" box in the STEERS Reports they submit. The STEERS report form has a drop-down menu on the affirmative defense box that says "yes" and "no." Tr. 8-64:12-15 [Robbins].

1228. The evidence shows that Environment Section staff always assert the affirmative defense, no matter what the circumstances of an emission event, as a matter of course. Tr. 8-64:13-17; 8-77:1-4 [Robbins].

1229. Before submitting the STEERS Report to TCEQ, Exxon does not evaluate the 11 affirmative defense criteria to determine whether any of them can be satisfied. Tr. 8-79:18 – 8:82:17 [Robbins]. Exxon takes the position that it is for TCEQ to decide whether Exxon qualifies for the affirmative defense, so Exxon always selects the "yes" option in the affirmative defense box. Tr. 8-67:1-3 [Robbins].

1230. Exxon personnel responsible for completing the STEERS reports are not qualified to determine whether the affirmative defense applies. For instance, Gary Robbins, an Environmental Coordinator who completed and submitted STEERS reports, did not know the health effects of the pollutants

emitted during emission events, so did not know whether they caused or were capable of causing a condition of air pollution. Tr. 8-71:9 – 8-75:19 [Robbins].

1231. The Environment Section, which is responsible for deciding whether to assert the affirmative defense, does not check Exxon's own citizen complaint log before asserting the affirmative defense to an emission event. Tr. 2-247:19-21 [Kovacs].

1232. Air dispersion modeling is not conducted before asserting the affirmative defense to an emission event, as Exxon commissions modeling only after the fact when requested to do so by TCEQ. Tr. 6-102:4-7 [Parmley].

1233. TCEQ does not exercise close oversight of Exxon's affirmative defense assertions. TCEQ's review of an affirmative defense claim asserted by a facility largely consists of comparing what is reported by a company to the statutory criteria for an affirmative defense. PX 623, at 59:22-24 [Sadlier].

D. Exxon presented no evidence to prove that violations that occurred during and after Hurricane Ike satisfied the affirmative defense.

1234. Exxon bears the burden to prove that the Hurricane Ike emission events meet the affirmative defense. Tr. 1-50:22-1-51:8.

1235. One of the affirmative defense criteria is that the unauthorized emissions did not cause or contribute to an exceedence of the National Ambient Air Quality Standards, prevention of significant deterioration

increments, or to "a condition of air pollution" as defined in the Texas Health and Safety Code. Tr. 2-244:20-25 [Kovacs].

1236. Exxon reported Title V permit violations that occurred during and after Hurricane Ike. Tr. 3-209:15-3-210:8 [Kovacs]; DX 21-23.

1237. David Cabe, Exxon's expert witness on air dispersion modeling, and Lucy Fraiser, Exxon's expert witness on toxicology, were each directed *not* to review any of the reported Title V permit violations that Exxon claims were associated with Hurricane Ike. Tr. 8-127:4-7 [Cabe], Tr. 9-150:5-8 [Frasier].

1238. The Governor's Proclamation based upon the threat of Hurricane Ike was issued on September 8, 2008. DX 225. That proclamation, however, did not relieve Exxon of the burden of proving that it satisfied all affirmative defense criteria to avoid penalties for unauthorized emissions.

1239. "Regulatory Guidance in Response to Hurricane Ike from the Executive Director of the TCEQ," dated September 15, 2008, is a supplemental document to the Governor's Hurricane Ike Disaster Proclamation to help owners and operators understand and comply with environmental rules. DX 225; PX 578, p. 1. The document states: "In no event shall authorized regulated entities create conditions of air pollution or exceed national ambient air quality standards." PX 578, p. 3; Tr. 4-16:19-4-18:21 [Kovacs].

1240. In fact, Exxon was fined $27,500 by U.S. EPA for an emission event that occurred during Hurricane Ike (an event that is not a subject of this action), so there can be no claim of blanket immunity from enforcement. Tr. 3-20:2-15 [Kovacs]; PX 613.

CONCLUSIONS OF LAW

I. PLAINTIFFS HAVE STANDING TO SUE.

1. Based on the evidence presented at trial, the Court finds that each of the Plaintiff organizations has standing to bring this action.[13] The groups are acting on behalf of their members, who live, shop, recreate, and visit family and friends near the Complex. These members have much more than a "general interest in environmental protection." Save our Cmty., 971 F.2d at 1161.

2. Organizations like the Plaintiff groups have standing to bring suit on behalf of their members if:

> (1) its members would otherwise have standing to sue in their own right; (2) the interests it seeks to protect are germane to the organization's purpose; and (3) neither the claim asserted nor the relief requested requires the participation of individual members.

Hunt, 432 U.S. at 343. Plaintiffs satisfy these requirements.

A. Plaintiffs Have Members Who Would Have Standing To Sue On Their Own.

3. Plaintiffs' members have standing to sue on their own if they satisfy the three prongs of standing: (1) injury in fact, (2) traceability, and (3) redressability. Legal Framework ¶ 25.

[13] In addition, Plaintiffs provided pre-suit notice as required by the CAA, 42 U.S.C. § 7604(b)(1)(A). FOF ¶¶ 54-55. Plaintiffs also provided a copy of the Complaint to the U.S. Attorney General and the Administrator of the EPA, as required by 42 U.S.C. 7604 (c)(3). FOF ¶ 56.

4. Sierra Club presented four members who testified at trial: Diane Aguirre Dominguez, Marilyn Kingman, Richard Shae Cottar, and Sharon Sprayberry. Environment Texas presented one member who testified at trial: Ms. Dominguez. The Court finds that these members each satisfy all three standing prongs.

1. Members have suffered "injury in fact."

5. Plaintiffs' members variously testified that they:

(a) Live near the Complex. FOF ¶ 1004 (Mr. Cottar resides two miles east of the Complex).

(b) Shop and do every-day activities near the Complex. FOF ¶ 991 (Ms. Kingman shops, banks, goes to the cleaner, and sees her doctor in neighborhoods near the Complex).

(c) Recreate near the Complex. FOF ¶¶ 1016-17 (Mr. Cottar and his family run, bike, skateboard, and play in parks near the Complex).

(d) Participate in community activities near the Complex. FOF ¶¶ 991-92 (Ms. Kingman attends church, volunteers at a thrift shop, and attends Lee College basketball games in neighborhoods near the Complex).

(e) Formerly lived for many years near the Complex, including during the period at issue in this suit and after this suit was commenced, but recently moved away from Baytown. FOF ¶¶ 975, 979 (Ms. Aguirre grew up a mile and a half from the Complex, moved to Houston in 2006 and to Oakland, California in March 2013); FOF ¶¶ 1025, 1030 (Ms. Sprayberry, who grew up in Baytown, lived one mile east of the Complex from 2004 until late May 2012).

(f) Visit family who live near the Complex. FOF ¶¶ 975, 979 (Ms. Aguirre regularly visits her family, who still live a mile and a half from the Complex in the house in which she grew up; she has concrete plans to visit them soon, during the holidays).

6. Plaintiffs' members detailed the injuries in fact they suffer. They:

(a) Experience adverse physical and health effects. FOF ¶ 983 (when she is in Baytown – and only when she is in Baytown – Ms. Aguirre has "allergy-like" symptoms, including a running nose, watery eyes, and chest constriction, for which she has taken medicine); FOF ¶¶ 1009-1010, 1012 (Mr. Cottar experienced physical pain while breathing; he experienced an odor so strong it caused a pain in his sinus cavity; his and his family's asthma symptoms are exacerbated); FOF ¶¶ 1023, 1026, 1031 (Ms. Sprayberry's asthma symptoms were exacerbated in Baytown; she has trouble breathing when in Baytown).

(b) Are concerned about the effects of the pollution they and their families have been breathing. FOF ¶¶ 984-85, 988 (Ms. Aguirre worries about emissions of cancer-causing chemicals and the effects of other chemicals); FOF ¶ 995 (Ms. Kingman worries about cancer); FOF ¶¶ 1032-33 (Ms. Sprayberry is worried about carcinogens and other potential health effects).

(c) Smell offensive odors. FOF ¶¶ 981-82, 985 (Aguirre); FOF ¶¶ 993-95, 998-99 (Kingman); FOF ¶¶ 1007, 1009-11 (Cottar); FOF ¶ 1032 (Sprayberry).

(d) Are disturbed by visible air pollution. FOF ¶¶ 984 (Aguirre); FOF ¶¶ 993, 996-97 (Kingman); FOF ¶¶ 1005, 1007, 1017 (Cottar); FOF ¶¶ 1029, 1032 (Sprayberry).

(e) Are disturbed at and in their own homes by air pollution incidents. FOF ¶ 982 (Aguirre); FOF ¶¶ 1005-06, 1011 (Cottar).

(f) Curtail recreational and other activities. FOF ¶ 986 (Ms. Aguirre will not go running when visiting her parents in Baytown because her breathing is labored and she gets an abrasive feeling in her throat and lungs); FOF ¶¶ 996-97 (Ms. Kingman limits activities in Baytown and outdoor activities with her grandchildren when she smells odors from the Complex or sees haze above it); FOF ¶¶ 1016-17 (Mr. Cottar limits his and his family's running, biking, skateboarding, and playing in parks because of air pollution concerns).

(g) Worry about the Complex exploding. FOF ¶ 984 (Aguirre); FOF ¶ 1027 (Sprayberry).

(h) Have curtailed their time in Baytown. FOF ¶¶ 1030, 1036 (Ms. Sprayberry moved out of Baytown because of the air pollution; she would prefer to live in Baytown and would do so if the air quality were better); FOF ¶ 1036 (Ms. Sprayberry would visit Baytown more frequently if the air quality were better).

The Findings of Fact referred to above provide more detail on these injuries.

7. Plaintiffs' members are clearly not mere "concerned bystanders." Cedar Point Oil, 73 F.3d at 556. And their injuries are much more serious than the "identifiable trifle" that is required. Id. at 557; Legal Framework ¶ 130. Their injuries are precisely the kinds that courts have held to constitute injury in fact, see Legal Framework ¶¶ 133-46, and the Court rules that they constitute injury in fact here.

2. The injuries are fairly traceable to Exxon.

8. Using the traceability analysis set out in Powell Duffryn, 913 F.2d at 72-73, and adopted by the Fifth Circuit and other courts, see Legal Framework ¶¶ 152-53, Plaintiffs can establish the traceability prong of standing for violations involving emissions by proving Exxon (1) emitted air pollutants greater than allowed by its permits, (2) into an area in which Plaintiffs' members have an interest that is or may be adversely affected by the pollutants, and that (3) these pollutants cause or contribute to the kinds of injuries alleged by Plaintiff's members. Plaintiffs proved all three elements of this analysis.

a. Exxon emitted air pollutants in amounts greater than allowed by its Title V permits.

9. As the Court rules below, Exxon emitted air pollutants in excess of the amounts allowed by its Title V permits.

b. The unlawful pollutants were emitted into an area in which Plaintiffs' members have an interest that is or may be adversely affected by the pollutants.

10. As discussed above, Plaintiffs' members testified that they reside, shop, recreate, visit their families and do other activities in areas of Baytown that are close to the Complex. One member, Ms. Sprayberry, moved away but would like to move back and would like to visit more frequently if Exxon reduces its pollution.

11. The evidence is clear that emissions from the Complex reach the areas of Baytown that these members use. Exxon itself admits that the Baytown community is affected by its emissions. Exxon admits that lowering emissions from the Complex would be more protective of public health for the community. FOF ¶ 817. In fact, Exxon has publicly stated that lowering its emissions is good for the entire Houston region, FOF ¶ 817, which obviously encompasses the areas frequented by Plaintiffs' members.

12. Exxon's own air dispersion modeler testified that air pollutants from the Complex can go significant distances beyond the facility's fenceline. FOF ¶ 562. Air pollutants from the Complex are carried by the wind, and the wind

blows from all directions at the Complex during the course of a year, and can change direction during a single day. FOF ¶¶ 563-64. The wind can change direction hour-to-hour or even minute-to-minute. FOF ¶ 564. Wind speed can also vary during the course of a day. FOF ¶ 565. Thus, the Complex's pollutants are carried throughout Baytown and the surrounding areas.

