IN THE SUPERIOR COURT OF THE VIRGIN ISLANDS
DIVISION OF ST. CROIX

RYAN ALLEYNE, ENID V. ALLEYNE, MICHAEL BICETTE, MARCO BLACKMAN, ANISTIA JOHN, GEORGE JOHN, SUSIE SANES and **ALICIA SANES,** on behalf of ANA VENTURA, on behalf of themselves and all others similarly situated, *Plaintiffs,* **v.** **DIAGEO USVI, INC.** and **CRUZAN VIRIL, LTD.,** *Defendants.*	**Case No.: SX 2013-CV- 143** **CLASS ACTION** **JURY TRIAL DEMANDED**

DEFENDANTS DIAGEO USVI, INC. AND CRUZAN VIRIL, LTD.'S RULE 12(b)(6) MEMORANDUM IN SUPPORT OF THEIR JOINT MOTION TO DISMISS

Defendants Diageo USVI, Inc. ("Diageo USVI") and Cruzan VIRIL, Ltd. ("Cruzan") respectfully move to dismiss the Complaint pursuant to Rule 12(b)(6) for failing to state a claim upon which relief can be granted.

I. Introduction

For centuries, rum has been produced and aged on St. Croix. Under the guise of nuisance and other common law claims, Plaintiffs are asking this Court to regulate ethanol emissions that occur during rum production and aging. Specifically, Plaintiffs are asking this Court to interfere with Defendants' long-established practices for aging rum by demanding that they install regenerative thermal oxidizer ("RTO") technology to capture and control ethanol emissions at their rum-aging facilities.

But Congress set up a comprehensive system to regulate air emissions—including ethanol emissions—through the Clean Air Act ("CAA"). And as numerous

courts recently have held, the CAA's comprehensive regulatory framework leaves "no room for a parallel track" where private plaintiffs can sidestep the expert federal and state agencies through a lawsuit alleging common law claims. *Am. Elec. Power Co. v. Connecticut*, 131 S. Ct. 2527, 2538 (2011) ("*AEP*"); *see also infra* at 11-12 (citing cases). This Court, too, should hold that Plaintiffs' common law claims are preempted by the CAA.

Even if Plaintiffs' claims were not preempted, they each fail. Plaintiffs premise each of their claims on the allegation that there is capture and control technology reasonably available for Defendants' rum-aging facilities, and that Defendants have a newfound duty to alter their operations by implementing RTO technology. *See, e.g.,* Compl. ¶¶ 72, 88-92, 107-08, 122-26, 131-52. But Plaintiffs do not and cannot allege the existence of any state or federal statute or regulation, local ordinance, or other law requiring Defendants (or any other rum producer) to utilize capture and control technology at rum-aging facilities. Moreover, even though Defendants are highly regulated—and operate under permits issued by the USVI Department of Planning and Natural Resources ("DPNR")—Plaintiffs do not and cannot allege that these permits require such technology. To the contrary, for over three decades, the United States Environmental Protection Agency ("EPA") consistently has taken the position that, because of the negative impacts on product quality and costs, there is *no duty* to implement capture and control technology at distilled spirits aging facilities.

Plaintiffs' request rests on nothing more than the fact that RTO technology is employed by makers of a wholly separate product—brandy—in one area of California,

and Plaintiffs' speculation that "it will work here too." But Plaintiffs' speculation is just that—speculation—and they plead no facts to plausibly support it. *See Bell Atlantic Corp. v. Twombly*, 550 U.S. 544, 555 (2007) (holding that, in order to survive a motion to dismiss, a plaintiff must plead facts—not "labels and conclusions"—that "raise a right to relief above the speculative level"). For this, and the additional reasons described below, each of Plaintiffs' claims must be dismissed.

II. Background

A. Defendants' Rum-Aging Facilities

The Nelthropp family has produced and aged rum under the name "Cruzan" in Estate Diamond for at least seven generations. St. Croix Chamber of Commerce, "Doing Business in the Virgin Islands", http://www.stxchamber.org/doing_business (last accessed July 24, 2013). In 2011, after establishing its production and aging operations in St. Croix and obtaining the necessary permits, Diageo USVI also began aging rum in Estate Diamond. Compl. ¶ 44. Today, rum is the only remaining major production industry on St. Croix.[1]

[1] Rum has always been critical to the St. Croix economy. In the early days, it was a main export. In fact, during the Great Depression, it helped the federal government keep the island functioning. Darwin Creque, *From 'Poorhouse' To Prosperity*, V.I. Daily News, Aug. 2, 1965, at 28-29; Charles Hillinger, *Caribbean Rum Trade Blends History With Success*, LA Times (May 25, 1987), *available at* http://articles.latimes.com/1987-05-25/business/fi-1514_1_sugar-cane (last accessed July 24, 2013). As noted above, today, rum is the only remaining major production industry on St. Croix. *See, e.g.,* Governor's statement as quoted in *Other Nations' Attack on V.I. Rum Cover-Over is Misguided*, V.I. Daily News, (Apr. 19, 2013), *available at* http://virginislandsdailynews.com/op-ed/other-nations-attack-on-v-i-rum-cover-over-is-misguided-1.1475403 (last accessed July 24, 2013).

Rum is aged in oak barrels. Compl. ¶ 25. During this centuries-old aging process, alcohol vapor (ethanol) escapes from the barrels and is emitted into the atmosphere. *Id.* Ethanol emissions are a type of natural "volatile organic compound" or "VOC." *Id.* As described in further detail below, in the CAA, Congress set up an extensive scheme to regulate the emissions of VOCs, including ethanol emissions. *See, e.g.*, 40 C.F.R. § 51.100(s) (defining "volatile organic compounds" to include ethanol); 12-9 V.I. R. & Regs. § 204-20(ddd) (defining "regulated air pollutants" to include "any volatile organic compounds").

Under the CAA, each state or territory must enact a state implementation plan or "SIP" consistent with the CAA's mandates.[2] The USVI's SIP requires both Cruzan and Diageo USVI to maintain permits in order to operate their aging facilities. 12-9 V.I. R. & Regs. § 206-20(c). The USVI DPNR—working in concert with EPA—oversees the permitting process and Defendants' emissions. 12 V.I.C. § 218(a)(2), (c) (requiring each proposed permit to be submitted to and approved by EPA); 12-9 V.I. R. & Regs. §§ 206-26, 206-27 (standards for DPNR review of construction and operation permit applications).

For example, when Diageo USVI established its rum operations in St. Croix, it evaluated ethanol emissions, discussed them with EPA and DPNR,[3] and submitted a

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[2] The U.S. Virgin Islands and other territories are assigned the same rights and responsibilities as states under the CAA. CAA § 302(d), 42 U.S.C. § 7602(d) (defining "State" to include "the Virgin Islands" and other territories). When discussing the CAA and its obligations, this memorandum will refer to territories as states.

[3] Letter from Richard C. Hittinger, President, Alliance Envtl. Grp., Inc., to Frank Jon, Envtl. Eng'r, U.S. EPA Region 2 (Mar. 16, 2009) (Exhibit 1); Letter from Richard C. Hittinger, President,

permit application for its aging warehouse that explained the emissions should be treated as "fugitive" emissions—*i.e.,* emissions that cannot reasonably be captured through control technology.[4] *See* Diageo USVI, Authority to Construct and Permit to Operate General Permit Application, Rum Storage Warehouses (May 2009) ("Permit Application") (Exhibit 3). As the Permit Application explained:

> The emissions from this facility should be treated as fugitive for the same reasons presented in a recent decision by the Indiana Office of Environmental Adjudication (Ref. 1; Attachment G). In this decision, the emissions from a Seagram's Whiskey aging warehouse were deemed to be fugitive after considering the EPA definition of fugitive emissions, the reasonableness of collecting emissions, and extensive evidence presented regarding the negative effect the collection of ethanol emissions would have on the aging process.

See id. at 6-7 under "Project Description."[5]

The Indiana Office of Environmental Adjudication decision, to which the Permit Application referred, found that ethanol "emissions are not collected at other similar facilities and that U.S. EPA has not identified any reasonably available control

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Alliance Envtl. Grp., Inc., to Nadine Noorhasan, Dir., U.S.V.I. DPNR, Div. of Envtl. Prot. (Jan. 23, 2009) (Exhibit 2).

[4] "Fugitive emissions" are those which "could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening." 40 C.F.R. § 52.21(b)(20); 12 V.I.C. § 202(k). Fugitive emissions are not considered in determining whether a stationary source is a "major source" and thus subject to additional permitting requirements under Title V of the CAA. 12-9 V.I. R. & Regs. § 204-20(hh)(2); *id.* § 206-51(a)(1) ("Any major source" is required to obtain a Title V permit).

[5] The Court can take judicial notice of—and consider for purposes of this motion to dismiss—the Defendants' permits and application materials, the EPA and state regulatory documents, Plaintiffs' property records, and the other public records cited by Defendants. *See In re Kelvin Manbodh Asbestos Litigation Series*, No. 324/1997, 2006 WL 1084317, at *3 (D.V.I. Mar. 6, 2006) (court can consider on a motion to dismiss "matters that the court can take judicial notice of"); *see also Papasan v. Allain,* 478 U.S. 265, 268 n.1 (1986) ("Although this case comes to us on a motion to dismiss under Federal Rule of Civil Procedure 12(b), we are not precluded in our review of the complaint from taking notice of items in the public record . . . .").

technology (RACT) for ethanol emissions from alcohol beverage aging warehouses." In re: Objection to the Issuance of Part 70 Operating Permit No. T-137-6928-00011 for Joseph E. Seagram & Sons, Inc., Ripley County, Indiana, 2004 OEA 58, ¶ 21 (03-AZ-J-3003) (Aug. 4, 2004), *available at* http://www.in.gov/oea/decisions/2004oea58.pdf. Indeed, for over three decades, EPA has taken the consistent position that ethanol emissions from distilled spirits aging facilities cannot be reasonably captured due to cost and the negative impact that control technology would have on product quality. *See* EPA, EPA-450/2-78-013, Cost and Engineering Study – Control of Volatile Organic Emissions from Whiskey Warehousing, p. 1-4 (1978) (due to cost and effect on product quality, "control of emissions from whiskey warehousing [including empty barrel storage] has not been demonstrated at this time") (Exhibit 4); EPA, EPA Contract 68-D2-0159, Emission Factor Documentation for AP-42 Section 9.12.3 – Distilled Spirits, Final Report, pp. 2-12 (1997) (noting "adverse impact" that ethanol control systems would have on product quality) (Exhibit 5); Letter from John C. Beale, Deputy Assistant Administrator for Air and Radiation, EPA, to the Honorable Robert C. Smith, U.S. Senate (Oct. 23, 2000) (EPA has not identified any "available technology which it considers to be RACT for alcohol beverage aging warehouses") (Exhibit 6).

Exercising their expert judgment, EPA and DPNR agreed that the emissions from Diageo USVI's aging warehouse are "fugitive," which was essential to Diageo USVI's classification as a "minor source" rather than a "major source." *See* 40 C.F.R. § 52.21(b)(1)(iii) (fugitive emissions "shall not be included in determining" whether source is a "major stationary source"); 12-9 V.I. R. & Regs. § 204-20(hh)(2) (stating the same).

DPNR thus issued "minor source" permits to Diageo USVI for the construction and operation of its aging warehouse. *See* DPNR, Minor Source Permit Authority To Construct, Permit No. STX-792-A-B-09 (Exhibit 7); DPNR, Minor Source Permit To Operate, STX-792-A-B-11 (Exhibit 8). These permits did not require Diageo USVI to implement any type of control technology to stop ethanol from escaping from the rum-aging warehouse. Likewise, Cruzan's permits have never required it to control ethanol emissions from its rum-aging warehouse. Plaintiffs could have—but did not—object to the Defendants' final permits in territorial courts. *See* 12 V.I.C. § 206(e) (authorizing review of permit issuance).

Exercising its authority under the USVI's SIP, DPNR recently sent letters to Defendants regarding citizen complaints relating to Defendants' ethanol emissions. *See* Letter from Alicia Barnes, Commissioner, DPNR, to Dan Kirby, Vice President, Diageo USVI (July 8, 2013) (Exhibit 9); Letter from Alicia Barnes, Commissioner, DPNR, to Gary Nelthropp, Vice President, Virgin Islands Rum Ltd. / Cruzan Rum (July 8, 2013) (Exhibit 10). As a result, Defendants and DPNR have begun a dialogue on the issue. Working with DPNR, Defendants hope to find an amicable resolution.

B. Plaintiffs

The named Plaintiffs own or rent property in subdivisions downwind of Estate Diamond, where Defendants operate their aging facilities.[6] As the Court knows, the

[6] Warranty Deed No. 4126/1992 between 1845 Corporation and Alleyne (Recorded Jul. 21, 1992); Warranty Deed between Robles and Bicette (Recorded Feb. 25, 2005); Warranty Deed between Billman and Blackman (Recorded May 11, 2005); Warranty Deed between Kasdan and John (Recorded June 7, 2007); Warranty Deed between

wind on St. Croix blows almost exclusively from the East—over HOVENSA, the Rohlsen airport, Estate Diamond, and then Enfield Green and William's Delight. Exhibit 12. The named Plaintiffs are all to the west of the HOVENSA plant, the Rohlsen Airport, and the rum-aging warehouses, within the same downwind track.

The named Plaintiffs complain that their properties exhibit stains, which they assert are caused by ethanol emissions emitted from Defendants' facilities. Compl. ¶ 37. Specifically, they claim that the ethanol emitted from Defendants' facilities—as opposed to the many other airborne contaminants (such as jet fuel residue from the airport) that have blown over their properties for years—"combine[s] with condensation on Plaintiffs' property" to catalyze growth of a mold known as *Baudoinia compniacensis*. Compl. ¶¶ 30, 32. All of the named Plaintiffs or their landlords purchased the homes at issue between 1990 and 2007.[7] This is long after rum-aging facilities, which allegedly cause such a "stain," were operating in Estate Diamond. Compl. ¶ 37.

III. Rule 12(b)(6) Standard

To survive a motion to dismiss, a complaint must demonstrate that the plaintiffs' claims are more than just "conceivable," but are in fact "plausible on [their] face." *Bell Atlantic Corp. v. Twombly,* 550 U.S. 544, 555 (2007); *Ashcroft v. Iqbal*, 556 U.S. 662, 678 (2009) (quoting *Twombly*, 550 U.S. at 570). In applying this plausibility standard,

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Noel and Grouby (Recorded Oct. 12, 2000); Warranty Deed No. 5986/1990 between Hernandez and Rivera (Recorded Aug. 22, 1990). *See* Exhibit 11.

[7] Alleyne in 1992, Bicette in 2005, Blackman in 2005, John in 2007, and the owners of the property rented by A. Sanes in 2000 and S. Sanes in 1990.

the Court should disregard all conclusory statements, even when "couched as a factual allegation." *Twombly*, 550 U.S. at 555 (internal quotation marks and citation omitted). Rather, the question is whether the *facts* pled demonstrate that the claims cross the threshold from "conceivable" to "plausible," and therefore adequately state a claim for relief.[8] Here, Plaintiffs have not stated a plausible claim for relief.

IV. Argument

A. The Clean Air Act Preempts Plaintiffs' Common Law Claims

A state law claim may be preempted through field preemption or conflict preemption. *North Carolina, ex rel. Cooper v. Tenn. Valley Auth.* ("*TVA*"), 615 F.3d 291, 303 (4th Cir. 2010). "Field preemption" occurs where the scheme of federal regulation is "so pervasive as to make reasonable the inference that Congress left no room for the States to supplement it," *id.* (quoting *Pac. Gas & Elec. Co. v. State Energy Res. Conservation & Dev. Comm.*, 461 U.S. 190, 204 (1983)), while "conflict preemption" precludes claims where state law "interferes with the methods by which the federal statute was designed to reach [its] goal," *id.* (quoting *Intl. Paper Co. v. Ouellette*, 479 U.S. 481, 494 (1987)). Plaintiffs' Complaint runs afoul of both. As numerous other

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[8] As Judge Gomez recently explained:

> To determine the sufficiency of a complaint . . . a court must take three steps: First, the court must 'tak[e] note of the elements a plaintiff must plead to state a claim.' . . . . Second, the court should identify allegations that, 'because they are no more than conclusions, are not entitled to the assumption of truth' . . . . Finally, 'where there are well-pleaded factual allegations, a court should assume their veracity and then determine whether they plausibly give rise to an entitlement for relief.'

Watts v. Blake-Coleman, No. 2011-61, 2012 WL 1080323, at *2 (D.V.I. Mar. 29, 2012).

courts recently have done, this Court should hold that that Plaintiffs' common law claims are preempted by the CAA's comprehensive framework for control and abatement of air emissions.

1. The CAA Provides A Comprehensive Framework For Regulating Air Emissions

The CAA comprehensively and pervasively regulates virtually all of the nation's air emissions from all sources. *See TVA*, 615 F.3d at 298 ("To say this regulatory and permitting regime is comprehensive would be an understatement."); *Bell v. Cheswick Generating Station*, 903 F. Supp. 2d 314, 322 (W.D. Pa. 2012), *appeal docketed*, No. 12-4216 (3d Cir. Nov. 16, 2012) (CAA "represents a comprehensive statutory and regulatory scheme"). The CAA specifically addresses the alleged economic and property effects from air emissions about which Plaintiffs complain, in addition to public health concerns. *See* CAA § 302(h), 42 U.S.C. § 7602(h) (defining "effects on welfare" to include "damage to and deterioration of property" and effects on "vegetation," "manmade materials," "economic values," and "personal comfort and well-being").

The Act sets forth an intricate and detailed framework for joint federal and state regulation of air emissions. EPA is tasked with developing National Ambient Air Quality Standards for air emissions that "cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare." CAA §§ 108(a)(1)(A), 109, 42 U.S.C. §§ 7408(a)(1)(A), 7409. In turn, states are responsible for developing state implementation plans ("SIPs") to provide for the "implementation, maintenance, and enforcement" of these standards within each state, which must be submitted to and approved by EPA. *Id.* § 110(a)(1), 42 U.S.C. § 7410(a)(1). Pursuant to the CAA, SIPs

contain permit programs limiting the amounts and types of emissions that each permit holder is allowed to discharge. *Id.* §§ 502(d)(1), 504(a), 42 U.S.C. §§ 7661a(d)(1), 7661c(a). SIPs also arm states with the ability to resolve citizen complaints about air emissions even after a permit is issued. *See, e.g.,* 12-9 V.I. R. & Regs. § 204-27(a) (addressing "air pollution nuisances").

Once approved by EPA, the provisions of these SIPs and any permits issued pursuant to them are federally enforceable by EPA and private citizens, as well as the applicable state. CAA §§ 113(b)(1), 304(a)(1), 42 U.S.C. §§ 7413(b)(1), 7604(a)(1).

2. Plaintiffs' Claims Conflict With—And Are Preempted By—The CAA's Comprehensive Regulatory Scheme

Recognizing this pervasive, finely crafted regulatory scheme, courts repeatedly have confirmed the CAA's preemptive effect over common law claims. In *AEP*, the U.S. Supreme Court held that nuisance claims under the federal common law "cannot be reconciled with the decisionmaking scheme Congress enacted" in the CAA. 131 S. Ct. at 2540. Because the Act already "provides a means to seek limits on emissions" that formed the basis of the plaintiffs' nuisance claims, the Court held that there is "no room for a parallel track" to limit emissions through the federal common law.[9] *Id.* at 2538.

Numerous other federal and state courts have applied the Court's reasoning in *AEP* to hold that the CAA also preempts state common law claims. *See, e.g.*, *Bell*, 903 F. Supp. 2d at 321-22. Indeed, *every court* that has recently considered the issue has

[9] The Supreme Court did not rule on the CAA's preemptive effect on state common law claims because no party had addressed the issue in briefing; instead, that decision was reserved for the court on remand. *AEP*, 131 S. Ct. at 2540. Tellingly, however, the *AEP* plaintiffs voluntarily dismissed their state law claims upon remand. *See Connecticut v. Am. Elec. Power Co.*, 406 F. Supp. 2d 265 (S.D.N.Y. 2009) (Notice of Voluntary Dismissal).

found that the Act preempts common law claims alleging that emissions regulated under the CAA cause a nuisance. *See Native Vill. of Kivalina v. ExxonMobil Corp.*, 696 F.3d 849 (9th Cir. 2012) (federal common law nuisance claim for damages); *TVA*, 615 F.3d at 301-06 (state common law nuisance claim); *Bell*, 903 F. Supp. 2d at 322-23 (state common law claims for nuisance, negligence, trespass, and strict liability); *Comer v. Murphy Oil USA, Inc.*, 839 F. Supp. 2d 849, 865 (S.D. Miss. 2012) (state common law nuisance, trespass, and negligence claims), *aff'd*, 718 F.3d 460 (5th Cir. 2013); *United States v. EME Homer City Generation, L.P.*, 823 F. Supp. 2d 274, 296-97 (W.D. Pa. 2011) (state common law nuisance claim); *Freeman v. Grain Processing Corp.*, No. LACV 021232, (Muscatine Cnty. (Iowa) Dist. Ct. Mar. 27, 2013) (order granting Defendant's motion for summary judgment) (state common law nuisance claim) (Exhibit 13).

Plaintiffs' common law claims here are likewise preempted. The CAA specifically addresses VOCs, including ethanol emissions. *See, e.g.,* 40 C.F.R. §51.100(s); 12-9 V.I. R. & Regs. §204-20(ddd). Exercising their authority under the CAA and USVI's SIP, EPA and DPNR did not require the use of any control technology with respect to ethanol emissions from Defendants' aging warehouses as part of the permitting process.

Moreover, if there is a nuisance of the type that Plaintiffs allege, then the nuisance provision in the USVI's SIP specifically empowers DPNR to address it. *See* 12-9 V.I. R. & Regs. § 204-27(a) (prohibiting emissions that "cause injury, detriment, nuisance, [or] annoyance" or that "cause injury or damage to business or property"); 12 V.I.C. § 215 (authorizing DPNR to seek administrative and civil penalties and injunctive

relief). Indeed, DPNR recently has engaged Defendants regarding their ethanol emissions, and the parties are in discussions. *See supra* at 7 and footnote 12 (discussing letters from DPNR).[10]

Apparently unsatisfied with the permits issued to Defendants—and discontent to let the expert agencies address Defendants' emissions through the tools in the CAA and USVI's SIP—Plaintiffs are asking this Court to bypass the carefully crafted regulatory program and create an incompatible regime of regulation by common law. But, as other courts have done, this Court should recognize the "considerable potential mischief" in common law nuisance actions that place generalist courts in the role of primary regulator and apply "the strongest cautionary presumption against them." *TVA*, 615 F.3d at 303. Allowing Plaintiffs to pursue their common law claims would upset the delicate equilibrium of state and federal authority and improperly insert this Court into the role of the expert executive agencies.