13. And Plaintiffs' members established that they experience the Complex's emissions first-hand. When the wind blows toward them from the Complex they smell offensive odors. FOF ¶¶ 994, 1009, 1032. Odors are stronger the closer Plaintiffs' members get to the Complex. FOF ¶ 1010. They see smoke and haze coming from the Complex. FOF ¶¶ 984, 993, 996-97,1005, 1007, 1017, 1029, and 1032. Plaintiffs' members have been awakened in the middle of the night by emissions from the Complex and by flaring incidents. FOF ¶¶ 1011, 1027. Some members' homes have been so close to the Complex that odors, smoke, and the ill effects from emissions could come from no other source. FOF ¶¶ 975-76, 981 (Ms. Aguirre's family home is a mile and a half from the Complex and there is no other industrial facility closer); FOF ¶ 1004 (Mr. Cottar lived across the street from the Refinery and Olefins Plant, and now lives two miles away from the Complex); FOF ¶ 1025 (Ms. Sprayberry lived one mile from Complex). Further, when Plaintiffs' members leave town, various persistent symptoms, such as coughing and breathing difficulties, disappear. FOF ¶¶ 983, 1030-32.

14. In addition, Mr. Cottar and Ms. Sprayberry have matched specific unlawful emission events at the Complex (as documented by Exxon's own statements and STEERS Reports) with particularly bad pollution incidents the have seen, smelled, and otherwise experienced at their homes (involving visible flares and plumes of smoke, powerful odors, immediate health impacts, and concerns for health and safety). FOF ¶¶ 1008, 1027-28. Although this type of evidence is not required in order to establish traceability, Legal Framework ¶¶ 147-51, it is nonetheless convincing evidence supporting a finding of traceability.

15. In short, this case is a far cry from the situation presented in Sierra Club v. City of Jackson, 34 Fed. Appx. 151 (5th Cir. 2002), a CWA case cited by Exxon. In that case, the Fifth Circuit reaffirmed that "an identifiable trifle" is sufficient to confer standing, id. at *3, but held that Sierra Club had offered no proof that any of its members had suffered any aesthetic, recreational, or other injury as a result of the defendant's discharge of pollutants to a waterway. Only two members testified; one used the waterway only far upstream of the point of alleged discharge, and the other had last used the waterway some 17 years before. Id. at *4. Further, the Fifth Circuit found "no indication that a single discharge from the city's facilities has actually reached any waterway." Id. at *5. Here, in contrast, Exxon's own modeling and monitoring data and the testimony of Plaintiffs' members make clear that

Exxon's unauthorized emissions make their way to the air breathed by Plaintiffs' members. Contrary to Exxon's suggestion, City of Jackson does not require Plaintiffs to present their own air dispersion modeling to prove traceability; it simply requires that, unlike the plaintiff in Jackson, Plaintiffs present credible evidence that their injuries are traceable to Exxon. This Plaintiffs have done.

c. The pollutants cause or contribute to the kinds of injuries alleged by Plaintiffs' members.

16. The Court finds that the pollutants unlawfully emitted by Exxon cause or contribute to the kinds of injuries alleged by Plaintiffs. The Court bases this finding on: government documents, the expert testimony of Dr. Brooks, the testimony of Exxon's own personnel and expert witnesses, and the testimony of Plaintiffs' members. Accordingly, the Court concludes that the third element of the traceability analysis is met.

17. As discussed more fully in the irreparable harm discussion below, Exxon personnel testified that the Complex's emissions affect public health. FOF ¶ 817 (a lower level of emissions from the Complex would be more protective of public health); FOF ¶ 505 (flaring emissions "can be a nuisance to the public"). This testimony by itself establishes that Exxon's unlawful emissions create the kinds of injuries suffered by Plaintiffs' members.

18. However, there is additional, ample evidence to support this conclusion. The Court has made findings of fact detailing the reasons each of the various air pollutants unlawfully emitted by Exxon are harmful to human health, which is a concern of Plaintiffs' members. FOF ¶¶ 633-816. These findings show that Plaintiffs' members' concerns are reasonable: in addition to posing long-term health problems, the pollutants cause the types of respiratory problems experienced by Plaintiffs' members.

19. These findings also show that many of the pollutants Exxon unlawfully emits can cause an offensive odor, including odors of the specific types described by Plaintiffs' members (such as sulfury rotten-egg odors, and sweet smelling chemical odors).

20. The Court has also found that being exposed to different air pollutants simultaneously can enhance the harmful effects on human health of each individual pollutant. FOF ¶¶ 602-12.

21. The Court has also found that breathing cancer-causing chemicals, which are emitted by Exxon, carries a lifetime risk that does not dissipate or lessen over time, and that there is no safe threshold below which exposure to carcinogens is benign. FOF ¶¶ 597-98. The Court has also considered expert testimony regarding studies that show living near a refinery increases one's risk of getting cancer. FOF ¶ 613. As discussed above, cancer is a concern of Plaintiffs' members.

22. The Court has also found that both short-term and long-term exposure to air pollution can each harm health, FOF ¶¶ 594-96, and that air pollution is particularly bad for vulnerable populations, including asthmatics such as Plaintiffs' members, FOF ¶¶ 599-601.

23. The Court has also made findings that specific pollutant emissions from the Complex cause significant threats to human health. FOF ¶¶ 933-64.

24. The Court has also made findings that, based on Exxon's own air dispersion modeling, specific emission events caused off-site concentrations of pollutants that exceeded regulatory standards. FOF ¶¶ 855-85. The Court notes, however, that, as discussed above, regulatory standards do not always take into account the effect of breathing multiple pollutants. Furthermore, the Court finds that, for a number of reasons, Exxon's air dispersion modeling likely understates the effect of its unlawful releases. FOF ¶¶ 886-97.

25. Similarly, the Court has made findings that data from existing air monitoring stations, though they are not well-suited to detecting the pollutant levels caused by episodic plumes of pollution from Exxon's unlawful emission events, still show elevated levels of pollutants caused by emissions from the Complex. FOF ¶¶ 898-932.

26. The Court also finds that violations of record-keeping, reporting, and other operational requirements can increase the risk of pollution and the risk of explosion, and that Plaintiffs' members' concerns about health and

explosion risks thus are fairly traceable to these violations.

27. In summary, Exxon's violations involve emissions and risks that cause or contribute to breathing difficulties, physical discomfort, offensive odors, health concerns, safety concerns, curtailment of recreational activities and other activities of life, visible air pollution, and the other types of injuries about which Plaintiffs' members have provided credible testimony.

3. The injuries can be redressed by an order from this Court.

28. As a matter of law, an injunction requiring Exxon to cease ongoing violations of its Title V permits redresses Plaintiffs' members' injuries by ensuring that that they will not be exposed to Exxon's illegal emissions in the future. Similarly, penalties will deter future violations. Legal Framework ¶¶ 156-63.

29. The fact that Exxon has committed violations after the Complaint was filed, and indeed right up to and during the time of trial (PX 20-22), highlights the need for an injunction and penalties. Crown Petroleum, 207 F.3d at 793-94; Chalmette Ref., 354 F. Supp. 2d at 705-06.

30. As a matter of law, a declaratory judgment would also redress Plaintiffs' injuries. Legal Framework ¶ 157. The Court notes that an Agreed Order negotiated by Exxon and TCEQ and entered in 2012 provides that violations of the Complex's permits will be deemed "non-violations" as long

as Exxon pays money to TCEQ. This administrative whitewashing of Exxon's compliance history highlights the importance of a court order declaring Exxon to be in violation of its permits.

B. This Suit's Purpose Is Germane To The Plaintiffs' Purposes.

31. The corporate purpose of both Plaintiff groups is to engage in activities that protect the environment. FOF ¶¶ 38, 48. Both groups work specifically to protect air quality. FOF ¶¶ 43-44, 53. This lawsuit is germane to the corporate purposes of the groups. Franklin County Power, 546 F.3d at 924 (CAA citizen suit is germane to purpose of Sierra Club); Sierra Club v. Tennessee Valley Auth., 430 F.3d at 1345 (11th Cir. 2005) (same). Exxon has not argued otherwise.

C. The Participation Of Individual Members Is Not Required.

32. Courts routinely hold that participation of individual members is not required in an environmental citizen suit because no monetary damages or particularized relief to a single person or group is sought. E.g., id.; Murphy Oil, 686 F. Supp. 2d at 678; Chalmette Ref., 354 F. Supp. 2d at 701. Again, Exxon has not argued otherwise.

D. Under Hunt, Organizations Need Not Have "Members" As Defined By State Law In Order To Have Associational Standing.

33. An incorporated group need not meet the requisites for membership under state corporate law in order to have associational standing to bring a

citizen suit on behalf of its members. Friends of the Earth ("FOE") v. Chevron, 129 F.3d 826, 829 (5th Cir. 1997); see Hunt, 432 U.S. at 341-45 (1977) (commission had standing to assert the interests of individual apple growers even though the apple growers were not its members).

34. For associational standing, what matters is whether there is "a sufficient nexus" between the interests of an organization and those it represents. Church of Scientology of Cal. v. Cazares, 638 F.2d 1272, 1279 (5th Cir. 1981). In FOE, the Fifth Circuit held that the fact that persons who used the Texas waterways in question had joined the plaintiff environmental group as "members" and voluntarily associated to further the purpose of the organization was sufficient to confer standing despite the group's failure to follow the steps necessary to have "members" as defined under District of Columbia corporate law. 129 F.3d at 828-29.

35. Here, Sierra Club's bylaws establish that the group does have members as that term is defined and used in California Corporations Code §§ 5057 and 5310, et. seq. PX 341; see FOF ¶¶ 50-51.

36. Environment Texas's bylaws provide for two classes of members who have participatory rights in the organization, although they are not "members" as that term is used in Chapter 22 of the Texas Business Organizations Code. PX 338.

37. The evidence shows a significant nexus between the purposes and activities of Environment Texas and Sierra Club and the interests of those who join each group.

38. Sierra Club members vote for the Sierra Club board of directors. In addition, members participate in setting the organization's agenda. FOF ¶ 52.

39. Environment Texas members vote for one of the three members of the Environment Texas board of directors. They, too, participate in setting the organization's agenda, as explained by the Director of Environment Texas, Luke Metzger. FOF ¶¶ 41-44. Environment Texas members, and particularly Houston area members, have indicated repeatedly that promoting clean air is a high priority for them. FOF ¶¶ 43-44.

40. Some members of both groups have joined specifically to show their support for this lawsuit, and to participate in the lawsuit as witnesses**.** FOF ¶¶ 973-74, 1002-03. While at trial Exxon implied that the Plaintiff groups attempted to solicit some of their members for this lawsuit, the facts do not bear out any such suggestion. Nor would it be inconsistent with the principles of associational standing for a group to ask people to join the group for purposes of pursuing a public interest lawsuit. PennEnvironment v. PPG Indus., Inc., 2014 WL 2214217, at *24 (W.D. Pa. Feb. 28, 2014); see NAACP v. Button, 371 U.S. 415 (1963). If anything, the fact that some of these members joined the groups to participate in a lawsuit they cared about strongly

enough to endure personal inconvenience to testify in depositions and at trial, with no possibility of personal financial gain from resolution of the case, establishes the identity of interests between groups and members joined in a common cause that is at the heart of the associational standing analysis.

II. PLAINTIFFS ESTABLISHED LIABILITY ON ALL COUNTS IN THE COMPLAINT.

41. As discussed above, a defendant's own air emission monitoring records and emission reports to the government are sufficient to establish the defendant's CAA violations in an enforcement proceeding. See Legal Framework ¶¶ 79-82. Here, Exxon's STEERS Reports, recordable emission event lists, and Deviation Reports all prove violations of the Complex's Title V permits. In fact, the purpose of these records is to report CAA violations to TCEQ. FOF ¶¶ 104-26, 134-41.

42. Exxon's records contain all the information necessary to determine which permits were violated, the specific permit limits that were violated, the dates on which the permit limits were violated, the duration of the violations, and the amount of pollutants illegally released into the atmosphere as a result of the violation or, for some violations, the operational or recordkeeping practice that was not properly performed.

43. As ordered by this Court, the contents of these records were agreed upon by the parties and presented in the form of stipulated tables, separately

for each count of the Complaint. They were admitted into evidence as PX 1-7E and DX 1-16 (PX 1-7E and DX 1-16 are the same documents). These stipulated tables do *not* include information on alleged violations that were previously excluded from this case on summary judgment. Plaintiffs provided the Court, as requested, with PX 1-7E in native, Excel spreadsheet format.

44. The records underlying these stipulated tables were also admitted into evidence. PX 16-18, PX 23-100, PX 101-112.

45. Plaintiffs determined the number of days of violations reflected in the stipulated tables and explained their methodology in doing so. FOF ¶¶ 142-230. Plaintiffs added a column to the stipulated tables (PX 1-7E) to reflect the number of days of violation associated with each violation of an emission standard or limitation. These exhibits, PX 588-603, were admitted into evidence. At trial, Plaintiffs presented the testimony of Environment Texas Director Luke Metzger, who supervised the preparation of these exhibits. Mr. Metzger explained the methodology used to determine the number of days on which each violation occurred and used to prepare these exhibits accordingly. The Court has evaluated this testimony, and finds that the methodology used by Plaintiffs in these exhibits comports with the legal requirements for counting days of violations, see Legal Framework ¶¶ 106-15, that Plaintiffs'

application of this methodology to individual violations is accurate,[14] and that Plaintiffs utilized reliable arithmetic software to total the "Number of Days of Violation" columns on exhibits PX 588-603. The Court thus accepts the number of days of violations shown in these exhibits.

46. As discussed above, the CAA authorizes citizens to bring suit both (1) for "wholly past" violations that have been "repeated" and (2) for "ongoing" violations. Legal Framework ¶¶ 63-71. Proof that a permit limit has been violated two or more times establishes that the violation of that limit has been "repeated" for purposes of the CAA. Legal Framework ¶ 65. Proof that a permit limit has been violated both before and after the Complaint was filed establishes that the violation of that limit is "ongoing;" proof of a single post-complaint violation suffices for this purpose. Legal Framework ¶70.

47. Stipulated tables PX 1-7E (marked by Exxon as DX 1-16) provide the necessary information to determine whether the violations set forth therein are wholly past and repeated, or are ongoing. The number of pre- and post-

[14] For example, Exxon argues in its post-trial submission that Plaintiffs miscalculated the days of violation for Deviation No. 22 on Line 24 of PX 599, claiming thatbecause the information in that exhibit confirms only that unlawful emissions resulting from a poorly functioning turbine occurred on the start date and on the end date, 67 days later. However, Exxon put on no evidence at trial regarding the dates on which unlawful emissions occurred, and the information stipulated to by Exxon in PX 599 establishes that 423 separate violations of a carbon monoxide emission limit occurred over a period of 67 days, until Exxon'sthe operating procedures were changed and the turbine was rebuilt. Since Exxon presented no evidence to establish that continuous compliance had been achieved prior to the end date of the reported deviation, the Court finds that counting this as 67 days of violation is correct. See 42 U.S.C. 7413(e)(2).

Complaint violations for each of the permit limits, separated by count, was summarized in charts prepared by Plaintiffs for each count of the Complaint, admitted as PX 9-15. For each of the counts of the Complaint, PX 9-15 contain a grand total of the number of days of violation for that count. Mr. Metzger also testified as to the methodology used to create these summary charts, which were prepared under his direction. The Court evaluated this testimony, and finds that the methodology used by Plaintiffs in creating these summary exhibits also comports with the legal requirements for determining whether a violation has been repeated and whether it is continuing. The Court thus accepts the information in these summary charts.

48. The Court finds that the violations of each permit requirement for which Plaintiffs are seeking relief are either wholly past and repeated, or ongoing, and thus that they are all the proper subject of a CAA citizen suit. The Court notes that most of these violations are ongoing. Because the CAA imposes strict liability on owners and operators who violate their Title V permits, see Legal Framework ¶¶ 25-35, Exxon has no defense to liability for the violations evidenced by its own records and by the supporting testimony of its own personnel who created or supervised the creation of those records. The specific breakdown of adjudicated violations, by count of the Complaint, is set forth below, based on the Court's findings in FOF ¶¶ 143-230.

A. Count I.

49. The Baytown Refinery's permit states that any emission of any air contaminant that results from an upset event or any activity associated with an upset is not authorized. Each day on which each air contaminant was emitted as a result of an upset event constitutes a separate day of violation.

50. Exhibits 1A and 1B establish that Exxon committed 10,749 days of violation of this emission limit. A summary of these violations is contained in Plaintiffs' Ex. 9.

B. Count II.

51. The permits for all three plants authorize emissions only of specifically named contaminants, only from specifically identified emission points, and subject to pounds per hour emission limits. All other emissions of air contaminants are unauthorized. Each day on which each air contaminant was emitted without authorization constitutes a separate day of violation.

52. Exhibits 2A through 2F establish that Exxon committed 13,738 days of violation of these emission limits. A summary of these violations is contained in Plaintiffs' Ex. 10.

C. Count III.

53. The permits for all three plants incorporate the Texas "HRVOC Rule," which limits facility-wide emissions of highly reactive volatile organic compounds to no more than 1,200 pounds per hour. Each day on which

facility-wide emissions exceeded the limit constitutes a separate day of violation.

54. Exhibit 3 establishes that Exxon committed 18 days of violation of this emission limit. A summary of these violations is contained in Plaintiffs' Ex. 11.

D. Count IV.

55. The permits for all three plants incorporate federal regulations prohibiting visible emissions from each flare for periods exceeding five minutes during any two-hour period. For each flare, each day on which visible emissions exceeded the limit constitutes a separate day of violation. Violations at two or more flares on the same calendar day constitute separate violations.

56. Exhibit 4 establishes that Exxon committed 44 days of violation of this emission limit. A summary of these violations is contained in Plaintiffs' Ex. 12.

E. Count V.

57. The permits for all three plants incorporate federal regulations requiring each flare to operate with a pilot flame present at all times. For each flare, each day on which no pilot flame was present constitutes a separate day of violation. Violations at two or more flares on the same calendar day constitute separate violations.

58. Exhibit 5 establishes that Exxon committed 32 days of violation of this emission standard. A summary of these violations is contained in Plaintiffs' Ex. 13.

F. Count VI.

59. The permits for all three plants prohibit fugitive emissions (emissions that do not exit from a stack or vent). The permit for the Refinery prohibited fugitive emissions until June 2010. Each day on which each air contaminant was emitted without authorization from a fugitive source constitutes a separate day of violation.

60. Exhibit 6 establishes that Exxon committed 235 days of violation of this emission limit. A summary of these violations is contained in Plaintiffs' Ex. 14.

G. Count VII.

61. Count VII covers a variety of violations of emission limits, as well as operating, monitoring, and recordkeeping requirements described in Exxon's semi-annual deviation reports. Each day on which each emission standard or limitation was violated constitutes a separate day of violation. Where Exxon reported that numerous separate instances of violation of an emission standard or limitation occurred over a period lasting more than one day, the number of days of violation is the smaller of (i) the number of times the standard was violated or (ii) the number of days over which the repeated

violation occurred (*e.g.*, 51 violations of an hourly concentration limit for hydrogen sulfide occurring over 12 days is 12 days of violation of that limit; 51 such violations occurring over 75 days is 51 days of violation). Each violation of a monitoring, recordkeeping, or reporting requirement constitutes one day of violation per monitoring, recordkeeping, or reporting period (*e.g.*, failure to submit one monthly report is one day of violation). Finally, each discrete failure to comply with an operational requirement, such as the failure to close an open-ended line, constitutes one day of violation (regardless of how many days it took to identify and rectify).

62. Exhibits 7A through 7E establish that Exxon committed 4,677 days of violation of these emission standards and limitations. A summary of these violations is contained in Plaintiffs' Ex. 15.

H. <u>In Summary</u>

63. Accordingly, the Court issues a declaratory judgment that Exxon violated its Title V permits and thus the CAA as follows:

Count I	10,749 days of violations
Count II	13,738 days of violations
Count III	18 days of violations
Count IV	44 days of violations
Count V	32 days of violations
Count VI	235 days of violations
Count VII	4,677 days of violations

III. A PERMANENT INJUNCTION IS ISSUED.

64. Plaintiffs ask the Court to permanently enjoin ongoing Title V permit violations at the Baytown Complex. The scope of the injunction Plaintiffs seek would prohibit Exxon from violating permit limits found by this Court to have been violated both before and after the Complaint was filed; these are the limits for which there are "ongoing violations." A list of these permit terms is attached as Appendix B. Such an injunction is a proper exercise of a district court's power in a citizen suit. Natural Res. Def. Council v. Texaco Ref. and Mktg., 2 F.3d 493, 507 (3d Cir. 1993).

65. Some courts have issued broader injunctions in citizen suits, but Plaintiffs do not seek one here. United States Pub. Interest Research Group v. Atl. Salmon of Maine, 257 F. Supp. 2d 407, 435 (D. Me.), aff'd 339 F.3d 23 (1st Cir. 2003) (in a CWA case, court ordered that defendants "shall cause all subsequent operation [of regulated facilities] to be conducted in strict compliance with [their CWA] permit").

66. For the following reasons, the Court enjoins ongoing Title V permit violations at the Baytown Complex.

67. A plaintiff seeking a permanent injunction must establish

> "(1) success on the merits; (2) that a failure to grant the injunction will result in irreparable injury; (3) that said injury outweighs any damage that the injunction will cause the opposing party; and (4) that the injunction will not disserve the public interest."

O'Connor v. Smith, 427 Fed. Appx. 359, 365 (5th Cir. 2011) (quoting VRC LLC v. City of Dallas, 460 F.3d 607, 611 (5th Cir. 2006)). Plaintiffs meet this test.

A. Success On The Merits.

68. As held above, Plaintiffs have achieved actual success on the merits of their claims.

B. Irreparable Injury If An Injunction Is Denied.

69. In assessing irreparable harm where a dispute involves the public interest, courts "look beyond the immediate interest of the named litigants" and consider the harm to the larger public. Mississippi Power & Light, Co. v. United Gas Pipe Line Co., 760 F.2d 618, 626 (5th Cir. 1985); see generally Winter v. Natural Res. Def. Council, Inc., 555 U.S. 7, 24 (2008) (in employing an injunction, "courts of equity should pay particular regard for the public consequences"). This principle is particularly apt here, since Congress authorized citizens to enforce the CAA as private attorneys general. See generally United States v. Marine Shale Processors, 81 F.3d 1329, 1359 (5th Cir. 1996) (noting "the extraordinary weight courts of equity place upon the pubic interest in a suit involving more than a mere private dispute").

70. The evidence here shows irreparable harm both to the public at large and to specific members of the Plaintiff groups.

71. The Supreme Court has held, "[e]nvironmental injury, by its nature, can seldom be adequately remedied by money damages and is often permanent or at least of lasting duration, *i.e.*, irreparable." Amoco Prod. Co. v. Village of Gambell, 480 U.S. 531, 545 (1987); accord U.S. v. Marine Shale Processors, 81 F.3d 1329, 1360 (5th Cir. 1996); Cmtys. for a Better Env't v. Cenco, 179 F. Supp. 2d 1128, 1148 (C.D. Cal. 2001), aff'd, 35 Fed. Appx. 508 (9th Cir. 2002).

72. Similarly, courts have held that an economic award cannot sufficiently compensate for harm to recreational and aesthetic enjoyment. Sierra Club v. Franklin County Power of Illinois, 546 F.3d 918, 936 (7th Cir. 1990), citing Amoco, 480 U.S. at 545. Cf. O'Connor, 427 Fed. Appx. at 367 (under Texas state law, no adequate remedy at law for interference with enjoyment of property).