Although their claims are framed as a simple tort action, Plaintiffs are effectively asking the Court to impose additional limits on Defendants' ethanol emissions beyond those deemed appropriate by EPA and DPNR. In *AEP*, the U.S. Supreme Court recognized Congress' "prescribed order of decisionmaking"—in which "the first decider under the Act is the expert administrative agency" and courts participate only through "review [of] agency action"—provides a compelling reason to "resist setting emission

[10] In addition, Plaintiffs could bring a citizen suit under the CAA in federal district court to challenge Defendants' compliance with their operating permits and any standard in the USVI SIP. Before doing so, Plaintiffs would have to provide DPNR with adequate notice and the opportunity to take action. CAA § 304(b)(1)(A), 42 U.S.C. § 7604(b)(1)(A). This ensures that "it is [the agency], not the citizens, who is principally responsible for enforcing the law." *Citizens for Clean Power v. Indian River Power, LLC*, 636 F. Supp. 2d 351, 357 (D. Del. 2009).

standards by judicial decree" via tort law. 131 S. Ct. at 2539. The "complex balancing" inherent in the regulation of emissions is "entrust[ed] . . . to EPA in the first instance, in combination with state regulators." *Id.*

Congress' decision to allocate primary regulatory responsibility to specialized executive agencies rather than to the courts reflects the relative expertise and institutional capabilities of these two branches of government. *See TVA*, 615 F.3d at 305 ("[W]e doubt seriously that Congress thought that a judge holding a twelve-day bench trial could evaluate more than a mere fraction of the information that regulatory bodies can consider."). The appropriate amount of regulation for any particular air emission source "cannot be prescribed in a vacuum: . . . informed assessment of competing interests is required." *AEP*, 131 S. Ct. at 2539. Recognizing the need for "a very high degree of specialized knowledge in chemistry, medicine, meteorology, biology, engineering, and other relevant fields that agencies rather than courts were likely to possess," Congress "opted rather emphatically for the benefits of agency expertise" to develop emission standards and controls in place of judicially managed common law doctrines. *TVA*, 615 F.3d at 304-05.

Unlike courts, executive agencies such as DPNR have the advantage of rulemaking. *See, e.g.*, 5 U.S.C. § 553 (governing federal agency rulemaking); V.I. R. & Regs. Ann. tit. 12 V.I.C. § 204(f) (authorizing DPNR to promulgate rules and regulations "after public comment or hearing on due notice"). The rulemaking process helps inform agency decisions by providing opportunities for input from "the varied and practical perspectives of industry and environmental groups" and has the added benefits of

"providing proactive instead of reactive control . . . allowing flexibility in developing rules, and lowering the likelihood of disturbing reliance interests." *TVA*, 615 F.3d at 305. Likewise, in the permitting process, the agencies are able to explore the scientific issues underlying air emissions, and to collaborate with both industry and the public in making a regulatory decision that balances the respective interests. *E.g.*, CAA § 502(b)(6), 42 U.S.C. § 7661a(b)(6).

In contrast, courts are ill-suited for developing emission limits and controls. As the Supreme Court observed in *AEP*:

> The expert agency is surely better equipped to do the job than individual district judges issuing ad hoc, case-by-case injunctions. Federal judges lack the scientific, economic, and technological resources an agency can utilize in coping with issues of this order. Judges may not commission scientific studies or convene groups of experts for advice, or issue rules under notice-and-comment procedures inviting input by any interested person, or seek the counsel of regulators in the States where the defendants are located. Rather, judges are confined by a record comprising the evidence the parties present. Moreover, federal district judges, sitting as sole adjudicators, lack authority to render precedential decisions binding other judges, even members of the same court.

131 S. Ct. at 2539-40. The Court thus left little doubt as to which branch of government is best suited to determine appropriate limits on emissions.

Despite these constraints, Plaintiffs propose that this Court determine—without reference to the CAA or the views of the EPA and the DPNR—what level of ethanol emissions from Defendants' permitted operations is appropriate. Deciding Plaintiffs' common law tort claims would require this Court to usurp the regulatory function that the CAA assigns to EPA and state and territorial regulators. In *AEP*, the Supreme Court held that decisions regarding "what amount of . . . emissions is unreasonable" and "what

level of reduction is practical, feasible, and economically viable" were entrusted by Congress to the executive branch. 131 S. Ct. at 2540 (internal quotation marks omitted).

Applying this holding, numerous courts have found that the CAA preempts tort claims such as nuisance and trespass that would require a court to make similar determinations regarding the "reasonableness" of a defendant's emissions. *Bell*, 903 F. Supp. 2d at 322 (dismissing state common law claims that "would require an impermissible determination regarding the reasonableness of an otherwise government regulated activity"); *Comer*, 839 F. Supp. 2d at 865 (dismissing state common law claims that "hinge[d] on a determination that the defendants' emissions are unreasonable"); *Freeman*, No. LACV 021232 at 13 (reasonableness of a defendant's emissions "is a judgment that has been entrusted by Congress to the EPA").

Similarly, Plaintiffs here ask this Court to find that Defendants' ethanol emissions are "unreasonable," Compl. ¶¶ 83, 115, 130, 134, and that those emissions "can be corrected or abated at reasonable expense," *id.* ¶¶ 87, 88, 151. These determinations have already been entrusted by Congress to EPA and the DPNR. Accordingly, Plaintiffs' attempt to bypass those agencies—and to transform this Court into the primary regulator of air emissions in the USVI—"cannot be reconciled with the decisionmaking scheme Congress enacted." *AEP*, 131 S. Ct. at 2540.[11] Plaintiffs'

[11] Plaintiffs may argue that their claims are preserved by one of the CAA's two general savings provisions. Neither savings clause, however, limits the Act's preemptive effect over common law claims. *See* CAA §§ 304(e) (limiting preemptive effect of requirements "in this section," *i.e.,* requirements applicable to federal citizen suits), 116 (preserving state authority to adopt more stringent emission standards), 42 U.S.C. §§ 7604(e), 7416. Moreover, a general savings clause "cannot in reason be construed as allowing a common law right, the continued existence of which would be absolutely inconsistent with the provisions of the act." *AT&T Mobility LLC v. Concepcion*, 131 S. Ct. 1740, 1748 (2011) ("[T]he act cannot be held to destroy itself."). Indeed,

claims are preempted and therefore should be dismissed with prejudice under Rule 12(b)(6). *See, e.g., Bell*, 903 F. Supp. 2d at 322-23 (holding plaintiffs' common law claims are preempted; dismissing with prejudice pursuant to Rule 12(b)(6)).

B. Even If Not Preempted, Each Count Fails As A Matter Of Law

Even if Plaintiffs' claims are not preempted, each count fails as matter of law. As a threshold matter, although Plaintiffs premise each of their counts on the allegation that control technology is reasonably available and Defendants have a duty to implement it, they fail to plead facts plausibly supporting that allegation. For this and the additional reasons described below, these counts should be dismissed.

1. Plaintiffs Have Failed To Plausibly Plead A Duty To Control Ethanol Emissions

Count I of the Complaint alleges a claim for negligence, which is now governed by the *Restatement (Third) of Torts: Liability for Physical and Emotional Harm* (Basic Principles) (2005) (hereinafter "*Restatement Third*"). *See* 1 V.I.C.§ 4; *see also Banks et al. v. Int'l Rental and Leasing Corp. d/b/a Budget Rent A Car,* S. Ct. Civ. No. 2011-0037, 2011 WL 6299025 (V.I. Dec. 15, 2011). A critical element of a negligence claim is a duty of care. *See Nickeo v. Atlantic Tele-Network Co.*, Civ. No. 748/1997, 2003 WL 193435, at *8 (V.I. Terr. Ct. Jan. 14, 2003) (explaining that, to "sue in negligence, a plaintiff must establish that the individual defendants had a duty of care to the plaintiff"). Here, the Complaint alleges that Defendants have breached a duty to use capture and control technology—specifically, RTO technology—to reduce ethanol emissions. Compl.

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several federal and state courts have considered this issue and held that the CAA's savings clauses do not preserve state common law claims of the type at issue here. *TVA*, 615 F.3d at 303-04; *Bell*, 903 F. Supp. 2d at 322; *Freeman*, No. LACV 021232 at 19-21.

¶¶ 28-29, 72; 131-52. But the facts pled by Plaintiffs do not plausibly support such a duty.

As noted above, Plaintiffs do not and cannot allege the existence of any state or federal statute or regulation, local ordinance, or other law requiring Defendants (or any other rum producer) to use capture and control technology at rum aging facilities, much less to use RTO technology. Nor do Defendants' operating permits require capture and control technology with respect to their rum-aging facilities. *See e.g.,* Exhibit 8. Indeed, Plaintiffs do not plead that any company anywhere has ever implemented such technology for a rum-aging warehouse.[12]

To the contrary, for decades, the EPA consistently has taken the position that there is *no duty* to implement capture and control technology at distilled spirits aging facilities. *See supra at 5-6.* The EPA determined specifically with respect to rum that control technology is not reasonably available for aging facilities when it approved Maryland's proposed requirements on a Seagram & Sons ("Seagram") rum facility. In 2001, Maryland decided to adopt a rule defining reasonably available control technology

[12] DPNR's recent letters to Defendants raise the possibility of informally resolving citizen complaints by reducing ethanol emissions and helping to clean homes. *See* Letter from Alicia Barnes, Commissioner, DPNR, to Dan Kirby, Vice President, Diageo USVI (July 8, 2013) (Exhibit 9); Letter from Alicia Barnes, Commissioner, DPNR, to Gary Nelthropp, Vice President, Virgin Islands Rum Ltd. / Cruzan Rum (July 8, 2013) (Exhibit 10). But on their face, these letters are merely invitations for DPNR and Defendants to resolve amicably whether and how ethanol emissions should be reduced. The letters are not findings that ethanol emissions control technology is required or feasible or that the type of emissions control requested by Plaintiffs, RTO, is even feasible. The EPA has never concluded that emissions control technology is feasible in connection with rum aging. These letters do not change that fact. As described above, what these letters do make plain is that the agencies charged with regulating air emissions under the CAA—the EPA and DPNR—are doing what Congress intended that they, and not the courts, do.

("RACT")[13] requirements for distilled spirits facilities. The only facility affected by Maryland's rule was Seagram's rum facility. When formulating this RACT rule, Maryland recognized the fundamentals of aging distilled spirits, and how a requirement to change air flows will damage the product. In its Technical Support Document developed to support this RACT rule, the Maryland Department for the Environment noted:

> The VOC from the aging operation is released as fugitive emissions and is caused by the breathing of the barrels. The reaction within the barrel and the breathing are part of the aging cycle. Interference with the breathing of the barrels or changing the airflow interfere with the product quality.

MDE Technical Support Document, Control of Volatile Organic Compounds from Distilled Spirits Facilities, COMAR 26.11.19.20, p. 1.

Maryland sought to have the EPA approve this RACT rule as part of its SIP. The rule imposes good management practice requirements on barrel filling and emptying and on storing empty barrels, but imposes no requirement to capture and control emissions from aging warehouses. In its Federal Register notice accepting this regulation as a SIP amendment, EPA stated:

> Neither the proposed nor adopted version of Maryland's RACT to control VOC emissions from distilled spirits facilities requires that VOCs be controlled from the aging warehouses. The Maryland regulation is not to be construed to mean that the required good operating practices manual extends to the aging process at the affected facility in Maryland.

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[13] The phrase "reasonably available control technology" is interpreted by the EPA to mean the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility. 44 Fed. Reg. 53762 (Sept. 17, 1979).

66 Fed. Reg. 56220 (Nov. 7, 2001). EPA, of course, would not have accepted the rule as part of Maryland's SIP had it concluded that technology to capture and control aging emissions was reasonably available. To the contrary, for decades, EPA has consistently determined that emissions from aging of distilled spirits, like whiskey and rum, cannot reasonably be captured due to costs and the negative impact on product quality. *See supra* at 6.

In seeking to impose a newfound duty on Defendants and their rum-aging facilities—contrary to centuries of practice in the USVI and the views of the EPA—Plaintiffs point to the fact that brandy makers in an area of California now utilize RTO technology in response to regulation by a local agency, the San Joaquin Valley Unified Air Pollution Control District ("SJVUAPCD"). *See, e.g.*, Compl. ¶ 144. But there is nothing in the Complaint to *plausibly* suggest that implementation of RTO technology by makers of a separate product in a far-away locality is relevant—much less controlling—with respect to the feasibility of using RTO technology for rum aging in the USVI.[14]

[14] Plaintiffs claim that "[a]ny differences between the design of rum and brandy-aging warehouses will not impede Adwest's ability to apply the same RTO technology to rum aging warehouses and achieve the same results as were achieved on brandy aging warehouses." Compl. ¶ 147. But this is precisely the type of conclusory allegation that was rejected as irrelevant and insufficient in *Twombly*, 550 U.S. at 555. Moreover, on the face of the relevant SJVUAPDCD Rule—and as the accompanying Staff Report makes clear—neither SJVUAPCD's analysis nor the Rule itself extend beyond brandy and wine-aging. *See* SJVUAPCD Rule 4695, 2.0 ("Applicability: This rule shall apply to brandy aging and wine aging operations."), *available at* http://www.valleyair.org/rules/1ruleslist.htm (last accessed July 24, 2013); Final Draft Staff Report for New Draft Rule 4695, at 3 (Aug. 9, 2009) ("[W]hiskey aging is not considered or included in this rule development process") (Exhibit 14).

The *Restatement Third's* instructions on when, and when not, to recognize a duty also caution against this Court recognizing the new duty that Plaintiffs seek.[15] Comment g. to § 7 (entitled "Duty") provides:

> g. *Deference to discretionary decisions of another branch of government.* Courts employ no-duty rules to defer to discretionary decisions made by officials from other branches of government, especially decisions that allocate resources or make other policy judgments. Courts often use the rubric of duty to hold that it is inappropriate to review these decisions in lawsuits.

In addition, Comment f. to § 7 states:

> *f. Institutional competence and administrative difficulties.* Sometimes a particular category of negligence claims would be difficult for courts to adjudicate. Courts may have difficulty gathering evidence or drawing doctrinal lines necessary to adjudicate certain categories of cases. These administrative concerns may support adopting a no-duty rule. For example, when a plaintiff claims that it is negligent merely to engage in the activity of manufacturing a product, the competing social concerns and affected groups would be appropriate considerations for a court in deciding to adopt a no-duty rule.

In this case, as described in detail above, the question of whether Defendants should be required to implement capture and control technology—much less a specific type of technology—has been committed by Congress to the expert federal and state agencies pursuant to the CAA for many of the reasons identified in these Comments. *See AEP*, 131 S. Ct. at 2539-40 (discussing reasons why "[t]he expert agency is surely better equipped to do the job [of regulating air emissions] than individual district judges issuing ad hoc, case-by-case injunctions"). And Congress' choice makes sense. These

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[15] Plaintiffs' request that this Court order Defendants to abate the alleged emissions by requiring Defendants to install an emissions control system is a claim for equitable relief that would be decided by this Court, not a jury. *See University of Virgin Islands v. Petersen-Springer*, 232 F. Supp. 2d 462 (D.V.I. 2002) (citing *Newfound Management Corp. v. Lewis*, 131 F.3d 108, 115 (3d Cir. 1997) ("Although actions at law entitle a party to a jury trial, cases in equity do not.")).

agencies, and not a generalist court, are better suited to address the complex scientific and policy questions underlying this issue.

For example: Will capture and control technology disrupt the rum-aging process, as EPA previously has recognized? How much ethanol must be captured to prevent the alleged "rum mold"? What type of capture and control technology will be required? At what cost? What if the capture does, as anticipated, have negative impacts on product quality or characteristics and thus sales? What are the potential implications on the St. Croix economy and other competing social concerns? These questions beg for the judgment of an expert agency acting through the notice and comment and permitting processes—not courts imposing newfound "duties" and injunctions based on amorphous common-law standards and a limited factual record.

Moreover, Plaintiffs' Complaint does not address—much less plausibly rebut—the "competing social concerns and affected groups" that weigh heavily in favor of this Court adopting a no-duty rule. *See Restatement Third* § 7 cmt. f. These factors include: (1) the importance of the rum industry to the economy of the Virgin Islands, (2) the history of rum production on St. Croix, (3) the long-established methodologies for aging rum, which Plaintiffs seek to alter; and (4) Defendants' expectation interests based on the lack of any capture and control requirement in their permits.

In summary, Plaintiffs' Complaint fails to plead facts to plausibly support Plaintiffs' proposed new duty and, in these circumstances, the *Restatement Third* cautions this

Court against recognition of such a duty. Plaintiffs' claim of negligence should be dismissed.[16]

2. Plaintiffs Have Not Plausibly Pled A Nuisance Claim

In order to plausibly plead a nuisance claim (Count II), Plaintiffs must plead facts showing an invasion is "unreasonable." *Bermudez v. Virgin Islands Telephone Corp.*, No. SX-10-CV-298, 2011 WL 321000, at *10 (V.I. Super. Jan. 20, 2011) (citing *Restatement (Second) of Torts* § 822 (1979) (internal citations omitted)). Here, Plaintiffs attempt to plead this element of their claim by alleging that "[r]easonable and cost effective emissions control technology exists" (Compl. ¶ 29) and that "Defendants' ethanol emissions can be corrected or abated at reasonable expense" (Compl. ¶ 88). When these conclusory allegations are disregarded, as the U.S. Supreme Court commanded in *Twombly* and *Iqbal, and* Judge Gomez confirmed in *Watts*,[17] there is no factual basis alleged in the Complaint to plausibly support that Defendants have acted

[16] Plaintiffs also appear to assert a claim for negligence *per se* based on the alleged violation of the civil and criminal statutes regarding private and public nuisances, 28 V.I.C § 331 and 14 V.I.C. §§ 1461-1462. *See* Compl. ¶ 71. But these statutes are irrelevant to the negligence claim. These statutes are not designed to protect against a particular type of conduct or a certain class of individuals. *See Restatement Third* §14 (negligence *per se* only applies where the statute at issue "is designed to protect against the type of accident the actor's conduct causes, and if the accident victim is within the class of person the statute is designed to protect"). Nor do they provide any sort of standard or structure that would aid the negligence determination. *See id.* §14 cmt. f (with respect to "[s]tatutes that duplicate the common law" that courts "more frequently . . . reject negligence *per se*, recognizing its redundancy and appreciating that it does not serve its typical function of simplifying or providing structure to the rendering of negligence determinations"). To the extent that Plaintiffs claim negligence *per se*, that claim should be rejected.

[17] Judge Gomez admonished in *Watts,* 2012 WL 1080323, at *1, that, in ruling on a Rule 12(b)(6) motion, "the court should identify allegations that, 'because they are no more than conclusions, are not entitled to the assumption of truth' . . . ." This admonition is particularly applicable to Count II, which rests on numerous conclusory statements, without specific facts to support those conclusions.

unreasonably by not implementing control and capture technology. *See supra* at 4-6. Accordingly, the nuisance claim must be dismissed.

Moreover, even if the centuries-old method of aging rum is now deemed a nuisance, Plaintiffs chose to "come to the nuisance" or *volenti non fit injuria*, meaning "to a willing person, injury is not done." Section 840D of the *Restatement (Second) of Torts* provides that coming to the nuisance is "not in itself sufficient to bar [the] action, *but it is a factor to be considered in determining whether the nuisance is actionable*." *Restatement (Second) of Torts* § 840D (1979) (emphasis added).

Rum production and aging operations have been conducted at Cruzan's present location for more than 220 years. According to Plaintiffs' own allegations, the alleged *Baudoinia compniacensis* caused by rum production and aging "is *very* visible on homes, businesses, vehicles, trees/plants and fruits/vegetables and is unsightly and damaging." Compl. ¶ 37 (emphasis added). Plaintiffs, of course, were born well after rum aging was taking place in Estate Diamond, and public records demonstrate that they, or their landlords, moved into the properties at issue here between 1990 and 2007.[18] If such a nuisance existed, it would have been known to Plaintiffs when they purchased real estate or began residing in the area and to the developers of these sub-divisions.

The *Restatement (Second) of Torts* provides an analogous illustration:

> A operates a brewery in a former residential area in which industrial plants are beginning to appear. The brewery noises, odors and smoke interfere with the use and enjoyment of the land of B adjoining it. C buys the land from B, moves in upon it and brings an action for the private nuisance.

[18] *See supra* n. 6, and accompanying text.

> The fact that C has come to the nuisance, together with the changing character of the locality, may be sufficient to prevent recovery.

Restatement (Second) of Torts § 840D, illus. 3 (1979). This case even more strongly calls for finding that Plaintiffs' claim is not actionable. This is not a case where rum operations are just "beginning to appear," as in the illustration above. *Id.* The aging of rum—and thus the release of ethanol and the alleged blackening that Plaintiffs' claim it causes—has been occurring for centuries in Estate Diamond. Compl. ¶ 37. To the extent there is a nuisance, Plaintiffs have "come to the nuisance" and, for this reason too, this Court should find that their claim is not actionable. *See also Leonard v. Gagliano*, 459 S.W.2d 732, 735-36 (Mo. Ct. App. 1970) (affirming district court's determination that the defendants' activities were consistent with the zoning and industrial character of the area, that the plaintiffs chose to come to the nuisance, and that their nuisance claim therefore was not actionable).