73. Courts have found irreparable harm where, absent an injunction, a defendant's activities would "result in higher emissions of air pollutants." Franklin County Power, 546 F.3d at 936; Cenco, 179 F. Supp. 2d at 1148. Courts have also found irreparable harm where a defendant's activities pose a danger to public health and welfare. Thumann v. Harris County, 2002 WL 31769446, at *1, 3 (Tex. App.—Houston [14th Dist] 2002) (not designated for publication) (injunction affirmed because defendant's operation of a "sham" wood recycling facility "endangered human health and welfare, as well as the

environment," and thus constituted irreparable harm); Wilson v. United Farm Workers of America, AFL-CIO, 774 S.W.2d 760, 763 (Tex.App.—Corpus Christi 1989) (injunction affirmed where further violations of sanitary standards posed a risk to the health of farmworkers and thus constituted irreparable harm).

74. Exxon's own records report that during the Claim Period the Complex has unlawfully emitted over 9,000,000 pounds of criteria pollutants (sulfur dioxide, nitrogen oxide, carbon monoxide, volatile organic compounds [ozone-forming chemicals], and particulate matter) alone. FOF ¶ 519. This amount is understated, likely by a great amount, because it includes emissions from flaring. As Dr. Sahu explained, the EPA- and TCEQ-approved method to calculate flare emissions for reporting purposes undercounts the actual amount of pollutants released. FOF ¶¶ 523-59. Understatement of emissions from petrochemical facilities is a well-known problem. FOF ¶¶ 560-61.

75. Plaintiffs presented ample evidence to prove that the Complex unlawfully emits chemicals that are known to be harmful to human health. FOF ¶¶ 569-816. This evidence included government reports, the expert testimony of Dr. Brooks, and the testimony of Exxon's own personnel. Included in Exxon's unlawful emissions are chemicals that are known to cause cancer, exposure to which creates an elevated life-long risk of harm;

"hazardous air pollutants" as designated under the CAA; ozone-forming chemicals; and chemicals that cause respiratory problems. FOF ¶¶ 633-816.

76. Plaintiffs also presented ample evidence to prove that the air contaminants Exxon unlawfully emitted have in fact adversely affected Plaintiffs' members and members of the community. FOF ¶¶ 817-1036. This evidence included air dispersion modeling, air monitoring station data, citizen complaints to Exxon and the Baytown City Council, testimony of plaintiffs' members, and analysis by Dr. Brooks. The Court again notes that given the flaws in air dispersion modeling and the limitations of air monitoring station data for detecting plumes of emissions from episodic emission events, the modeling results and monitoring data likely understate the effects of Exxon's unauthorized emissions. FOF ¶¶ 886-925.

77. Plaintiffs' members provided the Court with "on the ground" testimony on the effects of Exxon's pollution: people nearby are scared of breathing the pollution; they curb their activities because of it; they become physically sick from it. FOF ¶¶ 971-1036. Mr. Cottar presented videos of two flaring incidents that graphically displayed what it is like to live near the Complex during an emission event. PX 398, 401.

78. The Exxon complaint log and the video of the Baytown City Council meeting that was played at trial show that other members of the community similarly complain about Exxon's emissions. One of Exxon's

Environment Department staff told the Baytown City Council, "we really recognize that flaring creates emissions, it definitely can be a nuisance to the public." FOF ¶ 505.

79. Consistent with this evidence is the testimony of Jeffrey Kovacs, a manager in the Exxon Security, Safety, Health, and Environmental Department. Mr. Kovacs testified that although he lives in Houston, he shops and banks in Baytown (Tr. 3-252:19-22), just as Sierra Club member Marilyn Kingman does. Mr. Kovacs testified that the quality of the air is important to him during these activities:

> Q: And you want as little pollution in the air when you breathe when you're shopping and banking in Baytown, right?
>
> A: Yes, sir.
>
> Q: You want to breathe as clean air as possible in Baytown all year round, right?
>
> A: I want to breathe clean air.
>
> * * *
>
> Q: Every hour you're out shopping, every hour you're out banking, you want the air you're breathing to be as clean as possible, right?
>
> THE COURT: Is that correct?
>
> A: Yes, sir.
>
> * * *

Tr. 3-253:4-22. Mr. Kovacs further testified that reducing emissions from the Complex is beneficial to the community:

> Q: And it [reducing Complex emissions] helps people outside the fence line, right? That's what your point is or is that not the point?
>
> A: That is the point. It helps the environment, yes, sir.
>
> Q: It helps the environment. It helps public health, too, right?
>
> A: Yes.
>
> Q: Less emissions, better public health, agreed?
>
> A: Yes, sir.
>
> * * *
>
> Q: All right. So emissions [at the Complex] should still come down because it's more protective of public health, right?
>
> A: Yes, sir.

Tr. 3-255:15-22; 3-256:21-23. FOF ¶ 817.

80. This Court agrees with Mr. Kovacs on these points. Continued violation of the emission limits and other permit requirements this Court has found to be ongoing would continue to harm the Plaintiffs' members and the public generally, and an injunction requiring compliance with those requirements will therefore work to reduce such harm.

81. Moreover, breathing air pollutants is not the only irreparable harm emanating from Exxon's unlawful emissions. Many of the emissions, including the smaller ones during recordable emission events, involve the

release of flammable substances which pose a risk of fire and explosion. FOF ¶¶ 13, 33, 234-38. There have been over 300 fires reported at the Complex, so this risk is appreciable. FOF ¶ 404; Thumann, 2002 WL 31769446, at *4 (injunction warranted to address risk of fire at wood recycling facility where there was evidence of fires in the past). Plaintiffs' concern that there will be explosions at the Complex is a present harm; they are not obligated to wait until an explosion happens to demonstrate that harm.

82. The evidence also shows that Exxon's failure to follow a variety of operational, monitoring, and recordkeeping requirements (the Count VII violations) creates an irreparable harm. These requirements are in Exxon's permits to help safeguard the public health and safety. Exxon's repeated violation of these "non-emission-related" permit terms is an indication of lax operations that can lead to health and safety problems, and they serve to withhold timely compliance-related information from Plaintiffs, their members, and the public. FOF ¶¶ 243-50. Plaintiffs' members are reasonably concerned about the frequency of these violations, and their concern is an irreparable harm that can only be remedied with an injunction.

C. The Injury To Plaintiffs Absent An Injunction Outweighs Any Injury To Exxon If An Injunction Is Ordered.

83. "[W]hen environmental injury is sufficiently likely, the balance of harms will usually favor the issuance of an injunction to protect the

environment." Cenco, 179 F. Supp. 2d at 1148 (citing Save the Yaak Committee v. Block, 840 F.2d 714, 722 (9th Cir.1988). More specifically, courts find in citizen suits that "harm to the environment and to the public outweigh financial interests defendants may have." Oregon State Pub. Interest Research Group v. Pac. Coast Seafood, 374 F. Supp. 2d 902, 908 (D. Ore. 2005). See, e.g., Tenn. Valley Auth. v. Hill, 437 U.S. 153, 187-188 (1978) ($100 million cost of upgrading dam does not outweigh ecological value of endangered fish).

84. As one court said in a Clean Water Act citizen suit, "[e]conomic harm [to the violator] is assumed under the scheme of the CWA. Congress, in enacting the CWA, sought to allocate the external costs of water pollution to dischargers." American Canoe Ass'n v. City of Wilson Wastewater Treatment Plant, 1998 U.S. Dist. LEXIS 7766, at *28 (E.D. N.C. 1998) (preliminary injunction granted over city's objection that taxpayers would suffer); accord Marathon Pipe Line, 589 F.2d at 1309 (in CWA case, court stated that by imposing strict liability, Congress determined that "polluters rather than the public should bear the costs of water pollution").

85. TCEQ regulations embody this same principle, anticipating reduced production or even plant closings if they are necessary to achieve compliance. 30 Tex. Admin. Code § 122.143(4) (necessity of halting or reducing permitted activity to achieve compliance not a defense).

86. Exxon does not argue that compliance is unaffordable, given its vast resources. (Indeed, the undisputed testimony at trial established that, based on Exxon's after-tax profits for 2012, it can take the company as little as 18 hours to earn in profits the additional amount that Plaintiffs' engineering expert estimates should be spent annually to significantly reduce emission events at the Baytown Complex. FOF ¶ 1119.) Rather, Exxon argues that the cost of installing and operating upgrades to the Refinery's sulfur units, increasing flare gas recovery capacity, and implementing a flare minimization plan are not "economically reasonable" in light of the amounts of illegal pollution that would be reduced. However, Exxon's own expert witness on this topic, Karen Olson, testified that "economic reasonableness" is part of the permitting process, not the enforcement process, and that economics were already taken into account by TCEQ when it established the Title V permit limits for the Complex. FOF ¶ 509. Ms. Olson refused to say that Exxon should not comply with its permits if it thinks it would cost too much. FOF ¶ 510.

87. The Court also notes that Exxon did not offer any testimony suggesting there would be undue disruption to the operation of the Complex if it were ordered to comply with its Title V permits. Nor would such an argument be valid, since Exxon cannot complain about any disruption brought about by its consistent violations.

88. The Court notes that the February 2012 Agreed Order between Exxon and TCEQ has not stopped, and will not stop, Exxon's violations. In fact, the February 2012 Agreed Order is an agreement by TCEQ *not* to enforce Exxon's permits. FOF ¶¶ 1145-74. The Agreed Order provides for a "stipulated penalty" structure that allows Exxon to make payments that wipe violations off its compliance record. FOF ¶¶ 1147-51. The Agreed Order's "Environmental Improvement Projects" do not require reductions in emission events or in overall emissions. FOF ¶¶ 1152-57. Those projects could have been implemented earlier, but Exxon chose not do so. FOF ¶¶ 1158-65. The Agreed Order was negotiated between Exxon and former TCEQ upper management who retired from TCEQ and now work for Exxon via the regulatory "revolving door." FOF ¶¶ 1175-81.

89. In short, under the 2012 Agreed Order, emission events and unlawful emissions are treated as just a cost of doing business. FOF ¶¶ 1171-74. The Agreed Order will not alleviate the harm to Plaintiffs' members.

D. <u>An Injunction Will Serve The Public Interest.</u>

90. "[I]t is plain that the public interest calls upon the courts to require strict compliance with environmental statutes." <u>Conservation Law Found. v. Watt</u>, 560 F. Supp. 561, 583 (D. Mass.), <u>aff'd sub. nom Mass. v. Watts</u>, 716 F.2d 946 (1st Cir. 1983).

91. Courts have specifically found that "the public interest favors enforcing the Clean Act and protecting the environment." Cenco, 179 F. Supp. 2d at 1148; Franklin County, 546 F.3d at 936 (injunction in CAA citizen suit serves public interest where result would be decreased emissions and improved public health).

92. Exxon has offered no argument to the contrary, and this Court finds that the injunction issued herein will serve the public interest.

E. Order Of Injunction.

93. For the reasons set forth above, Plaintiffs' request for a permanent injunction is granted. The Court hereby enjoins Exxon from violating permit limits found by this Court to be ongoing, *i.e.*, those limits that have been violated both before and after the Complaint was filed. A list of these permit terms is attached as Appendix B. This injunction is effective upon entry of this Order, and shall expire five years from the date of entry of this Order or five years from the final disposition of any appeals of this order, whichever is later.

IV. A SPECIAL MASTER IS APPOINTED.

94. Federal courts retain the equitable authority to appoint a special master to monitor implementation of relief. In re Scott, 163 F3d 282, 283 (5th Cir. 1998). Courts have appointed special masters as part of the relief in environmental citizen suits. Humane Soc., 2010 WL 1837785, at *1, 15 (CWA); Honeywell, 263 F. Supp. 2d at 834 (D. N.J. 2003); cf. U.S. v.

Metropolitan Dist. Com'n, 679 F. Supp. at 1156. Monitors can serve an important function in assuring that firms are structurally equipped, and have in place appropriate processes and procedures, to comply with legal requirements. See generally Cristie Ford & David Hess, Can Corporate Monitorships Improve Corporate Compliance, 34 J. Corp. L. 679, 737 (2009).

95. The magnitude of the violations, the systemic nature of the violations, and Exxon's steadfast refusal to admit any shortcomings or admit that full compliance with its permits can be achieved, justify this remedy.