3. Plaintiffs' Trespass Claims Fail

Counts III and IV are claims for intentional and negligent trespass. Liability for trespass in the Virgin Islands is governed by Chapter 7 of the *Restatement (Second) of Torts* (§§ 157-166) (1965). *See* 1 V.I.C. § 4. Both trespass claims should be dismissed for two reasons. First, Plaintiffs base their trespass claims—like their other claims—on the alleged availability of capture and control technology and an alleged duty to implement such technology, without alleging any plausible factual support. Second, even accepting Plaintiffs' factual allegations as true, Defendants have not "physically invaded" their property with "tangible matter." *See, e.g., Bormann v. Bd. of Supervisors*,

584 N.W.2d 309, 315 (Iowa 1998) ("Trespass comprehends an actual physical invasion by a tangible matter." (internal quotation marks and citation omitted)).

Plaintiffs' negligent and intentional trespass claims both rest on the common allegation that "Defendants have a duty to minimize and prevent the ethanol emissions from invading Plaintiffs' real and personal property *since controls are available* to destroy the ethanol before it escapes the Defendants' property." Compl. ¶ 108 (Intentional Trespass) (emphasis added); Compl. ¶ 123 (same allegation with respect to Negligent Trespass); *see also* Compl. ¶¶ 111, 112, 125, 126. But, for the reasons described above, Plaintiffs have failed to plead facts plausibly demonstrating that control technology is reasonably available to capture ethanol from Defendants' rum-aging facilities. Accordingly, the trespass claims should be dismissed.

In addition, Plaintiffs' trespass claims fail because, even if Defendants' ethanol emissions enter into the atmosphere and drift over their land as Plaintiffs allege, that does not constitute a physical intrusion of a tangible item necessary to make out a trespass claim. The "gist of the tort" of trespass is the "intentional interference with rights of exclusive possession." Dan B. Dobbs, *The Law of Torts* § 50 at 95-96 (2000). Thus, the tort of trespass is committed when a person "enters or causes direct and tangible entry upon the land in possession of another." *Id.*; *see also Restatement (Second) of Torts* § 158 (Intentional Trespass) (1965) (dealing with "entry" onto land); *id.* § 165 (Negligent Trespass) (same); *Hodge v. McGowan,* 50 V.I. 296 (V.I. 2008) (citing § 158).

The "entry," moreover, must be through *"tangible*" matter.[19] Thus, the Comments to the *Restatement* sections on both intentional and negligent trespass discuss the physical entry by a person—or by a person causing a tangible item to enter another's property—like throwing a rock onto another's property. *See also id.* § 158, illus. 5 (describing the placement of a dam that causes water to back up onto another's land). But there are no Illustrations—and nothing else in the *Restatement*—suggesting that something invisible like ethanol that can only be detected by air testing can constitute a trespass. Compl. ¶ 103 (ethanol is "identifiable by existing means of air testing"). To the contrary, the traditional rule is that the "intentional introduction onto the land of another of smoke, gas, noise, [and] the like" generally "is not actionable in trespass." W. Page Keeton *et al*., *Prosser and Keeton on the Law of Torts* § 13, at 71 (5th ed. 1984).

Plaintiffs attempt to avoid dismissal by deeming ethanol "tangible." Compl. ¶ 103. But particularly under *Twombly*, saying does not make it so. *Twombly,* 550 U.S. at 555 (conclusory statements irrelevant). Moreover, pursuant to 1 V.I.C. § 42 (Words and Phrases), "[w]ords and phrases shall be read with their context and shall be construed

[19] *See, e.g., Johnson v. Paynesville Farmers Union Cooperative Oil Co.,* 817 N.W.2d 693, 701 (Minn. 2012) ("Our case law is consistent with this traditional formulation of trespass because we have recognized that a trespass can occur when a person or tangible object enters the plaintiff's land."); *City of Bristol v. Tilcon Minerals, Inc.*, 931 A.2d 237, 258 (Conn. 2007) ("[B]ecause it is the right of the owner in possession to exclusive possession that is protected by an action for trespass, it is generally held that the intrusion of the property be physical and accomplished by tangible matter."); *Bormann*, 584 N.W.2d at 315 ("Trespass comprehends an actual physical invasion by a tangible matter." (quoting *Ryan v. City of Emmetsburg*, 4 N.W. 2d 435, 438 (Iowa 1942))); *Adams v. Cleveland-Cliffs Iron Co.*, 602 N.W.2d 215, 222 (Mich. App. 1999) ("[W]e prefer to respect the traditional requirement of a direct invasion and agree with Prosser and Keeton, supra at § 13, p. 72, that '[t]he historical requirement of an intrusion by a person or some tangible thing seems the sounder way to go about protecting the exclusive right to the use of property.' Recovery for trespass . . . is available only upon proof of an unauthorized direct or immediate intrusion of a physical, tangible object onto land over which the plaintiff has a right of exclusive possession.").

according to the common and approved usage of the English language." And the common meaning of "tangible" does not cover an invisible substance like ethanol. *Black's Law Dictionary* 1592-93 (9th ed., 2009) explains:

> **tangible,** *adj.* (16c) **1.** Having or possessing physical form; CORPOREAL. **2.** Capable of being touched and seen; perceptible to the touch; capable of being possessed or realized. **3.** Capable of being understood by the mind.

Applying the traditional understanding of trespass and the plain meaning of "tangible," a number of courts have rejected that invisible particle matters like ethanol drifting from one property onto another can constitute trespass. *See, e.g., Johnson*, 817 N.W.2d at 701 (applying the "traditional formulation of trespass" and rejecting as a matter of law trespass claim based on pesticide sprayed on defendant's property allegedly drifting onto plaintiff's property); *Spicer v. City of Norfolk*, 46 Va. Cir. 535, at *6-7 (Va. Cir. 1996) (holding invisible gases and microscopic particles are not tangible, and thus cannot constitute a trespass).

Trespass is a limited tort dealing with "physical intrusions" and not other "annoyances." *Restatement (Second) of Torts* ch. 7, topic 1, intro. note at 276 (1965). The gravamen of Plaintiffs' complaint is that an invisible particle matter (ethanol) drifted from Defendants' rum-aging warehouses over their properties, and combined with natural elements to catalyze the growth of *Baudoinia compniacensis*. *See* Compl. ¶¶ 97, 100-101, 118. If Plaintiffs have a claim at all—and for the reasons described above they do not—it sounds in nuisance, not trespass. *See, e.g., Restatement (Second) of Torts* § 821D (1979) ("A private nuisance is a nontrespassory invasion of another's interest in the private use and enjoyment of land."); *L'Henri, Inc. v. Vulcan*

Materials, Civ. No. 2006-177, 2010 WL 924259 (D.V.I. Mar. 11, 2010) (same). Plaintiffs' attempt to blur the line between these distinct torts should be rejected.

Accepting the facts in Plaintiffs' Complaint as true, and disregarding the conclusory allegation that ethanol is "tangible," Defendants have not caused a tangible item to enter Plaintiffs' land and interfere with their exclusive right to possession. Accordingly, Counts III and IV must be dismissed.

4. The Injunctive Relief Count Does Not State A Cause Of Action

Finally, Plaintiffs frame their demand that this Court order Defendants to implement control technology as a free-standing cause of action entitled "Injunctive Relief." In the USVI, however, there is no separate cause of action for "injunctive relief." Rather, it is only a remedy under Chapter 48 of the *Restatement*. *See Restatement (Second) of Torts*, ch. 48, intro. note at 556 (1965) ("This Chapter deals with the remedy of injunction . . .").[20] Even if "Injunctive Relief" was a cause of action, moreover, it would fail because it rests on Plaintiffs' same speculative and deficient allegation that control technology is reasonably available for Defendants' rum-aging facilities. Compl. ¶¶ 131-52. Count V should be dismissed.

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[20] By analogy, courts applying Virgin Islands law routinely strike separate counts that seek punitive damages, which also is merely a remedy. *See, e.g., Abraham v. St. Croix Renaissance Grp., L.L.L.P*, Civ. No. 2008-071, 2013 WL 2128539, at *2 n.3 (3d Cir. May 17, 2013) (a count denominated "Punitive Damages" is not a freestanding cause of action); *Galloway v. Islands Mech. Contractor, Inc.*, Civ. No. 08-cv-71, 2013 WL 163811, at *1 (D.V.I. Jan. 14, 2013) (punitive damages is a remedy, not a cause of action).

V. Conclusion

Plaintiffs request that this Court push aside the expert agencies that Congress delegated to regulate air emissions and impose a newfound duty on the centuries-old rum industry. But that request is preempted by the Clean Air Act. Moreover, Plaintiffs have failed to plead facts, as opposed to labels and conclusions, plausibly supporting the elements of their claims. Because Plaintiffs' claims are fundamentally flawed—and no amount of re-pleading can fix them—this Court should dismiss the Complaint, and this case, with prejudice.

Dated: July 29, 2013

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CERTIFICATE OF SERVICE

I hereby certify that on this 29th day of July, 2013, I filed the foregoing with the Clerk of the Court, and delivered as indicated to the following:

EMAIL AND HAND DELIVER
VINCENT COLIANNI, II
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1138 King Street
Christiansted, St. Croix
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Exhibit 1

Alliance Environmental Group, Inc.

100 Jefferson Boulevard, Warwick, Rhode Island 02888
Telephone: 401.732.7600; Fax: 401.732.7670

March 16, 2009

Mr. Frank Jon, Environmental Engineer
US EPA Region 2
Air Program, Permitting Section
290 Broadway
New York, New York 10007-1866

RE: Diageo USVI Air Permit for Warehouse

Dear Mr. Jon:

Alliance Environmental Group (AEG) has prepared and submitted all required information, related to Diageo's proposed distillery, to the USVI Department of Planning and Natural Resources (USVI DPNR), Division of Environmental Protection. This facility will be located on the Renaissance Group LLLP property (Plot No. 1), St. Croix, U.S. Virgin Islands. We wish to clarify a question you had concerning the warehousing of barrels. Empty barrels will be stored in an on-site warehouse until they are filled and then transported to an off-site warehouse, located at the junction of West Airport Road and Route 64 (Melvin H. Evans Highway). This facility is remote from the distillery site, not on the St. Croix Renaissance Group property and will therefore be permitted separately from the distillery.

Currently, AEG is gathering information from Diageo and their construction contractor, J.B Benton Construction, LLC to prepare a minor source application for this off-site warehouse, which will be submitted to the USVI DNPNR. As this new facility will not have an air ventilating system, there will be no deliberate release of ethanol emissions, hence we are treating ethanol emissions as fugitive. In addition, since the USVIs are in attainment with NAAQS these emissions need not be considered when determining if this facility exceeds the 250 tpy threshold that would have made it a major source.

Call me any time if you have any questions at (401) 732-7600.

Very truly yours,
Alliance Environmental Group, Inc.

Richard C. Hittinger
President

Exhibit 2

Alliance Environmental Group, Inc.

100 Jefferson Boulevard, Warwick, Rhode Island 02888
Telephone: 401.732.7600; Fax: 401.732.7670

January 23, 2009

Nadine Noorhasan, PhD, Director (via email)
Division of Environmental Protection
Department of Planning & Natural Resources
45 Estate Mars Hill
Frederiksted, VI 00840

Re: Proposed Diageo USVI Aging Warehouse

Dr. Noorhasan:

Diageo USVI plans to construct a warehouse on St. Croix for aging the distilled rum produced at the distillery to be located on the St. Croix Renaissance Group (SCRG) property. This warehouse will not be located on the SCRG property. Since this process depends on wooden barrels for proper aging of the product, there will be emissions of ethanol emanating from this warehouse. These emissions are due to the porous nature of the wooden barrels.

We are requesting your concurrence with our interpretation of the VI Air regulations consistent with the United States Environmental Protection Agency (EPA) decisions for similar facilities under their jurisdiction. First, EPA has raised the threshold at which an ethanol plant will be considered a "major" source in an attainment area from 100 tons per year to 250 tons per year. (Federal Register / Vol. 66, No. 228 / Tuesday, November 27, 2001 / Rules and Regulations; Effective July 2, 2007). As such, EPA has revised key definitions in two Clean Air Act (CAA) permitting programs – the major New Source Review (NSR) program and the Title V program. The revised rules exclude ethanol manufacturing facilities that produce ethanol by natural fermentation processes from the definition of "chemical processing plants" and thus from the controlling definitions of "major" sources. The exclusion applies to all such facilities regardless of human consumption, fuel or for an industrial purpose.

In addition, EPA addressed when fugitive emissions must be considered in determining if the facility is major under the revised definitions. Likewise, revisions were made in the PSD, non-attainment NSR and Title V definitions to address when fugitive emissions must be considered in calculating whether a facility is major. In attainment areas, new ethanol producing facilities will not need to include fugitive emissions in calculating emissions for purposes of the 250 TPY threshold.

Finally, EPA has determined that ethanol emanating from wooden aging barrels is a fugitive emission. The natural flow of air without negative or positive pressure is critical to the proper aging of the product, making capture and recovery or control impossible. In a case presented to the Indiana Office of Environmental Adjudication (August 4, 2004), (attached), the ruling made in favor of the Seagram Distillery stating that collection and control of VOC emissions from whiskey aging warehouses would be unreasonable since it would alter the natural airflow that is critical to production of saleable product. It is our contention that the ethanol emissions from our facility would be fugitive and in as far as Federal regulations are concerned they would not need to be considered when determining the source category of this facility. Therefore, with this background we anticipate submitting a minor source permit application to the DPNR for this proposed new warehouse / aging facility. We also anticipate that since the facility will be defined as a minor source of air emissions, no Title V Air Operating Permit will be required for the facility even if the total fugitive emissions exceed 250 TPY. Please confirm that you agree with these conclusions and we will complete the appropriate application form with all necessary information for submittal to DPNR.

Thank you for you cooperation regarding this matter and please contact me with any questions or for further clarification of any issues relative to the distillery or this proposed warehouse / aging facility (ph: 401-732-7600; email: Rhittinger@AllianceEnvironmentalGroup.com).

Very truly yours,
Alliance Environmental Group, Inc.

Richard C. Hittinger
President

Cc: Verline Marcellin, DPNR
Brian Hunnius, Diageo USVI
David Wescott, Maguire Group

Exhibit 3

Diageo USVI

Authority to Construct and Permit to Operate

General Permit Application

Rum Storage Warehouses

St. Croix, U.S. Virgin Islands

Submitted to:

U.S. Virgin Islands

Department of Planning and Natural Resources
Division of Environmental Protection

May 2009

Prepared By:
Alliance Environmental Group
100 Jefferson Boulevard
Warwick, Rhode Island 02888

EXHIBIT
tabbies
3

Authority to Construct and Permit to Operate
General Permit Application

for

Diageo USVI

New Rum Storage Warehouses

#1 Estate Diamond, Fredericksted; Parcel No. 25

St. Croix U.S. Virgin Islands

Submitted to:

Department of Planning and Natural Resources

Division of Environmental Protection

St. Croix, U.S. Virgin Islands

Prepared By:
Alliance Environmental Group
100 Jefferson Boulevard
Warwick, Rhode Island 02888

GOVERNMENT OFTHE VIRGIN ISLANDS OF THE UNITED STATES DEPARTMENT OF PLANNING AND NATURAL RESOURCES
AIR POLLUTION CONTROL

APPLICATION FOR:
AUTHORITY TO CONSTRUCT AND PERMIT TO OPERATE

GENERAL INSTRUCTIONS

A. This application must be filled out completely and must be filed in **DUPLICATE.**

B. Applications are incomplete unless accompanied by **DUPLICATE** copies of all plans, specifications and drawings required. Details required for specific equipment are listed on separate forms which are available upon request.

NOTE: INCOMPLETE APPLICATIONS ARE NOT ACCEPTABLE.

Date of Application: **May 15, 2009**

APPLICATION INFORMATION

1. Permit to be issued to: (Business License Name of Corporation, Company, Individual Owner or Governmental Agency that is to operate the Equipment):
Diageo USVI
1131 King Street, Christiansted, St. Croix, USVI 00821

2. Mailing Address:

1131 King Street
Christiansted, St. Croix 00821

901 W 143rd St
Plainfield, IL 60544-8555
Phone: 815-436-2050

3. Address at which the equipment is to be operated:

Diageo USVI
Number 1 Street **Estate Diamond, Princes Quarter** Island: **St. Croix** Zip: **00851**
Parcel Identification Number: **Parcel #25** (May be obtained from upper right hand corner of tax bill.)

4. Check Type of Organization:

[X] Corp. **Diageo USVI** Partnership _____
Individual Owner _____ Governmental Agency _____

5. Describe General Nature of Business:

Diageo USVI proposes to construct and operate 2 new warehouses, which will store a maximum of 180,000 barrels of rum produced at the proposed Diageo distillery (application currently under consideration). These warehouses will be approximately 3.2 miles southwest from the distillery. See Attachment A for a more detailed description of the activities that will be conducted at this site.

6. Equipment Description: Pursuant to the Provisions of the U.S. Virgin Islands Code and the Rules and Regulations of the Air Pollution Control Region, application is hereby made for authority to construct and permit to operate the equipment listed in the table below:

A.

1. NEW PROCESS EQUIPMENT AND NEW AIR POLLUTION CONTROL APPARATUS
   NEW AIR POLLUTION CONTROL APPARATUS ON EXISTING PROCESS EQUIPMENT
   [X] NEW PROCESS EQUIPMENT WITH NO CONTROL APPARATUS
   This page provides a summary only

   OTHER: PRIOR PERMIT NUMBERS COVERING THIS INSTALLATION. SPECIFY. **n/a**
2. ESTIMATED STARTING DATE **June 2009** EST. COMPLETION **June 2010**

B. **See Attachment B for details of each emitter**

1. DESCRIPTION OF OPERATION
   See Attachment B
   IDENTIFY PROCESS EQUIPMENT
   See Attachment B
2. RAW MATERIALS (NAMES)
   See Attachment B
   TOTAL POUNDS PER HOUR _____ TOTAL POUNDS PER BATCH_____
   See Attachment B
   OPERATING FREQUENCY:
   See Attachment B
   [X] CONTINUOUS: 24 HRS. PER DAY 7 DAYS PER : [X] WEEK MONTH 365 DAYS PER YEAR
   BATCH: _____HRS. PER BATCH _____BATCHES PER: DAY WEEK

C. **See Attachment C for Emissions Calculations**

AIR CONTAMINANTS	EMISSION LEVEL (TONS/YR)	
	WITH CONTROL APPARATUS	WITHOUT CONTROL APPARATUS
PARTICULATE MATTER	**0.45 TPY (See Attachment C)**	**0.45 TPY**
CARBON MONOXIDE	**4.01 TPY (See Attachment C)**	**4.01 TPY**
OXIDES OF NITROGEN (NO_x)	**7.18 TPY (See Attachment C)**	**7.18 TPY**
SULFUR DIOXIDE (SO_2) VOLATILE	**0.02 TPY (See Attachment C)**	**0.02 TPY**
ORGANIC COMPOUNDS(VOCS)	**622.4 TPY (See Attachment C)**	**622.4 TPY**
ACETALDEHYDE (HAP)	**< 2 TPY (See Attachment C)**	**< 2 TPY**

D.	**See Attachment B for details of each source of emissions**
	1. DESCRIBE AIR POLLUTION CONTROL APPARATUS**:** 2. EFFICIENCY OF CONTROL APPARATUS:_____ %. 3. HEIGHT OF DISCHARGE ABOVE GROUND:_____ FT. 4. DISTANCE FROM DISCHARGE TO NEAREST PROPERTY LINE:_____ FT. 5. VOLUME OF GAS DISCHARGED INTO OPEN AIR:_____ FT^3/MIN. AT STACK CONDITIONS. 6. EXIT LINEAR VELOCITY AT POINT OF DISCHARGE:_____ FT/MIN. AT STACK CONDITIONS. 7. TEMPERATURE AT POINT OF DISCHARGE:_____ ^{0}F. 8. WILL EMISSIONS COMPLY WITH EXISTING LOCAL REQUIREMENTS?_____ . 9. INITIAL COST OF CONTROL APPARATUS: $_____ . 10. ESTIMATED ANNUAL OPERATING COST: $_____ .

This application is submitted in accordance with the provisions of the Virgin Islands Code 12, Chapter 9, Air Quality Control Regulations Section 20-20, and to the best of my knowledge and belief is true and correct.

Diageo USVI

901 W 143rd St
Plainfield, IL ,

Mailing Address

Zip Code **60544-8555**

Telephone No. **815-436-2050**

Signature

Printed name

Title

AUTHORITY TO CONSTRUCT AND PERMIT TO OPERATE

Application for permission to construct, install or alter the equipment and/or control apparatus as set forth above is approved.

Date _____ Approved by
Permit No. _____ Supervisor

Project Description

Location of Project

New warehouses, used to store rum produced by the Diageo USVI rum production distillery, will be located at the intersection of West Airport Road and the Melvin H. Evans Highway. It is located on parcel no. 25 of the Estate Diamond, the location of which is on the island of St. Croix in the U.S. Virgin Islands. These warehouses will have the airport to the east, residential properties to the north and west and vacant land with the ocean beyond to the south.

The U.S. Virgin Islands are composed of three major islands, with a number of smaller islands and cays. The three major islands are St. Croix, St. John, and St. Thomas. Located approximately 40 miles to the south of St. Thomas and St. John, St. Croix is the largest of the islands with an area of 84 square miles. It lies at latitude 17° 42' 24.60"N and longitude 64° 47' 16.02"W. The island extends some 19 miles from east to west and 6 miles from north to south (see Figure 1).

Property Ownership and Address

The land on which the proposed rum storage warehouses are to be located is owned by Diageo USVI (see Figure 2). The address and legal description of the property, based on survey maps from the United States Virgin Islands (USVI) Government Cadastral offices, is as follows:

Proposed Diageo USVI Rum Production Distillery
Plot No. 1
Estate Diamond; parcel no.25
Princes Quarter, St. Croix, USVI

Latitude: 17° 42' 24.60"N
Longitude: 64° 47' 16.02"W

Regulatory Applicability

St. Croix is in compliance all National Ambient Air Quality Standards.

Based on EPA and Virgin Island Rules & Regulations (VIR&R) this application is being submitted as a minor source. This designation is appropriate because the ethanol emissions, from aging rum in wooden barrels, are fugitive, therefore these emissions would not be included in the major source applicability calculations. In addition, the emissions from this facility were not incorporated into the Diageo Distillery Application, which was submitted to USVI-DEP in January of 2009 because this is a separate and distinct facility. Thus this application is being submitted independently of that application.

The emissions from this facility should be treated as fugitive for the same reasons presented in a recent decision by the Indiana Office of Environmental Adjudication (Ref. 1; Attachment G).

In this decision, the emissions from a Seagrams's Whiskey aging warehouse were deemed to be fugitive after considering the EPA definition of fugitive emissions; the reasonableness of collecting emissions, and extensive evidence presented regarding the negative effect the collection of ethanol emissions would have on the aging process.

Since the emissions from this facility are fugitive, then as stated in a recent EPA ruling (Ref. 2; Attachment H): "(ii) In determining whether a stationary source or modification is major, fugitive emissions from an emissions unit are included only if the emissions unit is part of one of the source categories listed in paragraph (b)(1)(iii) of this section or if the emission unit is located at a stationary source that belongs to one of the source categories listed in paragraph (b)(1)(iii) of this section." Since a distillery which produces ethanol no longer is to be considered a "Chemical Process Plant" as they had been in the past (EPA ruling Ref. 3; Attachment I) presumably, neither are the warehouses.

As mentioned above, emissions from this facility were not included in the Diageo Distillery Air Application previously submitted to the USVI-DNPR. This is consistent with the definition of a Major Source which appears on pp 16-17 of the VIR&R (Ref. 4; Attachment J) states that "For purposes of defining 'major source', a stationary source or group of stationary sources shall be considered part of a single industrial grouping of all of the pollutant emitting activities at such source or group of sources on contiguous or adjacent properties belong to the same major Group (i.e. all have the same two-digit code), as described in the 1987 Standard Industrial Classification Manual". Since these warehouses are not contiguous with the distillery, the emissions from them were not included in the Distillery application. In addition, since the Distillery is a manufacturing facility and the Warehouses are for storage, they are not in the same SIC code (Group).

Lastly, article 204-27 of the VIR&R states that "(a) No person shall cause or permit the discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, annoyance to persons or to the public or which endanger the comfort, repose, health, or safety of any such persons or the public or which cause or have tendency to cause injury or damage to business or property."

The only emission, which could be present in sufficient quantity to produce an odor, is the product being aged in barrels. While the 2 warehouses will not have any HVAC systems which would force ventilate the emissions from the barrels to the outside air, each warehouse will have 20- 6' X 3' vents on the sides of the building. A Figure A105 in Attachment D shows the placement of these vents. The exact path of airflow into and out of the warehouses is a function of factors such as ambient and room temperatures, ambient wind speed, direction, and atmospheric pressure. Therefore, the primary ventilation from each warehouse is ambient air entering through either the bottom or top vents and exiting through either the bottom or top vents. If one assumes that the entire 621 tons of ethanol (Attachment C-Table 1) will escape through these upper vents (emission source height of 10 meters) over the course of a year, then using the air modeling program "SCREEN3", the maximum concentration of ethanol at ground level will be observed 220 meters away from the buildings at a concentration of about 9 mg/m^3 (Attachment C-Table 3). If however one assumes that the entire 621 tons of ethanol will escape through the lower vents (emission source height of 2 meters) over the course of a year, then the maximum concentration of ethanol at ground level will be observed 168 meters away from the buildings at a concentration of about 23 mg/m^3 (Attachment C-Table 4). The published

OSHA odor threshold for ethanol is 100 mg/ m^3 (Ref. 5) therefore ethanol emissions from the warehouses should not present a detectable odor beyond the property line.

Ref 1: Indiana Office of Environmental Adjudication, State of Indiana; Cause No. 03-a-j-3003; August 4, 2004.
http://indianalawblog.com/documents/seagram.pdf

Ref 2: Federal Register / Vol. 73, No. 245 p-77899/ Friday, December 19, 2008 / Rules and Regulations "Prevention of Significant Deterioration (PSD) and Nonattainment New Source Review (NSR): Reconsideration of Inclusion of Fugitive Emissions"
http://www.epa.gov/fedrgstr/EPA-AIR/2008/December/Day-19/a29998.pdf

Ref 3: Federal Register / Vol. 72, No. 83 / Tuesday, May 1, 2007 / Rules and Regulations 40 CFR Parts 51, 52, 70, and 71 "Prevention of Significant Deterioration, Nonattainment New Source Review, and Title V: Treatment of Certain Ethanol Production Facilities Under the "Major Emitting Facility" Definition; Final Rule
http://www.epa.gov/fedrgstr/EPA-AIR/2007/May/Day-01/a7365.pdf

Ref. 4.Virgin Islands Air Pollution Control Act Rules and Regulations; Title 12 Chapter 09 Section 204-206; 1995
http://www.dpnr.gov.vi/dep/pubs/index.htm

Ref 5. Fazzalari, F (ed.) Compilation of Odor and Taste Threshold Values Data. ASTM Data Series SD 48A (Committee E-18). Philadelphia, PA: American Society for Testing and Materials, **1978** 61.

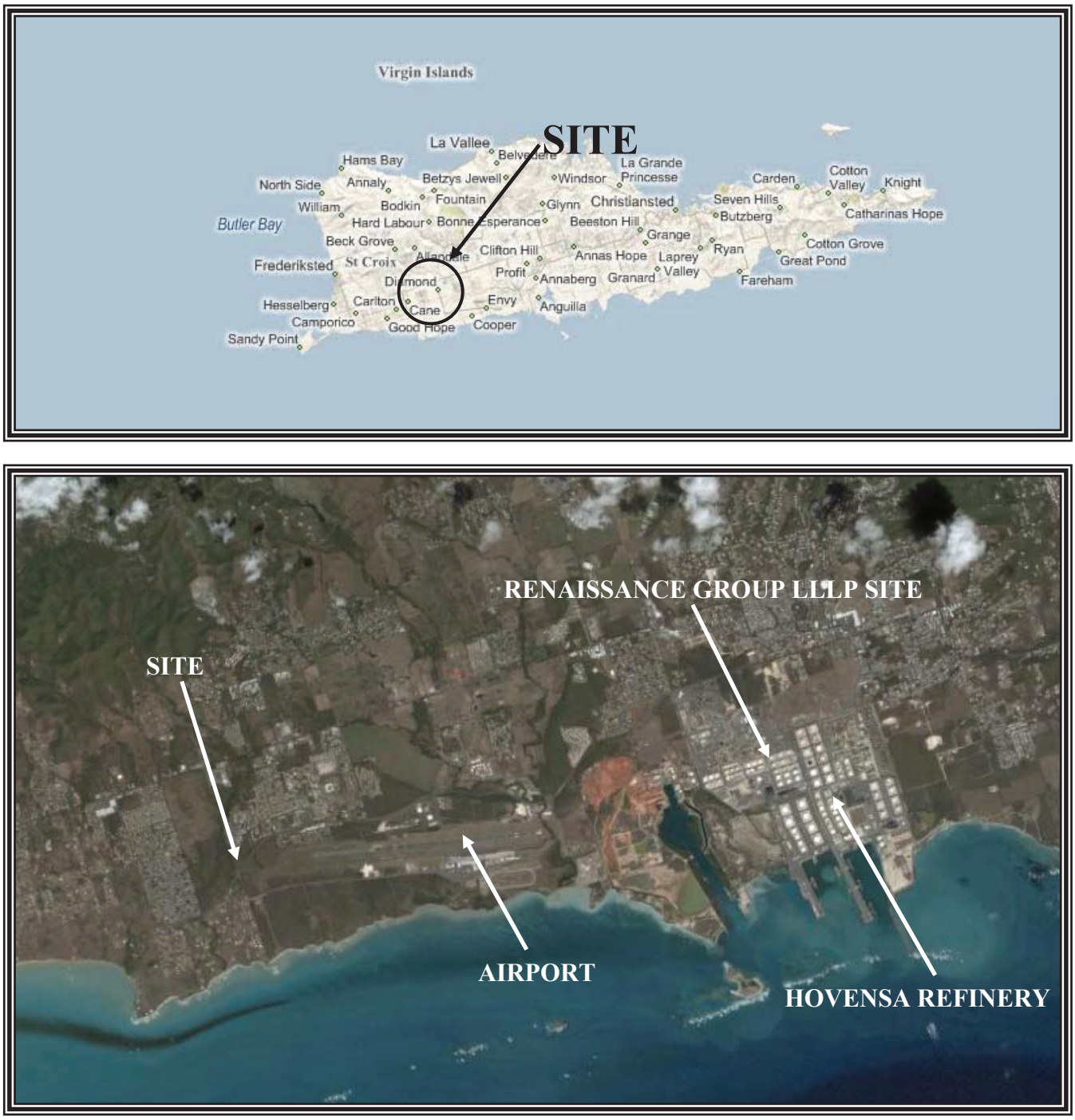

Figure 1: Regional Location of Renaissance LLLP Property

Figure 2: Site Location

Exhibit 4

EPA-450/2-78-013
April 1978

COST AND ENGINEERING STUDY - CONTROL OF VOLATILE ORGANIC EMISSIONS FROM WHISKEY WAREHOUSING

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

EPA-450/2-78-013

COST AND ENGINEERING STUDY - CONTROL OF VOLATILE ORGANIC EMISSIONS FROM WHISKEY WAREHOUSING

Emission Standards and Engineering Division
Chemical and Petroleum Branch

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
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April 1978

Publication No. EPA-450/2-78-013

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UNITS AND CONVERSIONS

Listed below are abbreviations and conversion factors for the metric units in this report and definitions for non-standard units associated with whiskey production.

Metric Unit (Abbreviation)	Equivalent
1 meter (m)	= 39.37 inches = 3.28 feet
1 centimeter (cm)	= 10^{-2} meter = 2.54 inches
1 hectare (ha)	= 10^{5} m^{2} = 2.47 acres
1 kilogram (kg)	= 2.2 pounds
1 metric ton (MT)	= 1000 kilograms = 2200 pounds

Unit	Definition
proof gallon (pg)	one U.S. gallon of 231 cubic inches containing 50 percent by volume ethanol or any volume of liquid containing an equivalent amount of ethanol. A proof gallon thus contains 1.5 kilogram of ethanol.
proof	twice the volume percent ethanol in a liquid. The number of proof gallons in a gallon of liquid is the proof divided by 100.

1.0 INTRODUCTION

The Environmental Protection Agency is currently providing technical assistance to the States and local jurisdictions on industries that emit significant quantities of air pollutants in those areas of the country where National Ambient Air Quality Standards are not being attained. This document is related to one such industry, whiskey warehousing. It is a significant source of volatile organic chemicals (VOC) in the area where the industry is concentrated, Kentucky, Illinois, Indiana, and Tennessee.

1.1 EMISSION SOURCE DESCRIPTION

In producing whiskey, alcohol distilled from fermented grain is stored in charred oak barrels for periods of four to eight years or more. During this period, the alcohol absorbs, and reacts with, constituents in the barrel wood and gains the distinctive taste and aroma of whiskey. This process is known as aging or maturation. During the aging period, ethanol and water seep through the barrel and evaporate into the air. Also when the barrels are emptied to bottle the whiskey, ethanol and water remaining in the barrel wood evaporate into the air. These last two phenomena are the major sources of VOC emissions in whiskey production.

Based on changes in the proof and liquid volume of whiskey during aging, an emission factor of 3.2 kg/barrel-yr. was computed. On the basis of production, the emission factor is .2kg ethanol/kg produced. Based on an estimated 10,260,000

barrels stored in Kentucky, Illinois, Indiana, and Tennessee, the total yearly emission of VOC from whiskey warehousing is 32,800 MT/yr for the four State areas.

1.2 CONTROL DEVICE DESCRIPTION

The method investigated for control of emissions both during aging and from barrel soakage after aging was carbon adsorption. Control of emissions during aging would involve closing the warehouse and ducting exhaust from the facility through a carbon adsorption unit. Control of barrel soakage losses would involve placing the empty barrels in a closed warehouse ducted to a carbon adsorption unit. These control methods are estimated to reduce emissions by 85 percent. The efficiency is limited by the need to design and operate the system in a manner that will not affect whiskey quality and by the physical difficulties in drying the saturated barrels.

The applicability of these control systems is determined by two factors:

1. the cost of systems and
2. the system's effect on whiskey quality.

The cost of the system for controlling losses during aging for three of the six cases studied is shown in Table 1-1. Also shown is the cost of controlling soakage losses by storing the empty barrels in a warehouse. As seen in the table, an important factor in the systems' cost is the credit for the recovered alcohol. The recovered alcohol can be redistilled to a product for which sufficient markets exist to use the amounts recovered; however, very few distillers have the equipment required for this redistillation. Thus, distillers would have to transport the recovered alcohol in crude form or install the necessary distillation equipment, options which significantly reduce the credit shown for the recovered alcohol.

Table 1-1

CONTROL SYSTEM COSTS

	Aging Loss Control			Soakage Loss Control
Warehouse Size, Barrels	20,000	50,000	100,000	50,000
Annual Capital Costs	$9,960	$15,410	$31,700	$71,000
Annual Operating Costs	$11,980	$17,280	$26,010	$58,710
Annual Credit, Recovered Alcohol	$13,610	$54,440	$68,050	$55,150
Net Cost (Return)/yr	$8,330	$(21,750)	$(8,340)	$74,560
Cost/Final Proof Gallon	3.0¢	-	-	2.8¢

Two other cost problems are present in installing and operating the control systems, providing steam for regeneration of the carbon beds and providing sufficient air flow to dry the empty barrels. Whiskey warehousing facilities, especially those in rural areas, are spread over large areas and would require long lines to carry regeneration steam from boilers to the warehouses. The cost of such a distribution system has not been estimated and thus was not included in the cost calculations. In controlling barrel soakage losses, large flows of air are used to dry the barrels. Since carbon adsorption unit costs rise directly with air flow capacity, the flow rate is a critical parameter in the system's cost. Since such a system has never been installed, the flow rate required is not known precisely and could have been underestimated in this report.

Whiskey quality could be affected if the carbon adsorption system altered such warehouse conditions as temperature, humidity, and ventilation. These changes would affect the various physical and chemical processes involved in whiskey aging and evaporation, such as the diffusion of water and ethanol through the wood, the transfer of wood constituents into the whiskey, and the chemical reactions

occurring in the wood and the whiskey. In the one full scale test of the control system, whiskey quality was in fact lowered and the test was discontinued. However, analysis of the test indicates that certain design and operating changes may have eliminated the whiskey quality problems.

The cost problems discussed above and the failure of the full scale test show that control of emissions from whiskey warehousing has not been demonstrated at this time. However, the control systems show a potential for breaking even or producing a profit, an unusual characteristic for a control system. Even without credit for recovered alcohol, the control system costs 7-10¢/proof gallon, which compares favorably to a production cost of $2.10/proof gallon. In addition, engineering analysis indicates that problems with whiskey quality can potentially be solved with proper design and operation. Thus, it appears possible that further work could demonstrate the feasibility of control. This work would include the following:

1. investigation of alternate carbon regeneration techniques, for example electric heating/vacuum regeneration

2. additional economic analysis. A low sensitivity of liquor demand to price changes and the large percentage of liquor prices made up by taxes may allow the costs of the control to be passed on even without credit for recovered alcohol.

3. additional testing of the control systems

4. scheduled tests to demonstrate an alternate aging system. This system is discussed in section 4.5.

This further work was not able to be completed at the publication date of this document.

2.0 WHISKEY WAREHOUSING AND AGING

The manufacture of whiskey involves two distinct steps - the production of unaged whiskey from cereal grains and the maturation of this whiskey by storage in charred white oak barrels.

In the production of unaged whiskey, grain is first milled, then cooked in water to solubilize the starches. The solubilized starches are then mixed with partially germinated grain. This step results in the starches being hydrolyzed to sugars by the enzymes in the germinated grain. The sugars are then fermented with yeast and the resulting mixture is distilled to produce unaged whiskey. The production of unaged whiskey is a source of only a small percent of the volatile organic chemicals emitted in whiskey manufacture. The emissions from this first step are described in Appendix A.

The unaged whiskey, colorless and pungent tasting, must be aged by storage in charred oak barrels to produce an alcoholic beverage with the traditional characteristics of whiskey. This step, whiskey aging, is the major source of emissions in whiskey manufacture and will be the principal focus of the report. This chapter will describe whiskey warehousing operations and the physical and chemical processes that occur as whiskey ages. Chapter 3 will present emission factors for whiskey warehousing and the basis of these emission factors, and Chapter 4 will describe possible emission controls and their advantages and disadvantages.

2.1 BARRELING AND WAREHOUSING

To produce an alcoholic beverage with the traditional qualities of whiskey, the unaged whiskey is stored in new, white oak barrels, whose head and staves have been charred. The barrels are normally constructed of 25 staves from 2 to 3 cm in thickness and charred for 30 to 50 seconds. The barrels typically hold 190 liters and are approximately 89 cm tall and 54 cm diameter at the head.

During aging, the barrels are stored in large warehouses. There are three types of warehouse design: brick and masonry rack design; metal clad, wood-frame rack design; and palletized design. Rack designs consist of multi-level lattice structures made of wood or metal, on which the barrels are tightly packed on their sides in long parallel rows and supported by beams at the ends of the barrels. In rack design warehouses, there are commonly three to six levels of barrels per floor and five to ten floors per warehouse. Brick rack designs have concrete floors, roof, and brick exteriors, with windows normally on each floor for ventilation. Metal clad rack designs have corrogated or sheet metal exterior and roof which are attached to the interior wood lattice. The wood lattice supports the barrels and provides the structural support for the warehouse. In contrast to brick and masonry warehouses, where the concrete floors block internal air circulation, metal clad warehouses are open internally with ventilation provided by windows or ventilators at the top and bottom of the structure. Palletized design warehouses are single story structures with barrels stored upright on pallets, with 15 barrels a pallet. Palletized designs require more land than rack designs, but reduce the labor required to handle the barrels.

The barrel capacity range of warehouses varies as a function of design: 40,000 to 100,000 for brick rack designs, 20,000 barrels or less for metal clad rack designs, and up to 35,000 for palletized designs. The absence of water sprinklers for fire protection in metal clad rack warehouses limits their size for insurance reasons.

The total barrel capacity of a typical warehousing operation ranges from 200,000 to 600,000 barrels. Brick warehouses are generally used in urban areas because of fire and building codes, and metal clad warehouses are generally used in rural areas. Metal clad warehouses are placed 60 meters or more apart for fire protection and thus a large storage facility with 30 warehouses will cover up to 450 hectares. Other smaller rural facilities may be dispersed because of hilly terrain or to place the warehouses in the optimum location for aging. A listing of barrels stored in Kentucky distilleries is presented in Appendix B.

2.2 MECHANISMS OF AGING

The main components of whiskey, ethanol and water, are relatively insignificant factors in its flavor intensity and palatability. The distinctive qualities of whiskey are due for the most part to the trace constituents, called "cogeners," present in the beverage. These substances are generated in part during fermentation, but the majority are added in the course of aging.

During aging these trace constituents are added to the whiskey by three mechanisms:[1]

1. extraction of organic substances from the wood and their transfer to the whiskey,

2. oxidation of the original substances and of the extracted wood material, and

3. reaction between various organic substances present in the liquid to form new products.

The nature and changes in the concentration of these trace constituents are shown in a comprehensive study of whiskey during maturation by Liebmann and Scherl of Schenley Distillers.[2] Their study covered an 8 year period and included analysis of 469 barrels. Table 2-1 presents the statistical design of the major variables of the study and Table 2-2 lists the characteristics of whiskey at various maturation times. The main changes in physical and chemical characteristics of whiskey, occurring as a function of time are shown in Figure 2-1.

There are several points to note concerning changes in whiskey during aging as observed in the Liebmann and Scherl study. The fixed acids, furfural, solids, color, and tannins in whiskey are added entirely during aging. (The small amounts present initially in the whiskey sampled in the study were due to the fact that some of the whiskey had been treated with oak chips before barreling.) In contrast, there are significant quantities of esters and fusel oil and lesser quantities of total acids and aldehydes present prior to aging. The concentration changes for most constituents are essentially complete by three years of aging; however, esters and solids continue to show significant increases in concentration beyond that time. The increase in aldehydes, acids and esters, oxidation and reaction products of alcohols, show the importance of chemical reactions in aging. In examining the chemical changes it is important to note that there are only rough relations between chemical analysis and quality, i.e., taste and aroma of whiskey. It is necessary to rely on the human senses of taste and smell to detect fine variations and thus evaluate the quality of whiskey.

The precise sequence and interdependence of the mechanisms responsible for aging are quite complex and not completely understood. However, the following paragraphs describe in general the chemical and physical phenomena responsible for aging. The description is purposely qualitative since the

Table 2-1. STATISTICAL DATA OF WHISKEY MATURATION STUDY BY LIEBMANN AND SCHERL[2]

Grain formula			Distillation			Treatment			Warehouse			Storage		
Type	No.	%	Type	No.	%	Type	No.	%	Type	No.	%	Location	No.	%
Bourbon			Singled	82	17	Untreated	255	54	Rack (wood)	219	47	Louisville, Ky.	128	27
60% corn														
40% small grain	84	18	Doubled	387	83	Oak chip-treated	54	12	Concrete	250	53	Schenley, Pa.	114	24
75% corn												Lexington, Ky.	64	14
25% small grain	43	9		469	100	Nuchar-treated	160	34		469	100			
80% corn												Lawrenceburg, Ind.	91	19
20% small grain	151	32					469	100				Frankfort, Ky.	72	16
88% corn														
12% small grain	112	24											469	100
Rye														
51% rye														
49% other grains	79	17												
	469	100												

Table 2-2. CHARACTERISTICS OF AMERICAN WHISKIES AT VARIOUS AGES[2]

Age		Proof	Total Acids	Fixed Acids	Esters	Aldehydes	Furfural	Fusel Oil	Solids	Color (Density)	Tannins	pH
Yr.	Mon.											
	0	101.8	5.9	0.8	16.7	1.4	0.2	111	8.7	0.032	0.7	4.92
	1	101.4	20.4	3.7	17.2	2.1	1.2	123	44.1	0.156	12	4.62
	3	101.3	32.2	5.3	18.5	2.8	1.5	131	66.6	0.205	21	4.46
	6	101.4	42.5	6.8	21.8	3.3	1.6	131	87.7	0.243	28	4.38
1	12	102.0	53.4	8.3	26.8	4.1	1.7	132	111.1	0.292	35	4.34
	18	102.5	59.1	9.0	31.1	4.8	1.8	132	127.8	0.308	39	4.29
2	24	103.1	61.8	9.2	35.5	5.5	1.8	134	137.5	0.328	42	4.29
	30	103.6	64.1	9.3	38.8	5.8	1.9	136	147.7	0.341	44	4.28
3	36	104.1	65.8	9.3	41.8	6.0	1.8	135	152.7	0.352	47	4.27
	42	104.7	67.8	9.4	44.7	6.0	1.9	137	157.7	0.360	48	4.26
4	48	105.2	69.2	9.4	47.6	6.1	1.8	138	165.9	0.365	48	4.26
	54	105.5	69.7	9.4	48.0	6.1	1.7	...	166.0	0.367	49	4.26
5	60	106.0	70.2	9.5	51.9	6.2	1.7	...	173.0	0.368	49	4.26
	66	106.7	72.0	9.5	55.6	6.3	1.8	...	174.2	0.369	49	4.26
6	72	107.4	71.6	9.5	57.6	6.5	1.8	...	181.5	0.380	49	4.24
	78	107.9	74.4	9.6	61.2	7.0	1.8	...	186.0	0.395	50	4.24
7	84	108.6	76.2	9.7	62.0	7.0	1.8	...	198.6	0.393	50	4.23
	90	109.9	79.4	9.7	64.4	7.0	2.0	...	198.9	0.413	50	4.22
8	96	109.3	81.9	9.7	64.8	7.0	2.0	...	209.6	0.449	53	4.20

* All figures represent average values and are expressed as grams per 100 liters at 100 proof, except proof (expressed as degrees proof), color (expressed as density), and pH.