96. The Court appoints a special master to monitor the relief granted in this Order. Defendants shall pay for the special master and the expenses he or she incurs. The special master may retain the services of professionals and technical people as needed, also at Exxon's expense. Honeywell, 263 F. Supp. 2d at 834.

97. The special master shall, on an annual basis beginning one year from the date the injunction ordered herein becomes effective, file a report with the Court setting out Exxon's efforts and progress in complying with the terms of the injunction. A copy of the report shall be provided to Plaintiffs at the time it is submitted to the Court, and shall be publicly available. The special master shall include in his or her report any recommendations he or she deems appropriate to facilitate compliance with the injunction. The special master shall be granted full access to the Baytown Complex, its personnel,

other Exxon personnel who may exercise responsibilities related to compliance with the injunction, and Exxon records and data related to compliance with the injunction.

98. The special master shall be appointed for as long as the injunction ordered herein remains effective.

99. Within 45 days of the entry of this Order, the parties shall submit to the Court an agreed-upon recommendation for a special master, including the qualifications of that person. If the parties are unable to agree, within 45 days of this Order each side shall submit two recommendations for a special master. In selecting a special master, the Court is not bound by any recommendations of the parties.

V. THE MAXIMUM PENALTY IS ASSESSED AGAINST EXXON.

100. The maximum penalty per day of violation is $37,500 for violations occurring on January 13, 2009, and after, and $32,500 for violations occurring before January 13, 2009. 42 U.S.C. § 7413(e); 40 C.F.R. §19.4.

101. Some violations appear in more than one count of the Complaint. FOF ¶¶ 185, 218. The Court will not double penalize Exxon for these violations.

A. The Two Approaches To Setting A Penalty.

102. The CAA requires the following factors to be considered in determining the amount of any penalty to be assessed:

> the size of the business, the economic impact of the penalty on the business, the violator's full compliance history and good faith efforts to comply, the duration of the violation as established by any credible evidence (including evidence other than the applicable test method), payment by the violator of penalties previously assessed for the same violation, the economic benefit of noncompliance, and the seriousness of the violation.

42 U.S.C. § 7413(e)(1). Consideration of these factors is mandatory. Pound, 498 F.3d at 1095, n.3. A court is not free to decide that a case is not an appropriate one for imposition of a penalty and then not apply the required criteria; a court must apply these factors in order to determine whether to impose a penalty. Pound, 498 F.3d at 1095, n.3. In assessing a penalty, a court may also consider "such other factors as justice may require." 42 U.S.C. § 7413(e)(1).

103. Penalty calculation "is not an exact science;" the importance of each penalty factor cannot "be precisely delineated." U.S. v. Citgo Petroleum Corp., 723 F.3d 547, 551 (5th Cir. 2013) (construing nearly identical CWA penalty provision; quoting Marine Shale, 81 F.3d at 1338). Ultimately, the court's task of considering these factors and assessing a penalty is "highly discretionary." Tull v. United States, 481 U.S. 412, 427 (2013) (CWA).

104. Courts have taken two approaches to setting a CAA penalty: "top down," in which the maximum total penalty is calculated and any appropriate reductions are made by considering the factors of 42 U.S.C. § 7413(e) as mitigating factors; and "bottom up," in which the economic benefit gained by

avoiding compliance is established, and the remaining five elements of § 7413(e) are used to adjust the economic benefit figure up or down. Citgo, 723 F.3d at 552. The Fifth Circuit noted that courts often adopt the top down approach. Marine Shale, 81 F.3d at 1337 (CWA case). This Court adopts the top down approach.

105. The Court notes, however, that in this case the top down and bottom up approaches are effectively the same, because the evidence shows that Exxon's economic benefit of non-compliance is at least $657 million, which is roughly equivalent to the maximum penalty for all violations in Counts II, III, IV, V and VII, which constitute the bulk of the non-overlapping violations in this case.

B. The Penalty Factors In This Case.

106. The Court accepts the $657 million economic benefit calculation of Plaintiffs' economist Jonathan Shefftz, who used inputs from Exxon itself and from Plaintiffs' engineering expert Keith Bowers as to capital expenditures delayed, and operation and maintenance costs avoided, by Exxon's failure to implement measures needed to comply with its permits.[15] See Citgo, 723 F.3d at 552; FOF ¶¶ 1091-1116.

[15] The Court notes that Mr. Shefftz calculated Exxon's economic benefit to be $634 million as of November 2013, and that he calculated it would continue to grow at an annual rate of 6.4 percent (the most recent figure for Exxon's weighted-average cost of capital), an increase each month of approximately $2.89 million for the avoided operation and

107. Mr. Shefftz's calculation is set out in FOF ¶¶ 1091-1116. Mr. Shefftz calculated economic benefit using the weighted-average cost of capital ("WACC"), which represents the cost of a company's debt and equity weighted by the value of each source of financing. It recognizes both the average return a company must make to satisfy its owners and investors and the company's cost of borrowing. Federal courts have accepted the use of WACC in calculating economic benefit in a citizen suit. U.S. v. Smithfield Foods, Inc, 191 F.3d 516, 530-531 (4th Cir. 1999) (CWA); Idaho Conservation League, 879 F. Supp. 2d at 1166-1167 (in CWA case, accepting Mr. Shefftz's economic benefit calculation). This Court accepts this method as well.

108. The other § 7413(e)(1) factors similarly support little or no downward adjustment from the maximum penalty amount:

1. Size of business.

109. With annual profits often in the tens of billions of dollars, FOF ¶¶ 1119-20, Exxon has the financial capability to pay a penalty far exceeding Plaintiffs' estimates of economic benefit. For example, $657 million represents approximately 1.5% of Exxon's net after-tax profit of $44 billion for just the year 2012 alone.

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maintenance costs and $405,000 for the delayed capital projects. Tr. 5-49:1-9; 5-52:6-10 [Shefftz]; PX 556, p. 14. Given the seven months that have passed since November 2013, Exxon's economic benefit has increased by approximately $23 million, to $657 million as of June 2014.

2. Economic impact of penalty.

110. Exxon will only feel the economic impact of an extremely large penalty, though it could absorb even the maximum penalty.

3. Violator's full compliance history.

111. Exxon's full compliance history is poor. This case covers thousands of days of violations over eight years. Many more large emission events at the Baytown Refinery (PX 8), reported to EPA under a 2005 consent decree, caused many hundreds of additional days of violation. Compare Citgo, 723 F.3d at 553 (950 days of violation "reflected a lack of environmental responsibility and a general disregard of [defendant's] duty to operate its business safely"). Exxon has been fined by TCEQ more than 50 separate times for air violations alone since 2005.

4. Violator's good faith efforts to comply.

112. The Court finds Exxon's attitude and approach to compliance troubling.

a. Exxon did not spend the necessary money to comply.

113. The testimony of Plaintiffs' engineering expert Keith Bowers demonstrated that Exxon could have complied with its permits, but simply did not spend the money required to do so. Exxon chose not to spend an adequate amount on maintenance, and failed to install equipment that would have halted or at least dramatically reduced illegal emissions. Mr. Shefftz calculated that,

on average in 2012, Exxon earned $90 million in net after-tax profits – the amount Mr. Bowers estimated the company is underspending on preventive maintenance – every 18 hours for the entire year. FOF ¶ 1119.

b. Exxon negotiated a deal with TCEQ which was an agreement by TCEQ *not* to enforce the Act.

114. As soon as Exxon received Plaintiffs' notice of intent to sue, company officials contacted TCEQ seeking an administrative enforcement order designed to undercut this federal enforcement action. FOF ¶¶ 1146. The resulting February 2012 Agreed Order allows Exxon to *wipe violations off the books* (violations are literally deemed to be non-violations) by paying a pre-set, often minimal stipulated penalty – some of which can be paid to an Exxon-affiliated organization. FOF ¶¶ 1147-51. Further, the 2012 Agreed Order's "Environmental Improvement Projects" do not require reductions in emission events or in overall emissions. FOF ¶¶ 1152-57. Essentially, under the 2012 Agreed Order, emission events are treated as just another cost doing business. FOF ¶¶ 1171-74. The 2012 Agreed Order was negotiated with members of TCEQ upper management who left the agency shortly thereafter and were hired to work for Exxon via the regulatory "revolving door." FOF ¶¶ 1175-81.

c. Exxon does not demonstrate good faith in its use of the affirmative defense for reportable emission events.

115. The evidence shows that members of Exxon's Environment Section staff always assert the affirmative defense to penalties as a matter of course, no matter what the circumstances of a particular emission event happen to be. FOF ¶ 1228. Before submitting the STEERS Report to TCEQ, Exxon does not evaluate the 11 affirmative defense criteria to determine whether any of them can be satisfied. Exxon takes the position that it is for TCEQ to decide whether Exxon qualifies for the affirmative defense, so Exxon always selects the "yes" option in the affirmative defense box on the reporting form. FOF ¶ 1229. However, TCEQ regulations expressly provide that the facility claiming the defense, and not TCEQ, must prove that all of the affirmative defense criteria apply. 30 Tex. Admin. Code § 101.222(b).

116. This is especially noteworthy because TCEQ does not exercise close oversight of Exxon's affirmative defense assertions. TCEQ's review of an affirmative defense claim asserted by a facility largely consists of comparing the company's own report of what happened to the statutory criteria for an affirmative defense. FOF ¶ 1223.

117. Further, the personnel to whom Exxon has assigned the responsibility for completing the STEERS reports are not qualified to determine whether the affirmative defense applies. For instance, Gary

Robbins, an Environmental Coordinator who completed and submitted many of the STEERS reports at issue in this case, did not know the health effects of the pollutants emitted during emission events, so did not know whether they caused or were capable of causing a condition of air pollution. FOF ¶ 1230.

118. Further, the Environment Section, which is responsible for deciding whether to assert the affirmative defense, does not check Exxon's own citizen complaint log – either before asserting the affirmative defense to an emission event or during the pendency of an affirmative defense determination by TCEQ. FOF ¶ 1231.

5. Duration of the violation.

119. The number of violations, and the overall duration of those violations, at the Complex are both extremely high. Exxon committed more days of violation than there have been actual days over the past 8 years (because violations occurred concurrently). Its unauthorized emissions from leaks alone total more hours than there have been actual hours in the past 8 years (because unauthorized emissions from simultaneous leak events occurred concurrently).

6. Payment by the violator of penalties previously assessed for the same violation.

120. Plaintiffs have ascertained that in agreed orders, TCEQ has assessed $1,146,132 for some of the violations alleged in this case. FOF ¶

1134. That amount will be deducted from the total penalty amount assessed by this Court.

7. Seriousness of the violations.

121. A court is not required to find that environmental harm or harm to public health resulted from a defendant's violations in order to find those violations "serious." United States v. Gulf Park Water Co., 14 F. Supp. 2d 854, 859 (S.D. Miss. 1998). See also id. (argument that CWA violations are not serious because there are other sources of pollution is rejected). The frequency and duration of violations, without more, is enough to establish that the violations are serious. Id. On the basis of the high frequency and long duration of Exxon's violations, the Court finds the violations here serious.

121A. In addition, and as discussed fully above, Exxon's violations are also serious because they adversely affect public health, create nuisance-type impacts that interfere with daily life, and create fears of fire and explosion. Exxon's emissions of HRVOCs and other ozone precursors contributes to an ongoing state of non-attainment with national ambient air quality standards for ozone in Harris County. Plaintiffs' expert Dr. Edward Brooks testified about public health impacts. Plaintiffs' expert Dr. Ranajit Sahu testified that the actual quantities of illegal emissions from Exxon's flares are often far greater than what Exxon reports, and this was uncontested by Exxon. (Although Exxon follows EPA and TCEQ rules on reporting flare emissions, those rules

lead to gross undercounting of emissions). Mr. Bowers and Exxon witnesses testified about the explosion risk. The Court credits these experts' testimony. In addition, the testimony of Plaintiffs' members about their personal experiences living near the Baytown Complex was fully consistent with the opinions offered by Plaintiffs' experts.