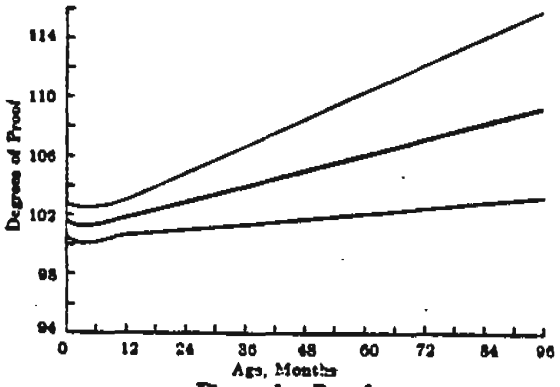

Figure 1. Proof

Averages — dispersion limits

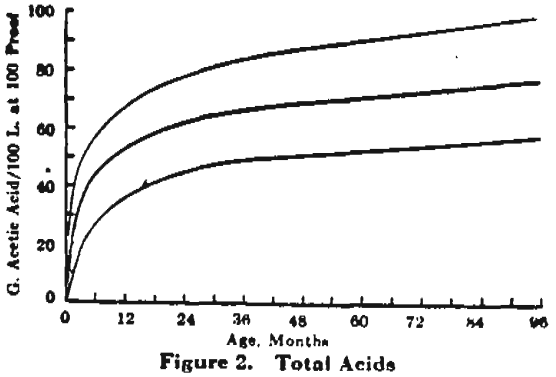

Figure 2. Total Acids

Averages — dispersion limits

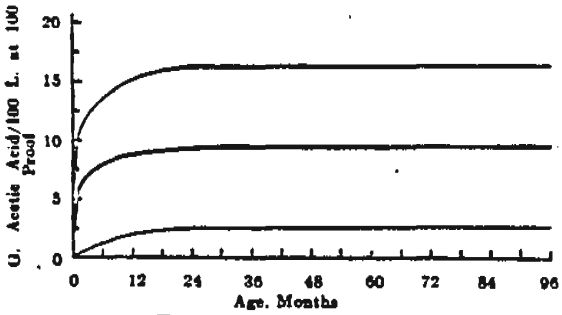

Figure 3. Fixed Acidity

Averages — dispersion limits

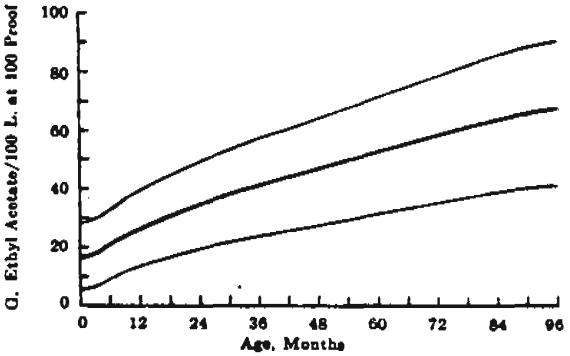

Figure 4. Esters

Averages — dispersion limits

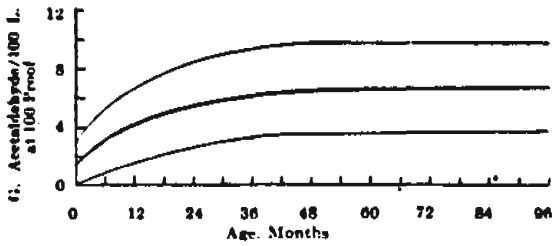

Figure 5. Aldehydes

Averages — dispersion limits

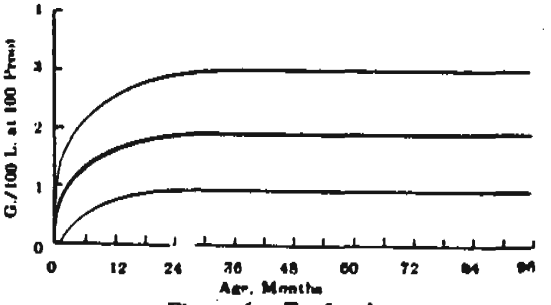

Figure 6. Furfural

Averages — dispersion limits

Figure 2-1. Effect of maturation on the physical and chemical characteristics of whiskey, Liebmann and Scherl study [2]

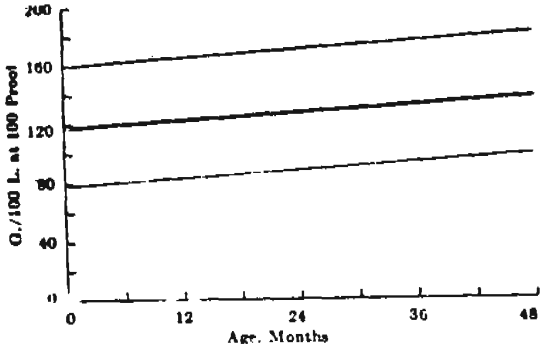

Figure 7. Fusel Oil

— Average; — dispersion limits

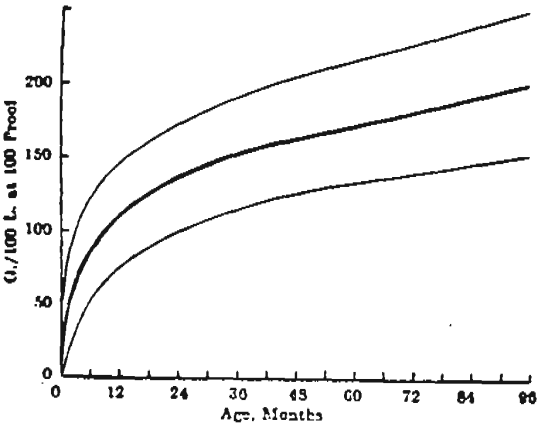

Figure 8. Solids

— Average; — dispersion limits

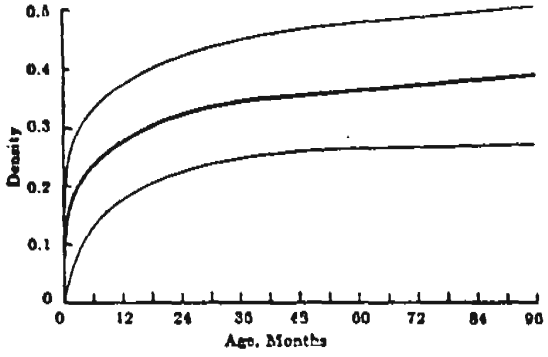

Figure 9. Color (Density)

— Average; — dispersion limits

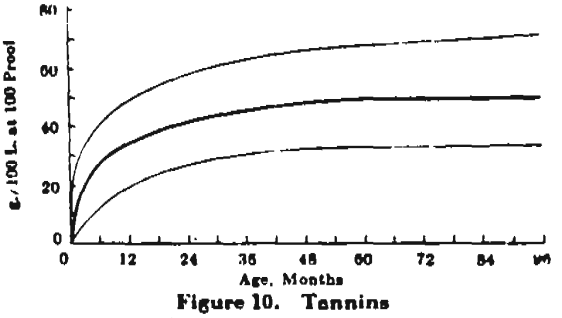

Figure 10. Tannins

— Average; — dispersion limits

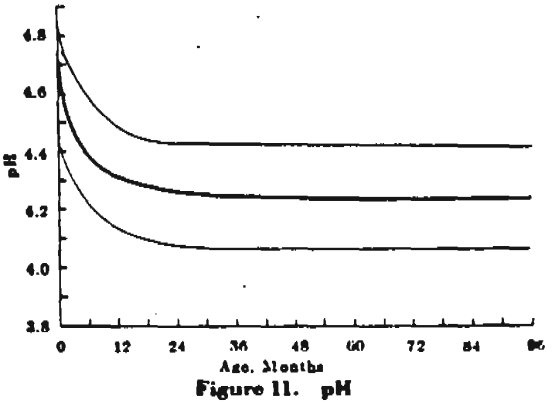

Figure 11. pH

— Average; — dispersion limits

Figure 2-1. (cont.) Effect of maturation on the physical and chemical characteristics of whiskey, Liebmann and Scherl study[2]

exact rates of the phenomena and the sensitivity of these phenomena to changes in such variables as temperature and entry proof is not precisely known.

The aging process begins when the barrel is filled with whiskey and the charred wood becomes saturated with liquid. The liquid extracts from the charred wood partially oxidized organic substances in the char, the biologically formed organic substances in the uncharred wood, plus color and various solids. This material is transferred to the bulk liquid in the barrel by simple diffusion, by convection currents in the bulk liquid and by temperature cycling. Temperature cycling causes transfer of material in the following way. As the barrel heats up, the gas above the liquid increases in pressure and forces liquid into the barrel wood. When the barrel cools and the gas pressure drops, the liquid flows out of the wood into the bulk liquid, carrying wood constituents with it. The materials transferred and originally in the wood react to form new compounds. These reactions occur on the surface of the wood, with the char acting as a catalyst, and in the bulk liquid. In addition, oxidation of chemical substances occurs as a result of the slow diffusion of air into the barrel liquid.

The rates of extraction, transfer, and reaction depend on temperature and the concentrations of various whiskey constituents. The effect of temperature is straightforward - higher temperatures increase the rates of extraction, transfer by diffusion, and reaction. Also, temperature changes cause convection currents in the liquid and pressure changes in the gas affecting transfer. The effect of concentration is more complex. The rate of extraction of various char and wood constituents will depend on the relative concentration of ethanol and water in the wood, since the constituents will exhibit differing solubilities in water vs. ethanol. The rate of extraction will also depend on the overall

concentration of liquid in the wood. The rate of diffusion will depend on the difference of concentrations of constituents in the wood, liquid, and air around the barrel. The rates of reaction will increase or decrease with the concentration of constituents.

The equilibrium concentrations of the various whiskey components depend heavily on the air flow around the barrel. A large air flow will lower the concentration of water, ethanol, and trace constituents in the air and increase the concentration gradient between the air and the barrel wood. This will have a number of effects. First, the larger concentration gradient will cause water and ethanol to evaporate faster and the ethanol/water content of the barrel wood to drop. An example of this phenomena is that a blotter strip whose end is stuck in water will be drier and water will evaporate faster with air blowing over it. The faster evaporating ethanol and water will draw more wood constituents out than normal, allowing less to travel inward to the bulk liquid. Also the lower liquid content of the wood will effect extraction. Finally, the larger concentration gradient for trace constiuents will cause these substances to evaporate to the air faster, again upsetting their inward transfer to the liquid. Figures 2-2 and 2-3 illustrate these various transfer mechanisms, and other aspects of aging.

2.3 WAREHOUSE OPERATION

The preceding discussion illustrates the importance of correctly controlling the barrel environment to produce a whiskey of a desired quality. Since each distiller desires to produce a whiskey with a quality distinctive to their brand, the various distillers control the barrel environment differently by operating their warehouses in different manners. However, it must be kept in mind that the effects on whiskey quality of such warehouse parameters as temperature, temperature cycling, humidity and ventilation are not precisely known.

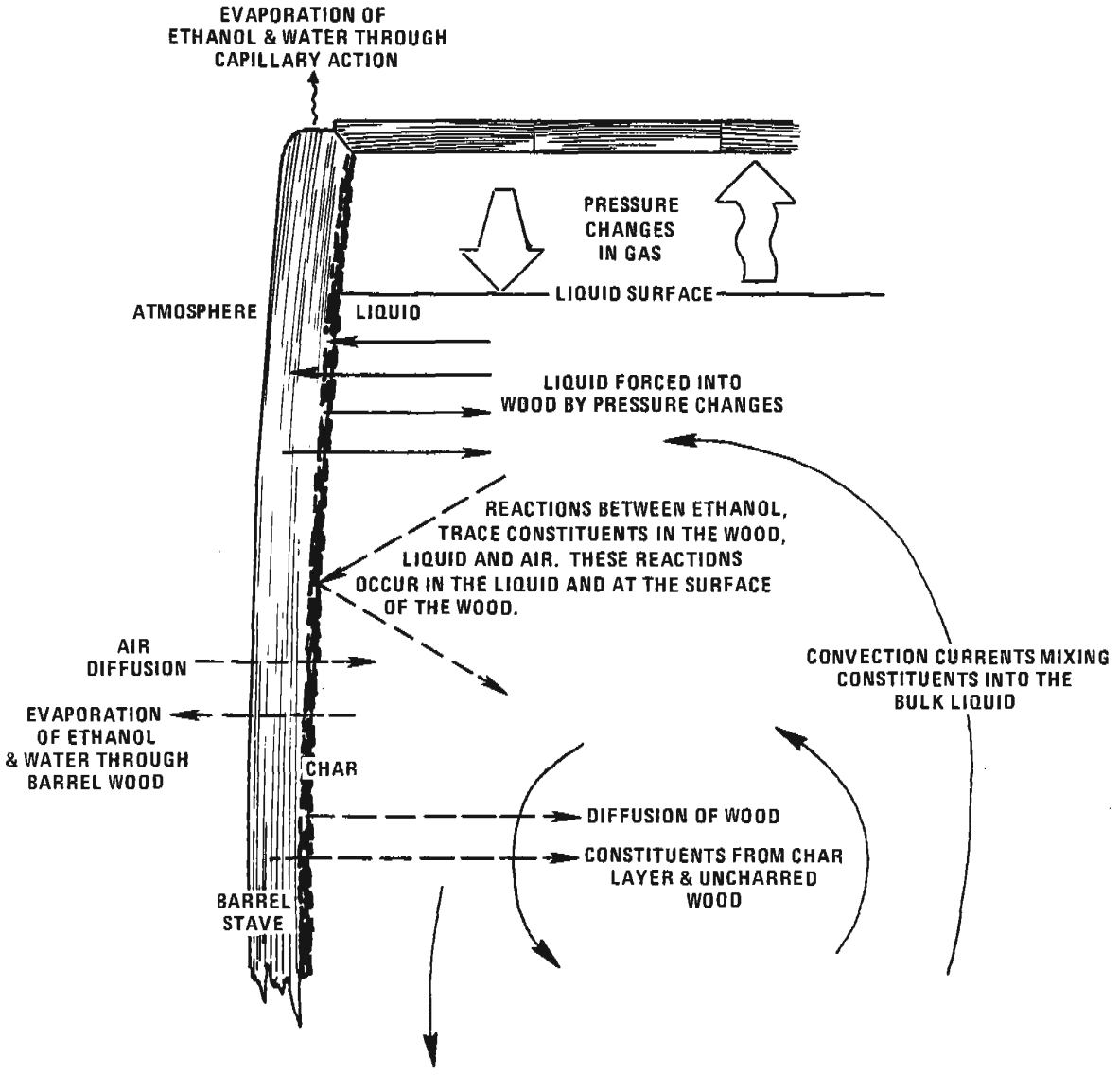

Figure 2-2. Mechanisms of whiskey aging.

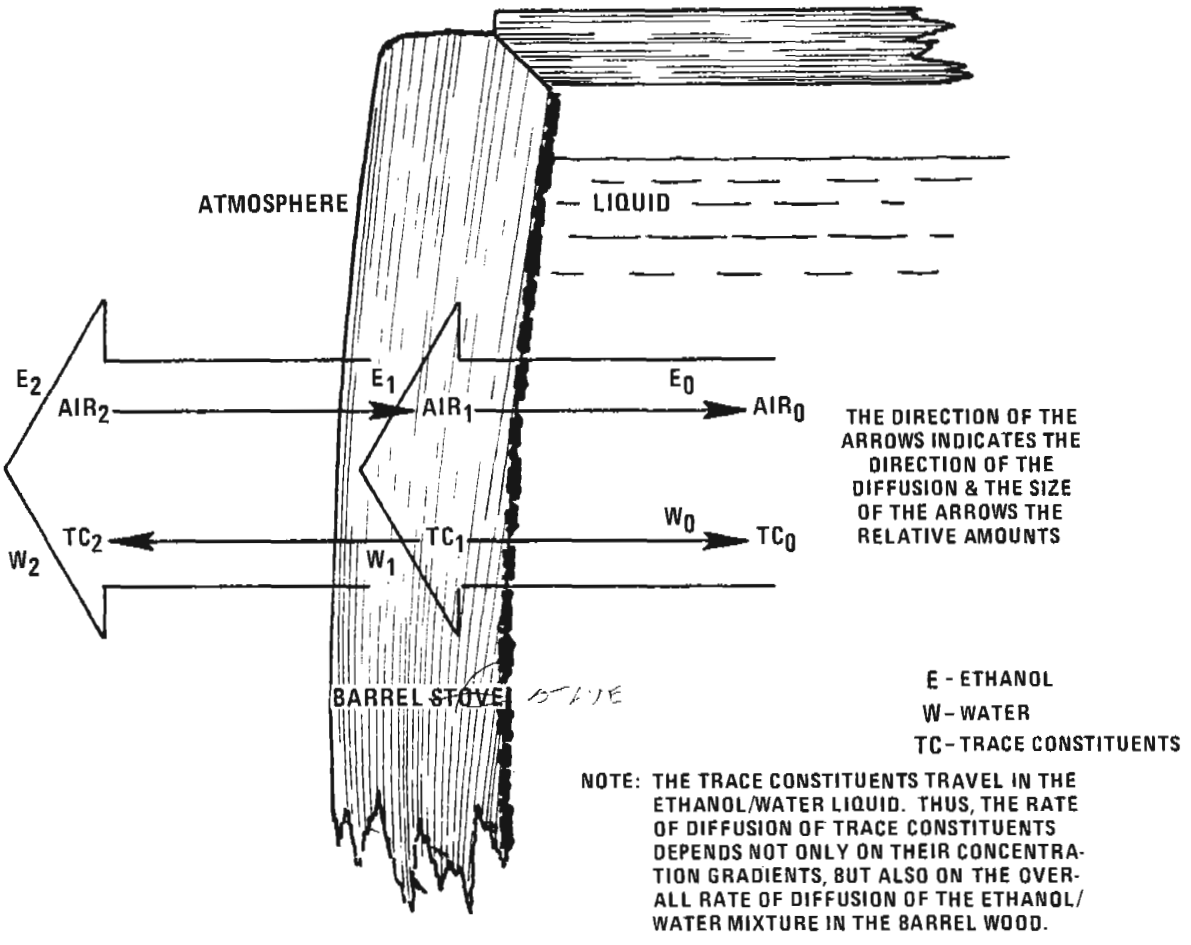

Figure 2-3. Diffusion through barrel staves in whiskey aging.

Thus, present methods of warehouse operation have not been developed by design and calculation; rather, each distiller's operation is for the most part the result of tradition and experience.

Other factors besides quality influence warehouse operation. These include the differing construction costs between metal clad and brick designs, the energy required if heating is used in the winter, the labor involved in moving barrels and opening and closing windows, the level of evaporative losses, and the savings in barrel costs if whiskey entry proof is increased.

The most important variation in warehouse operation is the type of warehouse: brick, metal clad or palletized. One aging/quality philosophy is that the best whiskey is produced when the barrel follows natural conditions during aging. Thus, metal clad warehouses are used since their exteriors are designed only to keep rain and snow from the barrels and provide no additional protection from the weather. However, the labor savings involved in palletized designs, construction costs and fire codes also influence the choice of warehouse type.

Another area where variations in practice occur is the type of ventilation provided for the solar heating effect. The large roof area of palletized designs and the poor insulation characteristics of metal clad designs allow relatively high rates of solar heat transfer through the roof and upper levels. If no natural or forced air circulation is provided, a hot, stagnant air mass develops in the upper area and a sizable temperature difference can develop between the top and bottom of the warehouse. This effect is commonly observed in metal clad warehouses during the summer, when temperatures of 120 to 140^{o}F can develop in the top floor while temperatures at the bottom are only 65 to 70^{o}F.

Various practices are followed with respect to this solar heating effect. Some distillers desire the elevated temperatures to achieve the type of aging they desire and thus close the bottom or top windows to create these high temperatures. Others provide for ventilation at the top and bottom of the warehouse to induce air flow and reduce the temperature difference. This is done not only to produce different temperatures for aging, but also to reduce the high evaporation losses at the elevated temperatures and to produce more uniform aging conditions in the warehouse. One distiller, in an effort to achieve complete uniformity of conditions and product, has sealed and insulated his metal clad houses and installed a central ventilation and heating system.

Variations in operating methods also exist among brick warehouses and between brick and metal clad houses. Brick houses have much better insulation characteristics, and thus do not experience the extreme temperature gradients in the warehouse during summer. Thus, whereas barrels stored in metal clad houses are rotated to average out the exposure temperature barrel rotation is not nearly as critical in brick warehouses. The insulating characteristics of brick warehouses also allow for heating in winter, whereas metal clads are allowed to follow the ambient temperature. In addition, among brick warehouses, different heating practices are used. Distillers not only maintain different temperatures in the winter, but also practice different cycling techniques. Some have only seasonal cycles, cooling in fall and warming in spring, while others intentionally increase and decrease the warehouse temperature several times in winter to produce the type of aging they desire. Variations between distillers also occur in the practice of summer ventilation. Some simply open the windows, while two locations have completely closed buildings and ventilate with fans.

Other more detailed variations undoubtedly exist. These include the time of the year windows are closed or heating starting, the length of temperature cycling, the frequency windows are open and shut, and the humidity characteristics of the spot selected for the warehouse. All of these variations illustrate the number of differing aging philosophies and traditions. The practices of several distillers are shown on Table 2-3.[3-11]

Table 2-3
Warehousing Operations

ick & Masonry Design

Company	Heating in Winter	Open Windows in Summer	Forced Air Ventilation in Summer	Temperature Cycles	Temperature Summer	Temperature Winter
A	Yes	Yes	No	seasonal	Ambient	40°F
A, Bldg. E	Yes	No, no windows	Yes	seasonal	Ambient	40°F
B	Yes	No	Yes	several times in winter	Ambient	55°F
C	Yes	Yes	No	several times in winter	Ambient	40°F
D	No	Yes	No	seasonal	Ambient	Ambient

etal Clad

Company	Heating in Winter	Windows open in summer Bottom	Windows open in summer Top	Barrel Rotation	Temperature - summer Top	Temperature - summer Bottom
E	No	Yes	Yes	every 2 years	95°F	85°F
F	No	No	Yes	every 2 years	120°F	-
present	No	Yes	Yes	Not stated	Not Stated	
previously	No	No	Yes	Not stated	120°F	65°F
H	No	Yes	No	New barrels started at top and moved down	elevated	70°F
I	The warehouses have been sealed and insulated and a central heating/ ventilation system installed				temperature cycling in winter; in summer forced air ventilation used to keep the ΔT to a minimum	

2.4 REFERENCES

1. Liebmann, A. J., and B. Scherl. Changes in Whiskey While Maturing. Industrial and Engineering Chemistry. 41:534-543, 1949.
2. Reference 1
3. Trip Report by Terry Briggs, Pedco, Cincinnati, Ohio on a visit to Jim Beam Distillery, Clermont County, Kentucky, April 7, 1977.
4. Trip Report by Terry Briggs, Pedco, Cincinnati, Ohio on a visit to Schenley Distillery, Louisville, Kentucky, April 7, 1977.
5. Trip Report by Terry Briggs, Pedco, Cincinnati, Ohio on a visit to Barton Distillery, Bardstown, Kentucky, April 7, 1977.
6. Trip Report by Terry Briggs, Pedco, Cincinnati, Ohio on a visit to Seagrams, Inc., Lawrenceburg, Indiana, March 30, 1977.
7. Trip Report by Terry Briggs, Pedco, Cincinnati, Ohio on a visit to Seagrams, Inc., Louisville, Kentucky, March 30, 1977.
8. Trip Report by Terry Briggs, Pedco, Cincinnati, Ohio on a visit to Brown-Foreman, Louisville, Kentucky, April 8, 1977.
9. Trip Report by Terry Briggs, Pedco, Cincinnati, Ohio, on a visit to Heaven Hill Distillery, Bardstown, Kentucky, April 7, 1977.
10. Telephone conversation between Mr. T. W. Samuels, Jr. President, Maker's Mark Distillery, Inc., Louisville, Kentucky and David C. Mascone, U. S. EPA, September 19, 1977.
11. Telephone conversation between Mr. David C. Mascone, U. S. EPA and Bill Padgett, Austin Nichols, Lawrenceburg, Kentucky, January 19, 1978.

3.0 VOLATILE ORGANIC EMISSIONS FROM WHISKEY WAREHOUSING

This chapter will describe the volatile organic emissions from whiskey warehousing, develop an emission factor for these emissions and present an estimated national emission inventory.

3.1 EMISSION SOURCE DESCRIPTION

The two sources of ethanol in whiskey warehousing are evaporation from the barrel wood during storage and evaporation from the saturated wood after the barrel is emptied. These emission sources are described below.

The first emission, evaporation during storage, occurs when liquid diffuses through the barrel staves and heads via the wood pores or travels by capillary action to the ends of the barrel staves. The liquid evaporated is both water and ethanol, with minor amounts of trace constituents. As discussed in Chapter 2.0, this ability of the barrel to "breath", i.e. allow liquid to evaporate and air to enter, is important to aging. Attempts made to age whiskey in sealed containers and thus prevent losses have proven unsuccessful since little aging occurred.

The rate of evaporation during aging is not constant. During the first six months to a year, the evaporation rate is low, since the wood starts dry and must become saturated before evaporation occurs. After saturation, the evaporation rate is greatest but decreases as the evaporation lowers the liquid level in the barrel. The lower liquid level decreases the surface area of the liquid in contact with the wood and thus the surface area subject to evaporation.

The second emission, evaporation after barrel emptying, occurs when the saturated barrels are stored after emptying. The amount and location of these emissions depend on the use that the distillers find for the barrels. A significant fraction are stored outside for lengthy periods during which much of the alcohol evaporates. Even if further use is found for the barrels, the bound alcohol will still evaporate if the barrels are stored long enough before reuse. Potential end uses for used barrels are aging Scotch, Canadian whiskies and American light whiskies, and as fuel or for decorative purposes. Federal law prohibits the use of used barrels in bourbon and American blended whiskey.

3.2 WHISKEY WAREHOUSING EMISSION FACTORS

Two sources of data are available to develop emissions factors for whiskey warehousing - aggregate loss data from IRS publications and individual loss data from specific distillers.

3.2.1 Emission Factors from IRS Data

The aggregate loss data from IRS publications are presented in Table 3-1.[1,2] Shown on this table are data on whiskey withdrawals, losses and stocks for 1974, 1975, and 1976, along with emission factors calculated from this data. Withdrawals represent whiskey removed from storage for comsumption. Losses represent the difference between the original and withdrawn amounts, i.e. that amount of whiskey lost due to evaporation and barrel soakage, plus theft, spills, etc. Average stocks represent an average of the amount of whiskey held in storage for that year and the previous five.

Three emission factors were developed from this data. Emission Factor I represents the fraction of whiskey production lost and equals .2 proof gallons lost for each proof gallon whiskey produced. This factor was computed by dividing

Table 3-1. LOSSES, WITHDRAWALS, AND STOCKS OF WHISKEY FOR THE U.S. From IRS Data

Column	1	2	3	4	5	6	7	8
	Year	Withdrawals	Losses	Withdrawals + Losses	Emission Factor I[1]	Average Stocks[2]	Emission Factor II[3]	Emission Factor III[4]
	1976	134.8	33.7	168.5	.200	870.6	.039	3.2
	1975	136.9	36.0	172.9	.208	910.0	.039	~~3.2~~ 3.3
	1974	138.1	33.9	172.0	.197	935.7	.036	3.0

[1]Computed by dividing column 3 by column 4, represents pg lost/pg whiskey produced.

[2]Represents the average of the stocks of whiskey in storage for the previous 6 years.

[3]Computed by dividing column 3 by column 6, represents (pg lost/year)/pg whiskey in storage.

[4]Computed by multiplying column 7 by 55 pg/barrel and 1.5 kg/pg lost, represents kg ethanol lost/barrel-yr.

Table 3-2. BARREL SOAKAGE LOSSES

Source	Barrel Soakage kg liquid	Barrel Soakage lbs liquid	Aging Time, years	Best Fit Equation	No. of years	kg lost-equation
Brown-Foreman	7.3	16	5		5	8.1
Boruff & Rittschof	10.3	22.6	8	kg liquid soakage	8	10.0
Gallagher, et. al.	8.6	19	5	(i.e. water + ethanol)	5	8.1
Schenley	5.5	12	1		1	5.4
	11.4	25	10	=.67(aging time,yrs) +4.7 for years 1 & greater	10	11.4

total losses by total production (losses plus withdrawals). Emission Factor II represents the loss rate based on stored whiskey and equals .038 proof gallons lost for each proof gallon in storage each year. This factor was computed by dividing total losses by average stocks. The number of proof gallons in stock was taken to be the average of the number of proof gallons in stock for that year and the previous five. The 6-year average stock was used since losses recorded for a given year represent losses on barrels emptied that year. These losses actually occurred not only during that year, but in previous years while the barrel was in storage. Six years is an approximation of the period of barrel storage - some of the losses for a given year come from barrels stored eight years and more, whereas some stored six years ago have already been emptied for four year old whiskey. Emission Factor III represents a weight loss rate per barrel per year and equals 3.2 kg ethanol/per barrel each year. This factor was computed by multiplying Emission Factor II by 55 proof gallons per barrel and 1.5 kg ethanol per proof gallon. It is important to note that the above figures include losses for both evaporation during storage and soaking into the barrel.

3.2.2 Emission Factors from Individual Distiller Data

The loss rate data from individual distillers and from experiments cover two areas, barrel soakage losses and evaporation losses during storage. These are discussed below.

The data available on barrel soakage losses are presented in Table 3-2.[3,4,5,6] The table shows the available data on total liquid soakage vs. aging time, plus a best fit equation for this data. The table indicates a rapid saturation of the barrel during the first year, followed by a constant, but slow, increase in weight during subsequent years. It should be noted that the data are for liquid soakage, i.e., both water and ethanol. Work by Boruff and Rittschof[7] indicates that the proof of the liquid in the barrel wood is approximately the same as

the proof of the stored whiskey; this permits a conversion from kg liquid to kg ethanol. Thus, a typical barrel storing 120 proof whiskey emptied after four years contains 3.8 kg of ethanol in the saturated wood.

The data from experiments and individual distillers on evaporation during storage are shown on Table 3-3.[7-13] The cumulative loss represents the total ethanol loss due to evaporation during the aging time shown. The annualized loss rate expresses this total at a constant yearly loss rate and was computed by dividing the cumulative loss by the aging time. Table 3-3 also shows a best fit equation for annualized losses for aging times of four years or more.

Annualized loss rates vs. aging time, as computed from the data and equation in Table 3-3, are shown on Table 3-4. Also shown on Table 3-4 are computed cumulative loss and computed incremental loss. Cumulative loss was calculated by multiplying the aging time by the annualized loss rates from the best fit equation. Incremental loss was computed by subtracting the computed cumulative loss for two successive years. This later number represents the additional evaporative loss during the given year of aging.

Figure 3-1 shows graphically the data on annualized loss rate from Table 3-3 and the computed annualized and incremental loss rates from Table 3-4. The graph clearly shows the wide variation in evaporative loss between distillers. These variations can be explained qualitatively by variations between distillers in such warehouse parameters as temperature, ventilation patters and temperature cycling. However, because of the large number of conditions that affect evaporation and the limited knowledge on the precise effects of the conditions on the rate of evaporation, no attempt was made to statistically relate warehouse conditions to evaporative loss.

Figure 3-1 also shows the variation in the incremental loss rate during aging, with the rate increasing during the first two years and decreasing in

Table 3-3. EVAPORATIVE LOSSES DURING STORAGE

Source No.[a]	Aging Time Years	Cumulative Loss kg ethanol/barrel	Annualized loss[b] kg ethanol/barrel-yr	Best fit Equation-Annualized Loss
Gallagher, et. al.	1	2.35	2.35	
Gallagher, et. al.	2	6.59	3.30	
A	4	9.52	2.38	For years 4 & greater
C	4	15.60	3.90	Annualized Loss (kg ethanol/barrel-yr)
E	4	9.32	2.33	= -.101(aging Time, yrs) +3.38
F	5	14.45	2.89	
C	6	20.88	3.48	
Boruff & Rittschof	8	17.76	2.22	
F	9	18.81	2.09	
I	10	26.70	2.67	

[a]Letters indicate data from individual distillers; Letters refer back to same distillers as Table 2-3

[b]Annualized losses assuming equal loss each year.

Table 3-4. COMPUTED ANNUALIZED, CUMULATIVE & INCREMENTAL LOSSES

Aging Time Years	Annualized Loss kg/barrel-yr[a]	Cumulative Loss kg/barrel[b]	Incremental Loss kg/barrel-yr[c]
1	2.35	2.35	2.35
2	3.30	6.60	4.25
3	3.10	9.30	2.70
4	2.98	11.92	2.62
5	2.88	14.40	2.48
6	2.78	16.68	2.28
7	2.67	18.69	2.01
8	2.57	20.56	1.87
9	2.47	22.23	1.67
10	2.37	23.70	1.47

[a]Years 1 & 2 are taken from Gallagher, et. al.; years 3 & greater from the best fit equation, Table 3-3.

[b]Annualized loss times aging time.

[c]Difference between cumulative loss for successive years.

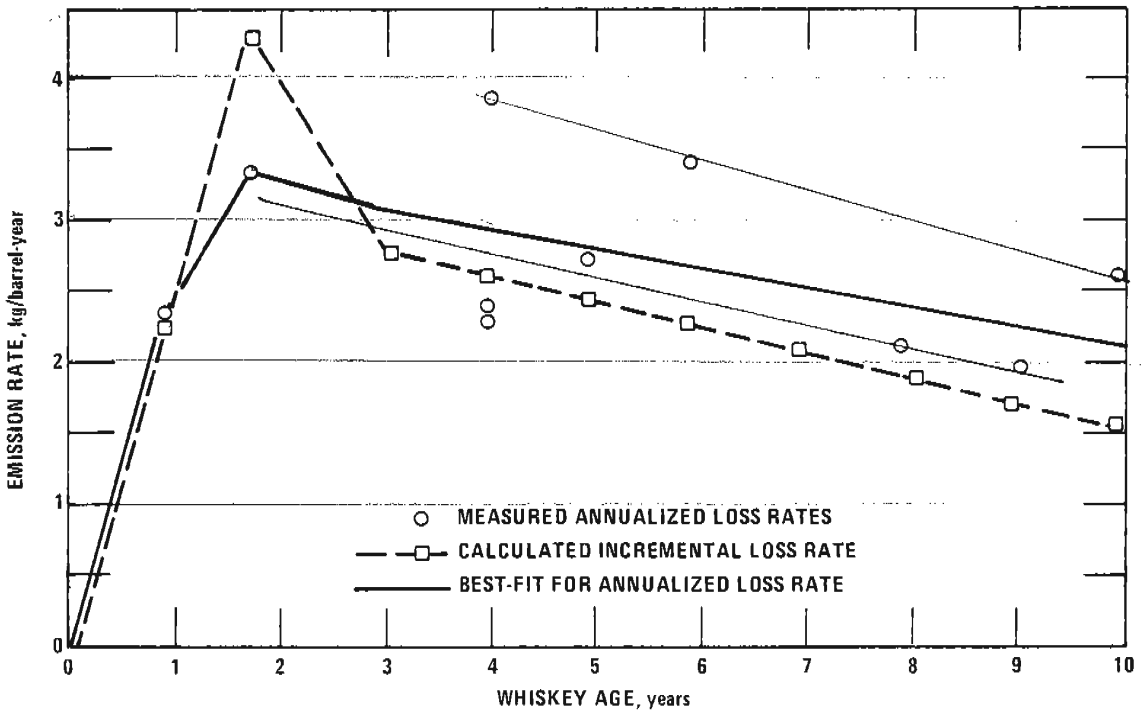

Figure 3-1. Emission rate relationships in the whiskey aging process.

subsequent years. This is in agreement with the theory discussed early. This variation in the incremental loss rate means that the age mix of the barrels in storage will affect the emission rate. Since barrels of different age have different evaporative loss rates, the total emissions will be determined by the fraction of barrels at each age.

Three different barrel age distributions were used to calculated emission factors: (1) the age distribution of bonded whiskey in Kentucky at the end of 1975;[14] (2) an age distribution based on fluctuating market from year to year; and (3) the age distribution based on distillers producing mainly four year old whiskey. Table 3-5 presents the barrel age distribution for the three cases and the respective emission factors of 2.55 kg/barrel-yr for case one, 2.74 kg/barrel-yr for case two, and 2.89 kg/barrel-yr for case three. These emission factors were calculated by multiplying the fraction of the barrels at a given age by the incremental loss for that age in Table 3-5. The four distillers producing primarily four and six year old whiskey used in case three are Jim Beam, Clermont, Kentucky; Jim Beam, Beam, Kentucky; Brown-Foreman, Louisville, Kentucky; and Fleischmann, Owensboro, Kentucky.[15]

The above emission factors represent evaporative losses during storage only. To determine overall emission factors, losses due to barrel soakage must be included. This loss is computed by assuming that the number of barrels emptied in a year equals the number of barrels one year old, and that the average barrel has a soakage equivalent to a five year old barrel. This figure is 4.2 kg ethanol/barrel. The overall emission factor is therefore:

Aging + Soakage = Total Emissions

case one) 2.55 + 4.2 (.112) = 3.02
case two) 2.74 + 4.2 (.172) = 3.46 kg/barrel-yr
case three) 2.89 + 4.2 (.181) = 3.65

In the preceding discussion, the variations in evaporative loss rate during aging were averaged together to develop a single emission factor.

Table 3-5. WAREHOUSE BARREL AGE DISTRIBUTION

(1) Whiskey by Various Periods of Production Remaining in Bonded Warehouses in Kentucky as of Dec. 31, 1975.

Age	Barrels in bond in Kentucky	Fraction by year	
0-1	685,600	0.112	0.2632
1-2	657,600	0.107	0.2527
2-3	813,800	0.132	0.3564
3-4	943,400	0.153	0.4005 Average barrel loss
4-5	868,700	0.141	0.3496 2.55 kg/barrel-year
5-6	821,000	0.134	0.3355
6-7	761,900	0.124	0.2902
7-8	349,600	0.057	0.1061
9+	247,200	0.040	0.0649
	6,148,600	1.000	2.5527

(2) Barrel Age Distribution Assuming a Uniform Year-to-Year Consumption Rate (100 bbl/yr basis)

Age	% Used (end of year)	Total by year	Fraction in warehouse by year	
0-1		100	0.172	
1-2		100	0.172	
2-3		100	0.172	
3-4	35	100	0.172	Average barrel loss
4-5	20	65	0.112	2.74 kg/barrel-year
5-6	15	45	0.079	
6-7		30	0.052	
7-8	20	30	0.052	
9+	10	10	0.017	
		580	1.000	

(3) 4 to 6 yr Whiskey Production

Age	Beam Beam, Ky.	Beam Clermont, Ky.	Brown-Forman Louisville, Ky.	Fleishmann Owensboro, Ky.	Overall age distribution
0-1	58948	60743	97000	30901	0.181
1-2	64014	74076	104437	38568	0.205
2-3	98247	78559	41840	35413	0.185
3-4	91239	84464	63371	36411	0.201
4-5	17572	24102	60514	30412	0.097
5-6	1110	31594	37320	35963	0.077
6-7	303	14981	4321	5412	0.018
7-8	2122	25207	2783	208	0.022
9+	5698	12069	858		0.014
					1.000

Average barrel loss = 2.74 kg/barrel-year

This single emission factor was then used together with data on barrel age distributions to compute several emission factors. A second method of developing emission factors from the loss data reported by individual distillers is to group the data into higher and lower measured annualized loss rates. As noted previously in Chapter 3, large variations in measured annualized loss rate result from differing warehouse operations. The analysis of the loss rates by dividing them into higher and lower values will provide two emission factors characterizing the spread of emissions caused by differences in warehouse operations. Examination of Figure 3-1 shows that the bottom four and top three data points for measured annualized loss fit into two convenient groups. Analysis of these groups results in emission factors of 2.3 and 3.6 kg/barrel-yr for evaporative loss during aging.

It should be noted that the above analysis was not performed rigorously. A rigorous analysis would require that the annualized loss data be converted to incremental losses, and then the incremental loss applied to barrel age distributions. This was not done because it was felt that three data points (four in the lower value case) were not sufficient for these conversions to remain statistically meaningful. Thus, the emission factors of 2.3 and 3.6 kg/barrel-yr were determined by drawing lines, lines through the bottom four and top three points for measured annualized losses (Figure 3-1) and the loss rate at year five were taken to be the appropriate emission factor.

All the emission factors for volatile organic chemicals from whiskey warehousing are summarized in Table 3-6. The emission factors based on the variations in warehouse operations are used in designing and costing the control system. The emission factors developed from the barrel age distributions, along with Emission Factor III from the IRS data, are used to develop emission inventories. Finally, Emission Factor I from the IRS data is used to relate

Table 3-6. SUMMARY OF EMISSION FACTORS
WHISKEY WAREHOUSING

Source	Figure	Description
IRS Publication	.20 proof gallons lost/proof gallons produced*	represents fraction of production lost
	.038 proof gallons lost/proof gallons storage-yr*	represents fraction of storage lost per year
	3.2 kg ethanol/barrel-yr*	represents amount of ethanol lost per barrel in storage per year
Individual Distiller Data & Experiments	3.8 kg ethanol soakage/barrel	represents amount of ethanol lost per barrel due to soakage into wood. The figure is for a barrel stored 4 years.
	3.02,3.46,3.65 kg ethanol/barrel-year	represents amount of ethanol lost due to both evaporation during storage and soakage for various barrel age distributions
	2.3,3.6 kg ethanol/barrel-yr	represents the range of ethanol loss durir storage caused by differing methods of warehouse operation; does not include soakage loss

*These figures include all types of loss - evaporation during storage, soakage into the barrel, plus leakage, theft,etc.

whiskey sales to markets in the discussion of reuse of the recovered alcohol. The reason for using each emission factor for the uses described above is given with the calculations involving that emission factor.

3.3 EMISSION INVENTORY

Total emission estimates are developed for three areas: (1) typical size distilleries, (2) States; and (3) nationwide.

Two representative facilities were chosen to develop emission totals for typical size distilleries: (1) a large 400,000 barrel facility producing primarily four year whiskies and (2) a smaller 50,000 barrel facility producing whiskies up to eight years and older. To compute the emission total for the 400,000 barrel facility the emission factor used is that of case three in on page 3-9 This emission factor is used since the barrel age distribution for case three and for the 400,000 barrel facility are both based on producing four year old whiskies. For the 50,000 barrel facility, the emission factor used is that of case one on page 3-9. This emission factor is used since the Kentucky barrel age distribution approximates those of distillers producing eight year and older whiskies. The emission totals for the large distillery is 400,000 barrels x 3.65 kg/barrel-yr = 1460 MT/yr and for the large distillery 50,000 barrels x 3.02 kg/barrel-yr = 151 MT/yr.