C. Exxon Did Not Prove The Affirmative Defense Criteria Apply.

122. Exxon argues that the affirmative defense in 30 Tex. Admin. Code § 101.222(b) and (c), which provides a limited affirmative defense to penalties only in enforcement actions involving unauthorized emissions from upset events (see Legal Framework ¶ 35), applied to violations during 98 emission events (DX 18-20) at issue in this case.

123. However, Exxon did not demonstrate that all of the affirmative defense criteria were met for those emission events. This is explained fully in FOF ¶¶ 1188-1226, and will only be summarized here.

124. There are eleven criteria that must be satisfied before the affirmative defense applies, and Exxon has the burden of proving it satisfied all eleven criteria for every emission event. In every case, it failed to meet that burden for one or more of the following criteria: (a) that the event was "caused by a sudden, unavoidable breakdown of equipment or process, beyond the control of the owner or operator," 30 Tex. Admin. Code § 101.222(b)(2); (b) that the event "did not stem from any activity or event that could have been

foreseen and avoided or planned for, and could not have been avoided by better operation and maintenance practices or technically feasible design consistent with good engineering practice," id. at § 101.222(b)(3); (c) that "prompt action was taken to achieve compliance," id. at § 101.222(b)(5); (d) that "the amount and duration of the unauthorized emissions were minimized," id. at § 101.222(b)(6); (e) that "the unauthorized emissions were not part of a frequent or recurring pattern indicative of inadequate design, operation or maintenance, id. at § 101.222(b)(9); and/or (f) that "the percentage of a facility's total annual operating hours during which unauthorized emissions occurred was not unreasonably high," id. at § 101.222(b)(10).

125. As demonstrated by the testimony of Mr. Bowers and Exxon's own personnel, the emission events were due to systemic problems at the Baytown Complex that could have been prevented with a greater attention to (and spending on) proper operation and maintenance practices and improved plant design. The testimony of Exxon's expert Christopher Buehler did not satisfy Exxon's burden of proving otherwise.

126. In addition, Exxon failed to meet its burden of proving it satisfied another of the 11 affirmative defense criteria, that these emission events did not "cause or contribute to…a condition of air pollution." 30 Tex. Admin. Code § 101.222(b)(11) and (c)(11). "Air pollution" is defined as "the presence

in the atmosphere of one or more air contaminants or combination of air contaminants in such concentration and of such duration that:

> (A) are or may tend to be injurious to or to adversely affect human health or welfare, animal life, vegetation or property; or
>
> (B) interfere with the normal use or enjoyment of animal life, vegetation, or property."

Texas Health & Safety Code, § 382.003(3).

127. The evidence showed that data from air monitoring stations, because of their inherent limitations, is not sufficiently reliable to prove that episodic emissions from specific emission events did not cause or contribute to a condition of air pollution. The evidence also showed that the downward biases in the air dispersion modeling conducted by Exxon's consultants prevents that modeling, too, from providing reliable proof that no conditions of air pollution were caused or contributed to.

D. Imposition Of Penalty

128. As stated, the Court adopts the top down approach to assessing a penalty. The Court has weighed all of the penalty factors set forth in 42 U.S.C. § 7413(e) and finds that none warrant a downward departure from the maximum except one: amounts already paid to TCEQ for some of the violations being penalized.

129. Plaintiffs have computed the number of days of violation under each count of the Complaint that occurred both before and after the statutory

maximum penalty amount increased from $32,500 to $37,500 on January 12, 2009, and presented them in summary exhibits, PX 9-15, which were admitted into evidence. At trial, Environment Texas Director Mr. Metzger, who supervised the preparation of these exhibits, explained the methodology used to assign violations to their appropriate time period and to multiply them by the appropriate maximum per day penalty amount. The Court has evaluated this testimony, and finds that the methodology used by Plaintiffs in these exhibits comports with the legal requirements for computing the maximum penalty for violations of each count of the Complaint. The Court thus accepts the maximum penalty calculations shown in these exhibits.

130. The Court hereby finds that the maximum penalties that may be assessed for violations falling within each of the seven counts of the Complaint are as follows:

Count I:	10,749 days of violations	$373,767,500 penalty
Count II:	13,738 days of violations	$478,665,000 penalty
Count III:	18 days of violations	$ 635,000 penalty
Count IV:	44 days of violations	$ 1,580,000 penalty
Count V:	32 days of violations	$ 1,115,000 penalty
Count VI:	235 days of violations	$ 8,117,500 penalty
Count VII:	4,677 days of violations	$160,702,500 penalty

PX 9-15.

131. Because the hourly emission limit violations stemming from the Count I violations of the "no upset emissions" provisions of the Refinery's permit (Plaintiff Exhibits 1A and 1B) contain a great deal of overlap with the

violations of hourly emission limits in the Refinery's permit under Count II (Plaintiff Exhibits 2A and 2B), the Court will not include Count I violations in the penalty assessment. Similarly, because the fugitive emission violations in Count VI overlap with violations of the emission standards and limitations described in Counts I, II, and VII, the Court will not include Count VI violation in the penalty assessment.

132. Accordingly, the maximum penalty for violations falling within Counts II, III, IV, V and VII is $642,697,500. After subtracting from this total the $1,146,132 Exxon has already been penalized by the TCEQ for some of these violations, the Court hereby orders Exxon to pay a civil penalty in the amount of $641,551,368.

133. Consistent with 42 U.S.C. § 7604(g)(2), the Court also directs that $100,000 of this penalty be used for beneficial mitigation projects to benefit the public health and/or outdoor air environment in the Harris County area, and further directs Plaintiffs and Exxon to jointly present a proposed list of such projects to the Court within 45 days of the entry of this Order. If the parties are unable to agree on a proposed list, each side will present a proposed list within 45 days of the entry of this Order.

VI. PLAINTIFFS ARE AWARDED FEES AND COSTS.

134. A prevailing plaintiff in a CAA citizen suit may be awarded the costs of litigation (including reasonable attorney and expert witness fees) under

42 U.S.C. § 7604(d). An award to a plaintiff is appropriate where the plaintiff "obtained some success on the merits." Sierra Club v. Khanjee Holding (US), Inc., 655 F.3d 699, 708 (7th Cir. 2011), citing Ruckelshaus v. Sierra Club, 463 U.S. 680, 688 (1983).

135. The Supreme Court held in a civil rights case that a fee award to a prevailing defendant is allowed only if the "plaintiff's action was frivolous, unreasonable, or without foundation," because allowing fee awards against plaintiffs who assert non-frivolous claims would chill the private enforcement that Congress sought to encourage. Christiansburg Garment Co. v. EEOC, 434 U.S. 412, 421-422 (1978); accord Stover v. Hattiesburg Pub. Sch. Dist., 549 F.3d 985, 997 (5th Cir. 2008). The Christianburg limits on fee awards to defendants apply to environmental citizen suits. E.g., Pennsylvania v. Delaware Valley Citizens' Council for Clean Air, 478 U.S. 546, 560 (1986) (attorneys fee-shifting environmental statutes must be interpreted in the same manner as fee-shifting civil rights statutes); Browder v. City of Moab, 427 F.3d 717, 723 (10th Cir. 2005); Sierra Club v. City of Little Rock, 351 F.3d 840, 846-847 (8th Cir. 2003).

136. Given that Plaintiffs have prevailed and obtained success on the merits, the Court finds that, pursuant to 42 U.S.C. § 7604(d), an award of Plaintiffs' costs of litigation (including reasonable attorney and expert witness fees) is warranted, in an amount to be determined in a further proceeding.

Plaintiffs are hereby ordered to file an application for its costs of litigation (including reasonable attorneys fees expert witness fees) within 90 days of the entry of this Order.

CONCLUSION

For the forgoing reasons, the Plaintiffs' request for declaratory relief, injunctive relief, appointment of a special master, assessment of civil penalties, and costs of litigation (including reasonable attorneys' fees and expert witness fees) is granted.

DAVID HITTNER
UNITED STATES DISTRICT JUDGE

APPENDIX A: SUMMARY OF COUNT VII REPEATED AND CONTINUING VIOLATIONS OF EMISSION STANDARDS AND LIMITATIONS REFLECTED IN EXXON'S TITLE V DEVIATION REPORTS

Permit O-01229: Based on PX599

Regulatory Requirement	Was Violation Repeated?	Was There A Post-Complaint Violation?
30 TAC 101.201(a)	Y	Y
30 TAC 101.201(b)	Y	Y
30 TAC 101.201(c)	Y	
30 TAC 101.201(g)		
30 TAC 101.211(a)	Y	
30 TAC 101.359(a)	Y	
30 TAC 106.261, 262	Y	Y
30 TAC 106.478(5)		Y
30 TAC 111.111(a)(1)	Y	Y
30 TAC 111.111(a)(4)(A)	Y	Y
30 TAC 111.111 (a)(8)	Y	Y
30 TAC 115.112(d)(2)	Y	Y
30 TAC 115.114(a)(4)		
30 TAC 115.121(a)(1)	Y	Y
30 TAC 115.125(3)(E)	Y	
30 TAC 115.146(2)		
30 TAC 115.151(a)(1)	Y	
30 TAC 115.212(a)(6)(A), (D)		
30 TAC 115.214(a)(1)(A), (D)	Y	
30 TAC 115.221-226		Y
30 TAC 115.241-248	Y	Y
30 TAC 115.352(2), (4)	Y	Y
30 TAC 115.354	Y	Y
30 TAC 115.412(1)(A), (C)	Y	
30 TAC 115.542(a)		
30 TAC 115.546(1)		
30 TAC 115.722(d)		
30 TAC 115.725	Y	Y
30 TAC 115.727(b)(2), (d)	Y	
30 TAC 115.764(a)	Y	

30 TAC 115.781	Y	Y
30 TAC 115.782(a), (b)	Y	
30 TAC 115.783(5)		Y
30 TAC 115.786(e)		
30 TAC 115.788(a)(2)(B)		
30 TAC 116.115(b)(2)	Y	
30 TAC 117.201(3)	Y	
30 TAC 117.206(e)	Y	
30 TAC 117.213(a)	Y	
30 TAC 117.219	Y	
30 TAC 117.310(c)(1)(A)	Y	Y
30 TAC 117.310(c)(2)	Y	Y
30 TAC 117.310(f)	Y	
30 TAC 117.335(a)(4)		Y
30 TAC 117.340(a), (h), (j)	Y	Y
30 TAC 117.345(b), (f)	Y	Y
30 TAC 117.8100(a)(1)	Y	Y
30 TAC 117.8140(a)(2), (b)	Y	Y
30 TAC 122.132(e)	Y	
30 TAC 122.145	Y	
30 TAC 122.146(5)(C)		
40 CFR 60.7(a)	Y	Y
40 CFR 60.7(c)		
40 CFR 60.11(b)(6)(ii)		Y
40 CFR 60.13(d)(1)	Y	Y
40 CFR 60.13(e)	Y	Y
40 CFR 60.15(d)		Y
40 CFR 60.18(c)(1)	Y	Y
40 CFR 60.18(b)(2), (c)(2), (f)(2)	Y	Y
40 CFR 60.18(c)(3)(ii)	Y	Y
40 CFR 60.48	Y	Y
40 CFR 60.103(a)		
40 CFR 60.104(a)(1)	Y	Y
40 CFR 60.104(a)(2)	Y	Y
40 CFR 60.104(a)(4)	Y	
40 CFR 60.105(a)(3)(2)	Y	Y
40 CFR 60.107(e)		
40 CFR 60.112b(a)(2)(ii)		