Total emission estimates will be developed for five States - Kentucky, Indiana, Illinois, Tennessee, and Maryland. Table 3-7 shows the number of barrels stored in each State[16] and the total emission estimate. The emission factor used was 3.2 kg/barrel year, based on the aggregate loss data from IRS publications. This emission factor was used since, being based on the widest

Table 3-7. TOTAL EMISSION ESTIMATE BY STATE

State	No. of Barrels in Storage June, 1976, Thousands	Total Emissions (MT/yr)
Kentucky	6130	19,620
Illinois	1290	4,130
Indiana	2260	7,240
Maryland	640	2,050
Tennessee	580	1,780

data base, it was most likely to have correctly averaged the variation in barrel emission rates that occur between warehouses.

The national emission total estimate is 38,170 MT/yr, based on 11.9 million barrels stored in June, 1976. The five States above represent 91 percent of the estimated emissions.

3.4 REFERENCES

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4.0 WAREHOUSE EMISSION CONTROL

Two methods for reduction of warehouse emissions were investigated: 1) carbon adsorption (CA) and 2) an alternate aging system. The second method of control is in early development and will require a number of years for testing. However, the system's potential for large reduction in aging costs makes it attractive as a control method, given successful testing.

4.1 CARBON ADSORPTION - SYSTEM DESCRIPTION

Controlling warehouse emissions by carbon adsorption would involve closing the warehouse and ducting the interior to a carbon adsorption unit. For brick warehouses, this would involve shutting most windows, doors, and ventilators, leaving some open for intake air, and running ductwork along the exterior of the building to the various floors. In some metal clad warehouses, extra work may be required to close gaps between metal sheets, and between the roof and the sides. However, most metal clad warehouses are tight enough in construction that closing windows, doors, and ventilators would be sufficient. The areas of sheet metal overlap would not need to be sealed since these areas would provide the infiltration required to balance the air removed by the CA unit.

The CA unit itself would be a skid-mounted package system containing two beds, fans, switching mechanisms and control, condenser/decanter, and internal piping for steam and air flow. The unit would run on a two cycle system with one bed adsorbing as the second was regenerated and cooled.

4.2 CARBON ADSORPTION - COST ANALYSIS

In determining the costs of the carbon adsorption system, a number of assumptions were made. These assumptions are listed in the sample calculation shown later. Several of the major assumptions are discussed below.

First, two warehouse ethanol concentrations, 750 and 1500 ppm, were chosen. The ethanol concentration must be stipulated since this parameter establishes the flow rate of the CA unit. The 750 ppm level complies with the OSHA exposure standard of 1000 ppm, 8 hour time-weighted average; the 1500 ppm level reflects the concentration believed to be required for proper whiskey aging. (A more complete discussion of the OSHA standard, whiskey quality and other impacts of the control system is presented later.) Second, a range of installed costs vs. adsorber size was chosen based on the evaluation of a number of sources.[1,2,3,4] The costs used ($20/scfm for units less than 4000 scfm, $14/scfm for units greater than 15,000 scfm, and $17 for those in between) represent figures in the middle of the range presented by the sources. Third, a value of $0.53/proof gallon of recovered alcohol was chosen. This was based on the current price of 190 proof alcohol of $1.12/gallon[5] (or $0.59/proof gallon) discounted $0.04/proof gallon for transportation and $0.02/proof gallon for the utilities required for redistillation of the recovered alcohol. Fourth, 85 percent recovery efficiency and an adsorber flow capacity of one and a half times that based on a warehouse mass balance were chosen. The 85 percent recovery allows for the maximum ethanol losses through openings in the warehouse, through design of CA unit to achieve proper aging and during redistillation. It is expected that greater efficiencies could be attained in many cases. The 1.5 times the mass balance design allows for variations in the adsorber air flow rate required for proper whiskey aging and for recovery of the higher emissions in summer caused by warmer temperatures. Finally, two barrel emission rates,

2.3 and 3.6 kg/barrel-year, were chosen to examine the effect the variations in emission rates caused by differing warehouse operations have on system design and cost. A sample calculation follows.

Sample Calculation

1) Assumptions

- barrel emission rate of either 2.3 or 3.6 kg/barrel-yr. (Approximately 5.0 or 8.0 lbs/barrel-yr) and warehouse ethanol concentration of either 750 or 1500 ppm.
- total installed costs (TIC)

  $20/scfm for units $\leq$ 4000 scfm
  $17/scfm 4000 scfm $\leq$ unit $\leq$ 15,000 scfm
  $14/scfm for units $\geq$ 15,000 scfm

- other costs

Annualized capital costs	= 15 percent TIC
Taxes, insurance, etc	= 4 percent TIC
Steam	= 17¢/100 lbs
Carbon	= $1.00/lb
Electricity	= 3¢/kw·hr
Maintenance	= .1 hr/hr operation at $10/hr

- design will be based on yearly operation, with an overall 85 percent recovery, with the actual unit at 1.5x the calculated flow rate
- bed design parameters - two foot bed depth, operating velocity at 75 fpm, 7 in. H_2O pressure drop, bed length 3 times bed width, 7 year bed life
- recovery parameters - bed capacity at 7lbs ethanol/100 lbs carbon, 3 lbs steam/lb ethanol recovered, $0.53/pg ethanol recovered

2) Calculations

Example - 50,000 barrel warehouse, 750 ppm, 3.64 kg/barrel-yr (8.0 lbs/barrel-yr)

- Mass Balance - the system must be designed so that the emission rate of ethanol matches the removal rate by the CA unit.

  emission rate = (No. of barrels)(lbs/barrel-year)
  removal rate = (scfm)ppm/10^6 (1/360)lb-mole/ft^3 X
  (46 lb/lb-mole)5.18(10)^5 min/yr

  or (No. of barrels)(lbs/barrel-yr) = scfm(ppm)6.62 $(10)^{-2}$
  thus (50,000)8 = scfm (750)6.62$(10)^{-2}$
  scfm = 8060

- Total Installed Costs

  Unit size = 1.5(8060) = 12,090 scfm
  $17/scfm (12,090) = $205,530
  Annualized .15($205,530) = $30,829

- Other Costs

the amount of ethanol recovered =
.85(50,000)8 =
340,000 lbs whiskey/yr

steam requirement =
340,000(3) = $1.02(10)^6$ lbs steam/yr
1.02 $(10)^6$ $.17/100 lbs steam =
$1734/yr

taxes, insurance, etc. =
.04 (TIC) = .04 ($205,530)
$8221

electricity =
(7 in H_2O) 249 pascals/in H_2O = 1160 joules/m^3 Air
5.18 $(10)^5$ min/yr (scfm) 1/35.3 (m^3/ft^3) = 1.47$(10)^4$ (scfm) m^3

using a 60 percent efficiency factor and 3.6 $(10)^6$ joules/kw·hr
(7.06/.6) $.03/kw·hr (8060) =
$2850/yr

maintenance and labor
.1 hr/hr operation x $10/hr =
8640 (.1) $10 = $8640

- Bed Design

scfm/linear velocity = surface area (SA)
SA = 12,090/75 = 161 ft^2

$L = 3W$; $SA = LW$; $SA = 3W^2$; $W = \sqrt{SA/3}$
$W = \sqrt{161/3}$ = 7.3 ft
$L = 3W$ = 22ft

Bed volume = 2 ft(SA) = 322
322 (30 lbs/ft^3) = 9660 lbs/carbon
9660/7 yr ($1/lb) = $1380/yr Replacement carbon

Cycle time (assume 50 percent of ethanol removed from bed each cycle)
340,000 lbs ethanol-yr/8640 = 39.4 lbs/hr
9660 lbs carbon (.07 lbs ethanol/lb carbon).5 removal efficiency =
338 lbs recovered/cycle
338/39.3 = 8.5 hours

- Value of Recovered Alcohol

3.31 lbs/pg
340,000/3.31 = 102,720 pg/yr
102,720 (.53) = $54,400/yr

A comparison of six recovery system design cases is presented in Table 4-1. The cases cover three warehouse sizes and two emission rate/warehouse ethanol concentration combinations. The warehouse capacities chosen were 20,000, 50,000, and 100,000 barrels and represent typical sizes for existing metal clad and brick units. The emission rate/warehouse ethanol concentrations chosen were 8 lb/yr-barrel, 1500 ppm, and 5 lb/yr-barrel 750 ppm. These cases represent the highest and lowest net return rates, respectively.

The cost analysis as presented in Table 4-1 indicates that the control system is financially feasible. Four of the six design cases offer net returns, the remaining cases small net costs. When these net costs are calculated on a per original proof gallon basis, aged 4 years, the cost is 0.52¢/proof gallon for Case A and 3.0¢/proof gallon for Case C. An average total cost for the six cases (costs without credit for recovered product) is 7¢/original proof gallon, aged 4 years. These figures compare to a $2.10/original proof gallon production cost for aged whiskey.[6]

The cost analysis in Table 4-1 does not include expenditures for steam production facilities or steam lines. Facilities without steam heating of warehouses (this includes most facilities with metal clad warehouses) would require lines, in some cases up to 750 meters, to transfer steam from the production plant to the warehouses. In addition, one or two smaller facilities would be require steam boilers in addition to steam lines. No calculations were made of these extra costs, but they would be significant.

4.3 CARBON ADSORPTION - FEASIBILITY

In addition to cost, several other considerations affect the applicability of carbon adsorption to control of VOC emissions from whiskey warehouses. These considerations are the system's effect on whiskey quality, the ability to reuse the recovered alcohol and OSHA standards.

Table 4-1

Recovery System Costs

Case	A	B	C	D	E	F
No. of Barrels	50,000	50,000	20,000	20,000	100,000	100,000
Warehouse ethanol conc.,	750	1,500	750	1,500	750	1,500
Emission rate, lbs/yr-barrel	5	8	5	8	5	8
Actual SCFM	5,040	4,030	2,010	1,610	10,070	8,060
Design, 1.5 Actual	7,560	6,045	3,020	2,420	15,100	12,080
Total Installed Costs (TIC)	$128,520	$102,760	$60,420	$48,340	$211,400	$205,360
Annualized TIC	$ 19,280	$ 15,410	$ 9,960	$ 7,250	$ 31,700	$ 30,800
Whiskey recovered, lbs/yr	212,500	340,000	85,000	136,000	425,000	680,000
Steam, 10^6 lbs/yr	.637	1.02	.255	.408	1.27	2.04
Steam, $/yr	$ 1,080	$ 1,730	$ 430	$ 690	$ 2,160	$ 3,470
Electricity, $/yr	$ 1,780	$ 1,420	$ 710	$ 570	$ 5,330	$ 2,850
Tax, etc., $/yr	$ 5,140	$ 4,110	$ 2,420	$ 1,930	$ 8,460	$ 8,210
Maintenance, $/yr	$ 8,640	$ 8,640	$ 8,640	$ 8,640	$ 8,640	$ 8,640
SA, $ft.^2$	100	80	40	32	200	160
Length, ft.	17	16	4	10	25	22
Width, ft.	5.8	5.2	3.7	3.3	8.2	7.3
Cycle Time, hrs.	8.5	4.3	8.5	4.3	8.5	4.3
Carbon, lbs.	12,000	9,600	4,800	3,840	23,000	19,200
Carbin, $/yr	$ 1,720	$ 1,380	$ 680	$ 540	$ 3,420	$ 2,740
Proof gallon whiskey/yr	64,200	102,720	25,680	41,090	128,400	205,540
Whiskey value, $/yr	$ 34,030	$ 54,440	$13,610	$21,780	$ 68,050	$108,940
Total Annual Costs, $	$ 37,640	$ 32,690	$21,940	$19,620	$ 59,710	$ 56,710
New Cost (Return)	$ 3,610	$(21,750)	$ 8,330	$(2,160)	$ (8,340)	$(52,230)
Cost/4 yr. Proof gal.	.52¢	--	3.0¢	--	--	--

4.3.1 Effect on Whiskey Quality

Whiskey quality is a critical factor in the marketability of whiskey and in the distinction between the various brands. Alterations in whiskey quality, i.e., taste and aroma, are a serious concern to distillers since such alterations could affect consumer acceptance of the product and thus reduce sales.

As discussed in Chapter 2, the taste and aroma qualities of whiskey are largely a product of whiskey aging. Whiskey aging, in turn, is a complex process composed of a number of interrelated chemical and physical mechanisms. A CA system, with the potential for changing such warehouse conditions as temperature, ventilation patterns, and humidity, could affect these aging mechanisms and thus alter quality.

The installation and operation of a CA system could affect whiskey quality in a number of ways. First, the increased ventilation provided by a carbon adsorber could lower the concentration of ethanol, water and trace constituents in the air around the barrel. This would increase the rates of evaporation of these constituents and alter the liquid content of the wood, upsetting the equilibrium concentrations in the wood, liquid and air and potentially affecting quality.

Proper design of the CA system could eliminate this effect. If the flow rate of the CA unit was adjusted so that the removal rate of air matched that provided by natural ventilation, the ethanol, humidity and trace constituent levels in the warehouse would remain unchanged. Since the CA unit is removing air, and thus the components in the air, at the same rate as natural ventilation, both natural ventilation and the CA system would provide for the same build up of these components in the warehouse.

However, other effects could occur. A CA unit provides a continuous flow of air across the barrels; natural ventilation would be intermittent. Thus, a CA unit would provide constant concentrations around the barrels, whereas natural ventilation would allow the buildup of stagnant layers. These stagnant layers would be removed occasionally by the natural ventilation, producing a stop-start effect in which evaporation occurs quickly after a draft and slows as the stagnant layer builds up. Another effect would be the lowering of the temperature differentials between the top and bottom of the warehouse. A CA would take air from several floors within the warehouse and either recirculate this air or draw in new air This mixing and ventilation would remove the hot, stagnant air at the top of the warehouse, reducing the temperature on these floors.

It appears that proper design could also eliminate these effects. The proper stagnation periods and concentration levels could be maintained around the barrel by adjusting the air flow rate and sequencing the ventilation. In such a system, only two or three of the warehouse floors would be ducted to the carbon adsorber at one time. Time-controlled dampers in the air exhaust lines would sequence which floors received ventilation. During the period a floor was off ventilation, the stagnation layers could build up. Elevated temperatures at the top of the warehouse could be achieved by using very low or no ventilation on the lower floors. Alternately, the system could be designed to draw air upward through the warehouse. The air drawn in at the bottom would be heated by the sun during the period it rose upward. Thus it appears that the proper combination of air flow rates, ventilation patterns, air recirculation, and other design parameters could reproduce most warehouse conditions. In addition, it appears that this could be achieved in most cases with straightforward engineering and at moderate cost.

However, proper design is not the only criterion; it is important to know what conditions to reproduce. Given the complex nature of whiskey aging, it is difficult to state precisely what are the conditions for proper aging and thus how to design the CA system. This is especially true considering the number of different brands of whiskey. Development of the system through experimentation is also difficult. A minimum of 2 years is required to notice quality changes in aging whiskey and 4 to 8 years to make a complete assessment. Potentially, 2 or 3 four to eight year aging cycles could be required to adjust the CA system to eliminate whiskey quality problems. Thus, the CA system's affect on whiskey quality is indeterminate. It would appear possible to design a system to reproduce the desired conditions but not possible to state with precision what these conditions are.

4.3.2 Re-use of Recovered Alcohol

Important to the costs of the CA system is the ability to re-use the recovered ethanol. This ability depends on two factors, the feasibility and costs of converting the recovered ethanol to a product suitable for use and the availability of markets for this converted product.

There are no market barriers to the re-use of the recovered alcohol, once it has been converted to grain neutral spirits. Though tax regulations prohibit its use in whiskies, the grain neutral spirits could be used in vodka and gin, or denatured for chemical use. Consumption figures[7,8] for both these indicate that sufficient markets exist to absorb the recovered product. If ethanol losses amount to 25 percent of the sales of American blended and straight whiskies,* this would provide 28 x 10^6 wine gallons/year or (assuming 100 proo

*Emission Factor II from the IRS data is .2 pg lost/pg produced. To calculate an emission factor based on consumption, the losses must be subtracted from production to arrive at a consumption figure. The loss rate on consumption is thus .2/(1-.2) = .25

whiskey) 15 x 10^6 190 proof gallons/year. The use of ethanol for gin and vodka (assuming 100 proof for these products) is 53 x 10^6 190 proof gallons/year. Thus, the available market, gin, vodka, and industrial use, is 253 x 10^6 190 proof gallons/year (See Table 4-2). The recovered ethanol represents 11 percent of this market.

The conversion of the recovered ethanol to grain neutral spirits presents no technical problems. The recovered alcohol is of sufficient quality for distillation to grain spirits and the equipment and procedures to perform this distillation are known to the industry. However, few distillers actually have the installed capacity to produce grain neutral spirits; only one in Kentucky has such a capacity.[9] Thus, most distillers would be required to ship the recovered alcohol to a location with distillation capacity or install the capacity themselves. Both options present additional costs. The recovered alcohol would be at approximately 50 proof before redistillation, and in such a dilute form, would cost 19 cents/proof gallon to transport by tank truck.[10,11] The costs of installing and operating distillation equipment to produce grain neutral spirits were not calculated but would be considerable.

4.3.3 OSHA Standards, Insurance, Energy, and Secondary Environmental Impact

An important consideration in applying carbon adsorption to whiskey warehouses is the effect the control device will have on safety and worker health. Closing the warehouse to install a CA unit could increase the concentration of ethanol inside the warehouse, potentially violating OSHA standards and increasing insurance risks.

The OSHA standard for ethanol is 1000 ppm, time-weighted-average for 8 hours. Several of the proposed design cases are based on 1500 ppm ethanol in the warehouse, an apparent violation of the OSHA standard. However, several factors should be considered. First, the OSHA standard is a time-weighted

TABLE 4-2

Distilled Liquor Sales

$(10)^6$ wine gallons/yr

	1975	1973
Vodka	65.0	54.0
Gin	36.2	35.3
	101.2	89.3
Cordials	23.8	20.6
Rum	14.4	13.4
Bottled Cocktails	7.0	5.0
Imp. Whiskey	95.3	91.9
Other	19.4	17.3
	159.9	148.2
Blended Am. Whiskey	46.6	53.5
Straight & Bonded Whiskey	64.1	66.2
	110.7	119.7
TOTAL	371.8	357.2

Industrial Ethanol Use

$(10)^6$ gallons 190 proof/yr

1975	210
1976	200
1980	220

Ethanol Market Pattern

Percent

Chemical Manufacture	44
Solvent	46
Export	10

average with no short term maximum exposure limit. Thus, the OSHA standard would not be violated if a worker spent only part of his time in the warehouse and the remaining time outside or in other parts of the distilling complex. Thus, a 1500 ppm ethanol concentration would not restrict entry. The OSHA standard may affect labor practices since workers could not remain in the warehouse all day.

Secondly, as the discussion of whiskey quality indicates, the CA system would of necessity have to be operated to reproduce existing conditions and practices. The 1500 ppm design case was chosen to represent ethanol concentration presently used in aging. Thus, the installation of a CA system would present no additional problems for worker health compared to present methods of operation.

Contacts with an insurance company indicated that no additional insurance on the warehouse is required.[12] In addition, as discussed above, the operation of a CA system should not increase ethanol levels in the warehouse over existing levels.

Another important consideration in control device evaluation is energy and secondary environmental impact. In recovering ethanol and converting it to a usable product, the main areas of energy consumption are the steam used in regeneration of the carbon and in redistilling. Assuming that a one still system can adequately purify the recovered alcohol, the energy usage for regeneration is calculated to be 6.6×10^6 joules/kg ethanol recovered and for redistillation 7.9×10^6 joules/kg ethanol recovered. The energy for redistillation would be required even without the control system since the recovered alcohol would be replacing alcohol presently produced. By comparison, a distiller in his normal production operations (cooking grain, heating warehouses, operating other stills) uses an estimated 80×10^6 joules/kg ethanol recovered. In addition, the energy value of the ethylene required in production of synthetic ethanol is calculated to be 33×10^6 joules/kg ethanol. Thus, the proposed control system could potentially save energy.

The main secondary environmental impact of the control system is the disposal of the waste water from distilling the recovered alcohol to grain neutral spirits. The amount of waste water produced in this manner would be 4 liters/kg ethanol recovered. By comparison, using a figure of 143 liters water/bushel grain in producing whiskey and assuming 95 of these liters become waste water, an estimated 61 liters waste water/kg ethanol recovered is produced by the normal operation of a distiller. Existing methods of waste water disposal at distillers should be able to handle this extra load.

4.4 CARBON ADSORPTION - WAREHOUSE TESTS

Between 1960 and 1968, a major distiller operated a carbon adsorption system on a whiskey warehouse at one of their facilities. A second distiller, National Distillers and Chemical Corporation, also installed a carbon adsorption system in the early 1950's to develop background data for a patent. However, the National test was conducted on only one warehouse floor, for one year, diverting a very small fraction of the exhaust air through a laboratory size carbon adsorber. Thus, the only full-scale test of the proposed control system is the one run from 1960 to 1968.

Table 4-3 lists the important data from the full scale test. Several points should be noted. First, the recovery efficiency and the proof of the recovered alcohol are both lower than the values used in the design calculations. Second, the carbon adsorber increased the rates of evaporation from the barrel and adversely affected quality. This last effect, the alteration of whiskey quality, was one of the principal reasons the test was stopped.

The full scale test, as run, does not demonstrate that a carbon absorption unit can be successfully applied to whiskey warehousing. At a recovery proof of 30, the transportation cost for the recovered alcohol is

Table 4-3. CARBON ADSORPTION SYSTEM DATA
FULL SCALE TEST, 1960-1968

Adsorber Design & Operating Parameters

Warehouse Size/Type:	97,500 Barrels/Brick & Concrete
Barrel Emission Rate:	5.25 lb/barrel-yr
Recovery Efficiency:	74 percent (5 yr. average)
Recovery Proof:	30.5

Operating Procedures & Conditions

Experiment One (1960-1964)	Year 1 & 2	Year 3	Year 4 & 5
Ventilation Rate	Normal	Reduced	Normal
Recirculation	Yes	Yes	No
Humidity	Elevated	Elevated	Normal
Proof	Decreased	Decreased	Stabilized
Whiskey Quality	-	Sour, wet wood characted	Improved to satisfactory

Experiment Two (1965-1968) All years

Ventilation Rate:	Normal	Proof:	Normal
Recirculation:	No	Quality:	Poor all years
Humidity:	Normal		

Chronology: The changes in year 3 of experiment one were made to reduce the elevated humidity and temperature in the experimental warehouse. This proved unsuccessful and due to this and continued problems with whiskey quality, changes were made in year 4. The second experiment was run since the number of changes that were made in the first experiment made it unreliable as a data source.