40 CFR 60.113b(1)(ii)	Y	Y
40 CFR 60.113(b)		
40 CFR 60.113b(a)(5)		
40 CFR 60.115(b)(4)		Y
40 CFR 60.480	Y	
40 CFR 60.482-1	Y	Y
40 CFR 60.482-2	Y	
40 CFR 60.482-5(b)	Y	
40 CFR 60.482-6	Y	Y
40 CFR 60.482-7	Y	Y
40 CFR 60.482-9(a)	Y	
40 CFR 60.482-10	Y	Y
40 CFR 60.487(c)(3)	Y	
40 CFR 60.592		
40 CFR 60.692-2	Y	Y
40 CFR 60.698(b)		
40 CFR 61.305	Y	Y
40 CFR 61.342(e)(2)(i)		
40 CFR 61.349(a)	Y	Y
40 CFR 61.354(d)		
40 CFR 61.357(d)(2)-(7)	Y	
40 CFR 63.6(e)	Y	
40 CFR 63.8(c)(6)		Y
40 CFR 63.10(d)(5)	Y	
40 CFR 63.11(b)(4)	Y	Y
40 CFR 63.11(b)(5)	Y	Y
40 CFR 63.11(b)(6)	Y	Y
40 CFR 63.104(b)(1), (c)	Y	
40 CFR 63.105		
40 CFR 63.119(b)(1)		
40 CFR 63.119(c)(2), (c)(3)	Y	Y
40 CFR 63.120(a)(5)		Y
40 CFR 63.120(b)(8)	Y	
40 CFR 63.130(f)		
40 CFR 63.152(c)(1), (2)	Y	
40 CFR 63.163(b)(1)		
40 CFR 63.166(b)		
40 CFR 63.167	Y	Y
40 CFR 63.168(b)(1)		

40 CFR 63.168(l)(2)		
40 CFR 63.640(n)(1)	Y	
40 CFR 63.643(a)(2)		Y
40 CFR 63.644(e)	Y	Y
40 CFR 63.646(a)	Y	
40 CFR 63.648	Y	Y
40 CFR 63.651(f)(6)	Y	
40 CFR 63.654(f)(6), (g)	Y	
40 CFR 63.7895(c)		
40 CFR 63.902(b)(1)		
40 CFR 63.1564(a)(2) Table 2	Y	
40 CFR 63.1565(a)(1)	Y	Y
40 CFR 63.1567(c)(1) Table 28	Y	
40 CFR 63.1571(c)(1); Table 7		
40 CFR 63.1572(a)	Y	Y
NSR 40394 MAERT		
NSR 9163 MAERT	Y	
NSR 44533 MAERT	Y	
NSR 18287 SC 1	Y	Y
NSR 18287 SC3	Y	
NSR 18287 CD 4		Y
NSR 18287 SC7	Y	
NSR 18287 SC8	Y	
NSR 18287 SC 11.A	Y	Y
NSR 18287 SC 11.B	Y	Y
NSR 18287 SC11.C		
NSR 18287 SC 11D		Y
NSR 18287 CD 13	Y	Y
NSR 18287 14.A	Y	
NSR 18287 SC 14B	Y	
NSR 18287 SC 14.D	Y	Y
NSR 18287 CD 17		Y
NSR 18287 SC 18	Y	
NSR 18287 CD20/SC20	Y	Y
NSR 18287 CD 21	Y	Y
NSR 18287 CD 22	Y	
NSR 18287 CD 23	Y	Y
NSR 18287 SC 24		
NSR 18287 CD 25	Y	Y

NSR 18287 CD 26	Y	Y
NSR 18287 CD 29	Y	Y
NSR 18287 CD 31		Y
NSR 18287 SC 34	Y	Y
NSR 18287 SC 35	Y	
NSR 18287 SC 36.A	Y	
NSR 18287 SC 37		
NSR 18287 SC 41	Y	Y
NSR 18287 SC 43C	Y	Y
NSR 18287 SC 45	Y	Y
NSR 18287 CD paragraph 123b	Y	Y
NSR 18287 MAERT	Y	Y

Permit O-01553: Based on PX600

Regulatory Requirement	Was Violation Repeated?	Was There A Post-Complaint Violation?
30 TAC 101.201	Y	Y
30 TAC 111.111(a)(1)(A)		Y
30 TAC 111.111(a)(4)(A)	Y	Y
30 TAC 111.111(a)(8)(A)	Y	
30 TAC 115.114(a)(1)	Y	
30 TAC 115.126(1)(B)	Y	
30 TAC 115.352	Y	Y
30 TAC 115.354	Y	Y
30 TAC 115.356(2)(A)&(B)	Y	
30 TAC 115.412(1)(a)		
30 TAC 115.722(c)	Y	Y
30 TAC 115.725	Y	Y
30 TAC 115.764(a)(6)	Y	
30 TAC 115.781(b)(3)	Y	Y
30 TAC 115.782	Y	Y
30 TAC 115.783(5)	Y	Y
30 TAC 116.617(d)(1)(B)		
30 TAC 117.206(e)	Y	
30 TAC 117.213	Y	
30 TAC 117.214	Y	
30 TAC 117.219	Y	

30 TAC 117.310(c)(1)(A)	Y	
30 TAC 117.310(c)(2)	Y	Y
30 TAC 117.310(f)	Y	Y
30 TAC 117.34	Y	Y
30 TAC 117.345	Y	
30 TAC 117.725(I)(1)		
30 TAC 117.8100(a)(1)(C)-(Part 60 Appendix F, Procedure 1, 4.1)	Y	
30 TAC 117.8140(a), (b)	Y	Y
40 CFR 60.18(c)(1)	Y	Y
40 CFR 60.18(c)(2)	Y	
40 CFR 60.18(c)(3)(B)	Y	Y
40 CFR 60.45(b)(7)	Y	Y
40 CFR 60.482-6(a)(1)	Y	Y
40 CFR 60.655(I)		
40 CFR 61.242-6(a)(1)	Y	Y
40 CFR 61.342(c)	Y	
40 CFR 61.348(a)(1)(i)	Y	
40 CFR 61.349(a)(2)	Y	Y
40 CFR 61.354	Y	
40 CFR 63.11(b)(4)	Y	Y
40 CFR 63.11(b)(5)		
40 CFR 63.11(b)(6)(ii)	Y	
40 CFR 63.167(a)(1)	Y	Y
40 CFR 68.190(b)(1)		
40 CFR 63.1022(a)	Y	
40 CFR 63.1025(b)	Y	Y
40 CFR 63.1027(a), (b)	Y	Y
40 CFR 63.1033(b)(1)	Y	Y
40 CFR 63.1063(c)(1)	Y	
NSR 3452/PSD-TX-302M2 MAERT Limits	Y	Y
NSR Permit # 3452/PSD-TX-302M2 SC 7A	Y	
NSR Permit #3452/PSD-TX-302M2 SC 9	Y	Y
NSR Permit #3452/PSD-TX-302M2 SC 12.E	Y	Y

NSR permit #3452/PSD-TX-302M2 SC 12.F & 13.A	Y	
NSR 3452 Special Condition 14		
NSR Permit #3452/PSD-TX-302M2 SC 15B	Y	
NSR Permit #3452/PSD-TX-302M2 SC 16G		Y
NSR Permit 3452/PSD-TX-302M2 SC 17 B & G	Y	
NSR Permit #3452/PSD-TX-302M2 SC 26.D(1), 31.A, 35.A(2)		Y
Refer to Title V Permit O-01553 Periodic Monitoring Summary Requirement for DEGREASERB		Y
NSR Permit 3452/PSD-TX-302M2	Y	

Permit O-01278: Based on PX601

Regulatory Requirement	Was Violation Repeated?	Was There A Post-Complaint Violation?
30 TAC 101.201	Y	
30 TAC 106.262(3)		
30 TAC 111.111(a)(4)(A)	Y	
30 TAC 111.111(a)(8)(A)		
30 TAC 115.126(1)(B)		
30 TAC 115.144(3)(F)		
30 TAC 115.146(2)	Y	
30 TAC 115.352(4)	Y	Y
30 TAC 115.722(d)(1)	Y	
30 TAC 115.725(d)	Y	Y
30 TAC 115.764(a)	Y	Y
30 TAC 115.783(5)	Y	Y
30 TAC 115.788(a)(2)(B)	Y	
30 TAC 116.115(b)(2)(G)		
30 TAC 117.206(e)(1)	Y	
30 TAC 117.208(d)(7)		

30 TAC 117.213(a)(1)(A)(ii)		
30 TAC 117.214(b)(2)		
30 TAC 117.219(b)(1)	Y	
30 TAC 117.310(c)(1)	Y	
30 TAC 117.310(f)		Y
30 TAC 117.340(h)		Y
30 TAC 117.345(f)(6),(10)		
30 TAC 117.8100(a)(1)	Y	Y
30 TAC 117.8140(b)	Y	Y
30 TAC 122.145(2)(B)	Y	
30 TAC 122.146	Y	
40 CFR 60.13(d)(1)		Y
40 CFR 60.18(c)(1)		
40 CFR 60.18(c)(2), (f)(2)	Y	
40 CFR 60.18(c)(3)	Y	Y
40 CFR 60.482-6(a)(1)	Y	
40 CFR 60.562-1(a)(1)(i)(C)	Y	
40 CFR 60.662(b)		
40 CFR 60.1063(e)(2)		
40 CFR 60.115b(a)(3)		
40 CFR 61.349(a)(2)	Y	
40 CFR 61.356(j)(7)		
40 CFR 63.10(d)(5)	Y	
40 CFR 63.11(b)(4)		
40 CFR 63.11(b)(5)		
40 CFR 63.11(b)(6)(ii)	Y	
40 CFR 63.104(c)	Y	
40 CFR 63.105(b)(c), (d), and (e)	Y	
40 CFR 63.113(a)(1)(i)		
40 CFR 63.114(d)(2)	Y	
40 CFR 63.119(c)(2)(ix)		
40 CFR 63.120(b)(9)		
40 CFR 63.143(b)	Y	
40 CFR 63.146(d)(2)		
40 CFR 63.163(b)(1)	Y	
40 CFR 63.167(a)(1)	Y	Y
40 CFR 63.174(b)(3)(i)		
40 CFR 63.792	Y	

40 CFR 63.983(b)(4)(ii)		Y
40 CFR 63.998(d)(1)(ii)(B)		Y
40 CFR 63.2450(e)(2)		
40 CFR 63.600(a), Table 1b	Y	
NSR Permit 1419 SC14.E	Y	
NSR Permit 28441 SC 1 & MAERT		Y
NSR 28441 SC4		
NSR Permit 28441 SC 8.E	Y	
NSR Permit 5710 SC 8.E	Y	
NSR Permit 8942 SC 6.E	Y	
NSR Permit 8942 SC 8	Y	
NSR Permit 9571 SC 5.E.	Y	Y
NSR Permit 9571 SC6.E	Y	
NSR Permit 9674 SC 6D		
NSR Permit 9674 SC 8.E	Y	
NSR Permit 20211 SC 0-4.E	Y	Y
NSR# 20211, SC3-6.B	Y	
NSR Permit # 20211, SC 3-7D	Y	
NSR Permit 20211 SC 3-11B	Y	
NSR Permit 20211 SC 2	Y	Y
NSR Permit 20211 SC 2.E. & 9		
NSR Permit 20211 SC 3.E	Y	Y
NSR Permit 20211 SC 56C		Y
NSR Permt 20211 MAERT	Y	
NSR Permit 36476 MAERT	Y	Y
NSR Permit 4600 SC 3A	Y	
NSR Permit 4600, SC 3B	Y	
NSR Permit 4600 SC 5A	Y	
NSR Permit 4600 SC 6A		Y
NSR Permit 5259 SC 2		
NSR Permit 5259 SC 3		
NSR Permit 96220 SC 11		Y
NSR Permit 96220 SC 12		Y
NSR Permit 5259 MAERT	Y	Y

Permit O-02269: Based on PX602

Regulatory Requirement	Was Violation Repeated?	Was There A Post-Complaint Violation?
30 TAC 101.201(b)(2)(G-K)	Y	
30 TAC 106.262(3)	Y	Y
30 TAC 111.111(a)(4)(A)		
30 TAC 111.111(a)(8)(B)(i)		
30 TAC 115.122(a)(1)	Y	
30 TAC 115.352(4)	Y	Y
30 TAC 115.725(d)	Y	
30 TAC 115.783(5)	Y	Y
30 TAC 115.788	Y	
30 TAC 122.146	Y	
40 CFR 60.112(b)(a)(3)(ii)	Y	
40 CFR 63.11(b)(6)(ii)	Y	
40 CFR 63.105(b), (c), (d), and (e)		
40 CFR 63.167(a)(1)	Y	Y
40 CFR 63.484(a) [63.119(e)(1)]		
40 CFR 63.502(a) [63.170, 63.172(b)]		
40 CFR 63.506	Y	
NSR Permit 20211 MAERT	Y	Y
NSR Permit 20211 SC1 & MAERT		Y
NSR Permit 20211 SC 0-4.E	Y	Y
NSR Permit 20211 SC 1-5	Y	
NSR Permit 20211 SC 1-6	Y	
NSR Permit 20211 SC 1-15	Y	
NSR Permit 20211 SC 1-16A	Y	
NSR Permit 20211 SC 3.E		Y
NSR Permit 20211 SC 5		Y
NSR Permit 20211 SC 21.A.(1)-(4)B.		Y
NSR Permit 20211 SC 31		Y

Permit O-02270: Based on PX603

Regulatory Requirement	Was Violation Repeated?	Was There A Post-Complaint Violation?
30 TAC 106.261	Y	
30 TAC 106.262	Y	
30 TAC 101.201(a)(2)(F&G)		
30 TAC 111.111(a)(1)(B)		
30 TAC 111.111(a)(8)(A)		
30 TAC 115.352(4)	Y	Y
30 TAC 115.722(c)(1)	Y	Y
30 TAC 115.783(5)	Y	Y
30 TAC 115.788(a)(2)(B)		
30 TAC 122.146	Y	
40 CFR 60.482-6(a)(1)	Y	Y
40 CFR 63.167(a)(1)	Y	Y
NSR Permit 8586 SC 1		Y
NSR Permit 8586 SC 3E	Y	Y
NSR Permit 8586 SC 8	Y	Y

APPENDIX B

The Court finds that Exxon's violations of the following emission standards and limitations, listed by count of the Complaint and by permit, are "ongoing" and are therefore the subject of the Court's injunction in this matter.

COUNT I

Violations of General Conditions 8 and 15, and Special Conditions 38 and 39 (formerly 60 and 61) in Permit 18287/PSD-TX-730M4, incorporated in Title V permit O1229, for Emissions of:
Ammonia (NH_3)
Ammonium Compounds (ammonium hydroxide, ammonium polysulfide, NH_4OH, $(NH_4)_2S_x$)
Benzene
Carbon Disulfide (CS_2)
Carbon Monoxide (CO)
Carbonyl Sulfide (COS)
Crude Oil
Halon 1301 (Bromotrifluoromethane)
Hydrogen Chloride (HCl)
Hydrogen Cyanide (HCN)
Hydrogen Sulfide (H_2S)
NO_x (Nitrogen Dioxide, Nitrogen Oxide)
N-Methyl-2-Pyrrolidone (NMP)
Opacity/Visible Emissions
"Other"
Particulate Matter (PM, coke fines)
Phosphoric Acid
Sodium Compounds (NaClO, NaOH)
Total Sulfur, Sulfur, Sulfur Compounds
Sulfur Dioxide (H_2O)
SO_x
Sulfuric Acid (H_2SO_4)

COUNT II

Refinery

Violations of General Conditions 8 and 15, Special Condition 1, and MAERT Limits in Permit 18287/PSD-TX-730M4, incorporated in Title V permit O1229, for Emissions of:
Ammonia
Ammonium Compounds (ammonium hydroxide, ammonium polysulfide, NH_4OH, $(NH_4)_2S_x$)
Benzene
Carbon Disulfide
Carbon Monoxide (CO)
Carbonyl Sulfide (COS)
Crude Oil
Halon 1301 (Bromotrifluoromethane)
Hydrogen Chloride (HCl)
Hydrogen Cyanide (HCN)
Hydrogen Sulfide (H_2S)
NO_x (Nitrogen Dioxide, Nitrogen Oxide)
N-Methyl-2-Pyrrolidone (NMP)
Opacity/Visible Emissions
"Other"
Particulate Matter (PM)
Phosphoric Acid
Sodium Hypochlorite (NaClO)
Total Sulfur, Sulfur, Sulfur Compounds
Sulfur Dioxide (H_2O)
SO_x
Sulfuric Acid (H_2SO_4)
Total VOC

Olefins Plant

Violations of General Condition 8, Special Condition 1, and MAERT Limits in 3452/PSD-TX-302M2, incorporated in permit O1553, for Emissions of:
Ammonia
Carbon Monoxide (CO)
Chlorine
Hydrogen Sulfide (H_2S)
NO_x (Nitrogen Dioxide, Nitrogen Oxide)
Opacity/Visible Emissions
Particulate Matter (PM, coke fines)
Total VOC

Chemical Plant

Violations of General Condition 8, Special Condition 1, and MAERT Limits in Permit 5259, incorporated in Title V permit O1278, for Emissions of:
Carbon Monoxide (CO)

Violations of General Condition 8, Special Condition 1, and MAERT Limits in Permit 20211, incorporated in Title V permits O1278 and O2269, for Emissions of:
Carbon Monoxide (CO)
Hydrochloric Acid/Hydrogen Chloride (HCl)
NO_x (Nitrogen Dioxide, Nitrogen Oxide)
Total VOC

Violations of General Condition 8, Special Condition 1, and MAERT Limits in Permit 36476, incorporated in Title V permit O1278, for Emissions of:
Ammonia (NH_3)
Carbon Monoxide (CO)
Carbonyl Sulfide (COS)
Hydrogen Cyanide (HCN)
Hydrogen Sulfide (H_2S)

NO_x
Sulfur Dioxide (SO_2H_2O)
Total VOC
Carbon Monoxide (CO)
Hydrogen Sulfide (H_2S)

"No Authorization" Chemical Plant Emissions of:
Ammonia (NH_3)
Carbon Monoxide (CO)
Carbonyl Sulfide (COS)
Freon R-22
Hydrochloric Acid/Hydrogen Chloride (HCl)
Hydrogen Sulfide (H_2S)
NO_x (Nitrogen Dioxide, Nitrogen Oxide)
Opacity/Visible Emissions
Particulate Matter (PM, PM_{10})
Sodium Hypochlorite (NaOCl)
Sulfur Dioxide (SO_2)
Total VOC

COUNT III

30 Tex. Admin. Code § 115.722 (the "HRVOC Rule"), in Olefins Plant permit O1553, and Chemical Plant permit O1278.

COUNT IV

40 C.F.R. §§ 60.18(c)(1) and 63.11(b)(4) ("smoking flares"), in Refinery permit O1229, and Olefins Plant permit O1553.

COUNT V

40 C.F.R. §§ 60.18(c)(2) and/or 63.11(b)(5) (pilot flame requirement), in Refinery permit O1229, and Chemical Plant permits O1278 and O2269.

COUNT VI

Violations of General Conditions 8 and 14/15, Special Condition 1, and MAERT Limits, incorporated into Title V permits O1229, O1553, O1278, for fugitive emissions of:
REFINERY
Benzene
Carbon Monoxide (CO)
Hydrogen Sulfide (H_2S)
NO_x
Other/Unspecified
VOC
OLEFINS PLANT
VOCs
CHEMICAL PLANT
Ammonia (NH_3)
Carbon Monoxide (CO)
Carbonyl Sulfide (COS)
Hydrogen Sulfide (H_2S)
Methyl Chloride (MeCl)
Particulate Matter
VOCs

COUNT VII

Permit O-01229

Violations of the Following Regulatory Requirements:
30 TAC 101.201(a)
30 TAC 101.201(b)
30 TAC 106.261, 262
30 TAC 111.111(a)(1)
30 TAC 111.111(a)(4)(A)
30 TAC 111.111 (a)(8)
30 TAC 115.112(d)(2)

30 TAC 115.121(a)(1)
30 TAC 115.241-248
30 TAC 115.352(2), (4)
30 TAC 115.354
30 TAC 115.725
30 TAC 115.781
30 TAC 117.310(c)(1)(A)
30 TAC 117.310(c)(2)
30 TAC 117.340(a), (h), (j)
30 TAC 117.345(b), (f)
30 TAC 117.8100(a)(1)
30 TAC 117.8140(a)(2), (b)
40 CFR 60.7(a)
40 CFR 60.13(d)(1)
40 CFR 60.13(e)
40 CFR 60.18(c)(1)
40 CFR 60.18(b)(2), (c)(2), (f)(2)
40 CFR 60.18(c)(3)(ii)
40 CFR 60.48
40 CFR 60.104(a)(1)
40 CFR 60.104(a)(2)
40 CFR 60.105(a)(3)(2)
40 CFR 60.113b(1)(ii)
40 CFR 60.482-1
40 CFR 60.482-6
40 CFR 60.482-7
40 CFR 60.482-10
40 CFR 60.692-2
40 CFR 61.305
40 CFR 61.349(a)
40 CFR 63.11(b)(4)
40 CFR 63.11(b)(5)
40 CFR 63.11(b)(6)
40 CFR 63.119(c)(2), (c)(3)
40 CFR 63.167
40 CFR 63.644(e)
40 CFR 63.648
40 CFR 63.1565(a)(1)
40 CFR 63.1572(a)

NSR 18287 SC 1
NSR 18287 SC 11.A
NSR 18287 SC 11.B
NSR 18287 CD 13
NSR 18287 SC 14.D
NSR 18287 CD20/SC20
NSR 18287 CD 21
NSR 18287 CD 23
NSR 18287 CD 25
NSR 18287 CD 26
NSR 18287 CD 29
NSR 18287 SC 34
NSR 18287 SC 41
NSR 18287 SC 43C
NSR 18287 SC 45
NSR 18287 CD paragraph 123b
NSR 18287 MAERT

Permit O-01553

Violations of the Following Regulatory Requirements:
30 TAC 101.201
30 TAC 111.111(a)(4)(A)
30 TAC 115.352
30 TAC 115.354
30 TAC 115.722(c)
30 TAC 115.725
30 TAC 115.781(b)(3)
30 TAC 115.782
30 TAC 115.783(5)
30 TAC 117.310(c)(2)
30 TAC 117.310(f)
30 TAC 117.34
30 TAC 117.8140(a), (b)
40 CFR 60.18(c)(1)
40 CFR 60.18(c)(3)(B)
40 CFR 60.45(b)(7)
40 CFR 60.482-6(a)(1)
40 CFR 61.242-6(a)(1)

40 CFR 61.349(a)(2)
40 CFR 63.11(b)(4)
40 CFR 63.167(a)(1)
40 CFR 63.1025(b)
40 CFR 63.1027(a), (b)
40 CFR 63.1033(b)(1)
NSR 3452/PSD-TX-302M2 MAERT Limits
NSR Permit #3452/PSD-TX-302M2 SC 9
NSR Permit #3452/PSD-TX-302M2 SC 12.E

Permit O-01278

Violations of the Following Regulatory Requirements:
30 TAC 115.352(4)
30 TAC 115.725(d)
30 TAC 115.764(a)
30 TAC 115.783(5)
30 TAC 117.8100(a)(1)
30 TAC 117.8140(b)
40 CFR 60.18(c)(3)
40 CFR 63.167(a)(1)
NSR Permit 9571 SC 5.E.
NSR Permit 20211 SC 0-4.E
NSR Permit 20211 SC 2
NSR Permit 20211 SC 3.E
NSR Permit 36476 MAERT
NSR Permit 5259 MAERT

Permit O-02269

Violations of the Following Regulatory Requirements:
30 TAC 106.262(3)
30 TAC 115.352(4)
30 TAC 115.783(5)
40 CFR 63.167(a)(1)
NSR Permit 20211 MAERT
NSR Permit 20211 SC 0-4.E

Permit O-02270

Violations of the Following Regulatory Requirements:
30 TAC 115.352(4)
30 TAC 115.722(c)(1)
30 TAC 115.783(5)
40 CFR 60.482-6(a)(1)
40 CFR 63.167(a)(1)
NSR Permit 8586 SC 3E
NSR Permit 8586 SC 8

CERTIFICATE OF SERVICE

On June 23, 2014, a true and correct copy of the foregoing was served through the Court's ECF system and in compliance with the Federal Rules of Civil Procedure on all counsel of record.

/s/ Philip H. Hilder
Philip H. Hilder