Other Effects:

Evaporation: During both experiments, the rate of evaporation from the barrels increased. During the first experiment, the increase was .3 percent/yr (3.2 percent/yr. vs. 2.9 percent/yr normal) and during the second experiment, the increase was .4 percent/yr higher (3.3 percent/yr vs. 2.9 percent/yr normal).

Recovery: During the first two years of experiment one, when the adsorber exhaust was recirculated to the warehouse, the recovery rates were 83.3 and 93.3 percent compared to the 74 percent overall recovery for all five years.

32¢/proof gallon; this amount must be subtracted from the value of the recovered alcohol since the distiller would be required to absorb this cost. The recovery rate is 10 percent lower, and the steam usage higher (at 30 proof, the steam rate is 7 kg/kg) than the figures used in the design calculations, again adding costs. Finally, the whiskey lost due to the excess evaporation would need to be reproduced at $2.10/proof gallon aged. Though some of this is recovered by the carbon adsorption system (75 percent in the full scale test study), the recovery value is much lower. The effect of these factors on the recovery system cost is shown in Table 4-4. Thus, the factors in the test result in a net loss for the system. However, the net loss is 4.8¢/proof gallon aged, compared to $2.10 production costs. Therefore, the increased costs shown in the test, though significant, do not by themselves make the system infeasible.

The more critical problem was the system's demonstrated adverse effect on whiskey quality. In the full scale test, 360 barrels (180 in the second experiment) were filled with a quality approved lot of whiskey and split equally between the experimental warehouse (the warehouse with the CA unit) and a control warehouse (a warehouse operated normally). Whiskey quality tests were run yearly on samples from both sets of barrels; the samples were evaluated by taste test panel in a procedure similar to the method by which the actual product is tested. The results are shown in Table 4-3. The quality was poor into year three of experiment one; subsequent changes in the recovery system corrected this poor quality in year four and five. A second experiment was conducted to verify these results; however, the quality was poor in all years. The acceptable quality of years four and five in experiment one seems to have occurred because the poor quality of the previous years was being "undone." Normally, aging would not start with whiskey which had an inferior quality that needed to be corrected.

Table 4-4. COST CALCULATIONS
FULL SCALE TEST

Design Parameters:	No. of barrels: 100,000 Emission Rate: 5.25 lbs/barrel-yr Ethanol Concentration: 1500 ppm (assumed) Excess loss: .35 percent yr (average of two experiments) or .35/2.9 = .12, fractional increase in emission rate Recovery: 75 percent Steam Rate: 7 lbs steam/lb ethanol recovered	
System Parameters:	Adsorber size calculated: 5290 scfm Adsorber size, 1.5 x calculated: 7930 scfm Ethanol lost: $5.88(10)^5$ lbs/yr Ethanol recovered: $4.41(10)^5$ lbs/yr, $1.33(10)^5$ proof gallons/yr Steam: $3.09(10)^6$ lbs/yr Carbon: 12,720 lbs	
Costs:	Annual Capital Cost	$20,220
	Taxes, Ins., etc.	5,390
	Electricity	2,800
	Steam	5,250
	Maintenance	8,640
	Carbon	1,820
		44,120
	Credit for recovered ethanol, $.21/pg (includes transportation)	-27,930
	Net cost	$16,190/yr $64,760 for 4 years
	Excess Evaporation	.12(100,000)(5.25)4 = 252,000 lbs, 76,130 proof gallons at $2.10/proof gallon $159,980
	Total Cost	$224,720 for four years
Cost per Proof Gallon	55 proof gallons/barrel orignally	
	100,000 barrels	5,500,000 proof gallons
	minus evaporation	- 532,000
	minus soakage	- 250,000
		4,718,000 final proof gallons
Cost/final proof gallon	$\$225(10)^3/4.72(10)^6$ =	4.8¢/proof gallon

It appears that certain changes in the design and operation of the CA system during the test could have eliminated problems encountered. First, the low recovery rate experienced was apparently due to the inadequate size of the adsorber unit. During each cycle, it is hypothesized that the bed became saturated and breakthrough occurred. Alcohol laden air thus passed through the adsorber to the atmosphere with no recovery occurring. The higher recoveries experienced during the first two years were apparently due to the recycling of the adsorber exhaust stream to the warehouse. Thus, when breakthrough occurred, the unrecovered alcohol was recirculated back into the warehouse and no loss to the atmosphere occurred. This unrecovered alcohol was eventually captured because, as it was recirculated back to the warehouse, the ethanol concentration in the warehouse increased. This increased concentration would increase the capacity of the adsorber unit, resulting in the eventual recovery of the alcohol. Confirmation of this hypothesis would require, among other things knowledge, of the adsorber bed capacity at the concentration, temperature and humidity of the warehouse air. This information is not available.

The deterioration of whiskey quality in the test study was apparently caused by three factors: higher humidity, lower ethanol concentrations, and continuous ventilation. The elevated humidity existed in the first three years during the time the adsorber exhaust was recirculated. Since the CA unit did not remove water, the recirculation of the adsorber exhaust resulted in the accumulation in the warehouse of the water evaporating from the barrels. The lower ethanol levels resulted from the continuous removal of organics from the warehouse by the CA unit. Though natural ventilation would also remove ethanol, the CA unit provided continuous air removal. In contrast, natural ventilation would be intermittent, removing ethanol only occasionally. In fact, during nights, weekends and winter, there may be no ventilation in warehouses since during those periods the windows and doors are sometimes

closed. In addition to continuous ventilation lowering the ethanol concentration, continuous ventilation also upset the stagnant air layers that develop around the barrel in natural ventilation. As discussed in Chapter 2.0, the removal of these stagnant layers replaces the stop-start diffusion pattern that normally occurs with natural ventilation.

The manner in which these factors affected quality is not clear. However, the altered concentrations of ethanol and water around the barrel and the continuous ventilation probably altered the concentrations, and cycles in concentrations, of substances in the barrel wood and bulk whiskey. The rates at which the mechanisms responsible for aging - extraction and solubilizing of wood constituents, diffusion of these constituents into the bulk liquid, chemical reactions between the various substances and transport of air into the bulk liquid - occur depend on these concentrations. Thus altering these concentrations alters the rate at which the aging mechanisms proceed, altering whiskey quality.

Various modifications in the test may have alleviated the whiskey quality problems. These modifications would have been to operate the system intermittently and to recirculate the adsorber exhaust part of the time. Intermittent operation could have been accomplished by sequencing the floors that receive ventilation, as described in section 4.3.1. Another option would have been to shut off the CA system during periods when the warehouse windows and doors would have been closed under normal operation. Such a method of operation would have allowed for stagnation periods, permitted the accumulation of ethanol to the proper levels required for aging, and reduced or eliminated excess ethanol evaporation. Partial recirculation could have eliminated the problem of both low and excessive humidity. This could have been accomplished by occassionally routing the adsorber exhaust to the warehouse. The amount of partial recirculation would be determined by the humidity level in the warehouse; the adsorber would be

exhausted outside when the humidity became too high. Another variation of partial recirculation could occur in winter, when high air circulation rates may have been required for forced air heating. During this period, the adsorber could have been partially bypassed, with this by-pass stream being recirculated. This would allow for sufficient air movement for heating, without exhausting ethanol laden air to outside and without upsetting aging by removing the ethanol from the larger air streams required for heating.

4.5 ALTERNATE SYSTEM OF AGING

A novel system of whiskey aging is under development in which maturation takes place not in charred oak barrels but in closed stainless steel vessels lined with straight charred staves.[13] This system is of interest due to its potential for large savings in aging costs and for almost complete elimination of aging losses. Its applicability to whiskey aging and control of warehousing emissions will depend on the system's ability to produce whiskey of acceptable quality.

The central component of the system is a cylindrical stainless steel vessel approximately 5 meters in diameter and 7 meters high, holding approximately 100,000 liters of liquid. Inside the vessel, straight charred oak staves are held in the whiskey by arms extending radially from a shaft at the center of the vessel. The staves are arranged so that air spaces created between them are manifolded together to the central shaft holding the arms, and from there to vacuum, pressure and condensing equipment. The central shaft can be designed to rotate to move the staves through the whiskey. The vacuum equipment pulls vapors through the staves to duplicate aging and the condenser recovers this vapor as liquid and returns it to the vessel. The pressure equipment provides for further controls over the aging process potentially useful in producing whiskey of a desired quality. Finally, internal heating coils provide for temperature control of the aging whiskey.

The large cost savings in the system occur in three areas. First, the labor and wood cost of the barrels is reduced by using straight wood staves and using less wood per volume of whiskey stored. Second, the loss of whiskey through evaporation is eliminated since the system captures the vapors and returns them after condensation. Third, the warehouse area is reduced since the system requires only 1/10th the volume. The cost savings that result can be substantial, up to 50 percent of present aging costs.

The system's most important feature of the system from an emission standpoint is the complete elimination of whiskey loss. Loss during aging is eliminated since ethanol evaporating through the staves is captured in the air spaces manifolded to the condensers, which return the vapor as liquid to the vessel. Soakage losses are reduced since the alcohol remaining in the used staves is partially recovered by continuing to draw a vacuum after the whiskey is emptied. The vacuum evaporates the ethanol in the staves and draws it to the condensers where the ethanol is recovered. Finally, any losses due to spillage and barrel leaks are eliminated since the whiskey is piped into and out of the aging vessels. Thus, the system has the capacity to be almost loss free.

The key factor determining the system's applicability to whiskey aging and emission reduction is the quality of the whiskey produced. Since testing of the system has not been completed, it is not known if the system will properly age whiskey. Testing of the system is scheduled for 1978.

4.6 CONTROL OF BARREL SOAKAGE LOSSES

The major control device discussed to this point, carbon adsorption, is applicable only to the control of evaporation during barrel storage; control of losses due to soakage in the barrel staves would require additional measures. These measures, along with present uncontrolled practices, are described below.

Present practice is to rinse used barrels with one gallon of water before selling or storing the barrels. The amount of whiskey recovered in this manner appears to be low since such a rinse removes only the surface film of whiskey on the barrel staves. One distiller practices a more complete rinse using 3 gallons of water and rolling and shaking the barrel to improve recovery. This practice removes approximately one half gallon from the barrel wood, or about .7 kg ethanol.[14] This is less than 20 percent of the estimated 3.8 kg of ethanol in the barrel wood. Thus, present practices recover only a small percent of the liquid soakage in whiskey barrels. No other systems to further recover barrel soakage are in practice.

Three types of systems have potential applicability: more complete rinsing, vacuum evaporation, and steaming. More complete rinsing could be accomplished using a greater amount of water, greater agitation of the barrel, more than one rinse and heating the water. Vacuum evaporation would involve connecting the used barrel to a vacuum source to draw out the vapors. Vacuum is available at most distillers since vacuum evaporation is used to dry spent grain for animal feed. Steaming would involve passing steam through the barrel, using the heat to evaporate the ethanol in the wood. The steam would then be condensed to recover the ethanol. The dilute whiskey produced in these methods could be used in adjusting the proof of bottled whiskey. Whiskey is typically diluted before bottling, since it is aged at higher proofs than those at which it is marketed.

Two factors appear to limit the effectiveness of all three recovery methods, the inherent slowness of diffusion in wood and the barrel configuration. The physical mechanisms, extraction, heat, and vacuum evaporation, on which the recovery methods are based all attempt to increase the rate of diffusion of ethanol through the wood. However, the small pore structure of the wood and the great width of the stave (2 cm is a considerable distance in terms of molecular diffusion) results in extremely slow diffusion; 3 to 6 months are required to saturate the wood after filling the barrels. Even if a hundred fold increase in the diffusion rate could be achieved, more than a day would be required to recover all ethanol in the barrel staves. In addition, the barrel configuration does not allow optimum contacting in rinsing and steaming. Water touches only a small percentage of the wood at any one time in rinsing, and unless extra holes or special spargers are provided, steam distribution inside a barrel would be uneven and steam contact with the walls poor.

It would appear that other methods of recovery of barrel soakage losses might be necessary. These methods would require methods of operation both unfamiliar to the whiskey industry and complex. They would involve splintering the barrels into small slivers of wood, passing the slivers through water extraction and vacuum filtration and evaporation. The slivers would then be available as fuel. Alternately, the saturated wood slivers or the saturated staves themselves could be fed to a boiler. Adjustments in the boiler operation would be required to assure proper firing with saturated wood as a partial fuel. As noted, these operations would be complex, but could be technically possible and, with credit for the wood fuel and recovered ethanol, financially feasible. However, no analysis of this option was made.

One final method may be feasible, storage of the empty barrels in enclosed warehouses vented to a carbon adsorber. An economic analysis of this option is shown

on Table 4-5. The analysis assumes that nine months of storage would be required to remove 85 percent of the liquid in the barrel wood and that the first 20 percent of the liquid would have been removed by water rinsing. Thus, assuming 3.8 kilograms of ethanol in the wood, the system would recover .65(3.8) or 2.5 kg from each barrel. A warehouse ethanol concentration of 250 ppm was chosen since a low concentration would be required to evaporate the liquid from the wood. Finally the recovery efficiency was set at 95 percent or better since no special features would be required to protect whiskey quality. The final cost of the system is 2.8¢/proof gallon whiskey.

Since many of the design parameters used in the analysis were based only on engineering judgement, the final cost figure for this control system could change significantly in actual practice. The nine month time period, the 85 percent removal and the 250 ppm ethanol level need to be verified before the system can be finally judged. However, the analysis does give a preliminary indication of the system's feasibility and shows that further study is warranted.

Table 4-5

Control System for Barrel Soakage Losses - Warehousing

Assumptions	Storage period:	9 months
	Ethanol level:	250 ppm
	Total Barrel soakage:	3.8 kg ethanol
	Warehouse capacity:	50,000 barrels
Recovery on Adsorber	Removal from barrel	85 percent 20 percent from rinsing 65 percent from storage
		95 percent
Design	Emission rate:	3.3 kg ethanol/yr-barrel slot
	Adsorber size:	21,900 scfm
	Surface Area:	292 ft^2
	Carbon:	35,040 lbs
	Recovery:	104050 pg
	Steam:	1.03 $(10)^6$ lbs/yr
Costs	Annualized Capital Cost:	$46,000
	Taxes, Insurance, etc:	$12,260
	Electricity:	$ 7,730
	Steam:	$ 1,750
	Carbon:	$ 5,000
	Maintenance:	$ 8,640
	Warehouse-Depreciation[15]	$15,000
	Handling (50¢/barrel)[15]	$33,330
		$129,710/yr
	Recovery Credit	$55,150
	Net Cost	$74,560/yr
	Cost/proof gallon	2.8¢

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APPENDIX A. EMISSIONS FROM THE PRODUCTION OF UNAGED WHISKEY

The production of unaged whiskey involves preparation and fermentation of grain and distillation of the resulting liquid to produce unaged whiskey. The three largest sources of volatile organic emissions in this operation are the fermentor vent, the distillation column vents and the drying of the used grain.

The fermentation of grain in whiskey manufacture produces large amounts of carbon dioxide. This carbon dioxide exits from the fermentor by vents on the top and carries with it minor amounts of ethanol. A measured value for this emission is 183 g ethanol/m^3 grain.[1] Using 146 proof gallons whiskey/m^3 grain, and a production of whiskey of 79.2 x 10^6 proof gallons in 1976, the total nationwide emissions from this source are 99 MT/yr. A typical large distillery producing 4 x 10^6 proof gallons whiskey/year would emit 5.0 MT/yr.

In the operation of the various distillation columns in a distillery, ethanol is emitted from the inert vents on the column condensers. However, with the double condenser system commonly used and condenser temperatures of 70 to 90°F, these emissions are low. One emission estimate is 0.0022 kg ethanol/proof gallon-column.[2] Using the whiskey production above, and assuming 1.5 columns/distillery as an average, the total nationwide emissions from this source are 260 MT/yr. A typical large distillery with a 3 distillation column system producing 4 x 10^6 proof gallons/year would emit 26.4 MT/yr.

The grain remaining after fermentation and distillation is typically dried and sold as animal feed. During drying some of the residual ethanol in the grain is evaporated to the air. The ethanol content of the grain slurry remaining after distillation is 0.1 to 0.01 percent by weight;[3] however, a large portion of this ethanol would be mixed with the wastewater removed from grain slurry. Assuming 0.05 percent ethanol in the grain and that 30 percent is evaporated to the air, the nationwide emissions are 206 MT/yr. A large distillery producing 4×10^6 proof gallons/yr would emit 10.1 MT/yr.

The typical large distillery described in this appendix is analagous to the typical distillery in Chapter 3.0. That distillery had emissions of 1460 MT/yr from aging; the total emissions from the emission points described in this appendix is 41.3 MT/yr, less than 3 percent of the aging emissions.

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APPENDIX B.

WHISKEY BY VARIOUS PERIODS OF PRODUCTION REMAINING IN BONDED WAREHOUSES IN KENTUCKY AS OF DECEMBER 31, 1975

Prepared from information obtained at the Office of the Department of Revenue of the Commonwealth of Kentucky

DISTILLERY	REMAINING WHISKEY PRODUCED OR RECEIVED — BOTTLED IN BOND — AGE — CALENDAR YEAR ENDING DECEMBER 31									TOTAL	
	Over 8 Years	1968 No. Barrels	1969 No. Barrels	1970 No. Barrels	1971 No. Barrels	1972 No. Barrels	1973 No. Barrels	1974 No. Barrels	1975 No. Barrels	No. Barrels	Per Cent
Barton Brands, Inc. Bardstown, D.S.P. Ky. 12	25,829	10,596	34,533	53,657	34,464	1,544	64,279	16,831	20,248	261,981	4.26
Jas. B. Beam Distilling Co. Bardstown, Kentucky								41,233	13,320	54,553	799,601
Beam, Ky.	5,698	2,122	303	1,110	17,572	91,239	98,247	64,014	58,948	339,253	13.01
Clermont, Ky.	12,069	25,207	14,981	31,594	24,102	84,464	78,559	74,076	60,743	405,795	
Blair Distilling Co. St. Francis, Ky.			4,523	4,336	328		531			9,718	.16
J.T.S. Brown's Son Co. Lawrenceburg, Ky.	4,450	24,761	28,391	10,582	13,816					82,000	1.33
Brown-Forman Distillers Corp. (3 Units) Louisville, Ky.	858	2,783	4,321	37,320	60,514	63,371	41,840	104,437	97,000	412,444	6.70
Commonwealth Distillers, Inc. (Formerly T.W. Samuels) Deatsville, Ky.	11,299	5,625	7,071	4,266						28,261	.46
Double Springs Distilling Co. Bardstown, Ky.	2,470	8,214	4,538	7,190	6,540	3,928	5,644			38,524	94,833
Frankfort, Ky.	1,399	1,642	5,928		10,753	16,731	15,380	1,800		53,633	1.54
Louisville, Ky.	1,243	1,019	389	25						2,676	
Fleischmann Distilling Corp. Owensboro, Ky.		208	5,412	35,963	30,412	36,411	35,413	38,568	30,901	213,288	3.47
Glenmore Distilleries Co. Owensboro, Ky.	6,621	24,968	8,988	25,111	45,418	40,017	29,884			181,007	2.94
Yellowstone, Inc. Louisville, Ky.		3,311	10,577	23,637	20,891	18,236	13,076	10,816	1,117	101,661	1.65
Heaven Hill Distilleries, Inc. Bardstown, Ky.	13,207	24,058	35,726	49,775	66,816	62,141	64,771	53,868	47,429	417,791	6.80
Hoffman Distilling Co. Lawrenceburg, Ky.	6,768	1,423	869	824	2,099					11,983	.20
Medley Distilling Co. Owensboro, Ky.	844	1,275	6,759	3,137	31,098	28,745	29,721	17,928	9,713	129,220	2.10
Ben F. Medley Distillery Stanley, Ky.	75		35		119					229	.01
National Distillers & Chem. Corp. (3 Units) Louisville, Ky.	1,493	12,258	96,993	133,920	126,436	99,304				470,404	1,031,752
(3 Units) Frankfort, Ky.	1,411	7,740	124,302	152,553	151,814	106,923			66,605	611,348	17.59
Austin Nichols Distilling Lawrenceburg, Ky.	3,413	16,083	23,202	20,050	14,685	22,763	23,552	30,226	17,446	171,420	188,152
Jessamine County, Ky.									16,732	16,732	3.06

WHISKEY BY VARIOUS PERIODS OF PRODUCTION REMAINING IN BONDED WAREHOUSES IN KENTUCKY AS OF DECEMBER 31, 1975

Prepared from information obtained at the Office of the Department of Revenue of the Commonwealth of Kentucky

DISTILLERY	REMAINING WHISKEY PRODUCED OR RECEIVED — BOTTLED IN BOND → AGE — CALENDAR YEAR ENDING DECEMBER 31									TOTAL	
	Over 8 Years	1968 No. Barrels	1969 No. Barrels	1970 No. Barrels	1971 No. Barrels	1972 No. Barrels	1973 No. Barrels	1974 No. Barrels	1975 No. Barrels	No. Barrels	Per Cent
Old Boone Distillery Co. Meadowlawn, Ky.	14,254	4,783	3,726	1,483	269	2,142	9,812	3,314	3,997	43,780	.71
Old Fitzgerald Distillery, Inc. Louisville, Ky.	6,107	36,252	61,382	51,119	50,417	38,420	10,969	9,962	9,287	273,915	4.45
Schenley Industries, Inc. Bernheim Distilling Co. Louisville, Ky.	6,209	27,569	38,212	22,478	21,692	53,988	108,108	44,987	47,436	370,679	1,102,515
Park & Tilford Dist. of Ky. Louisville, Ky.	6,062	2,679	3,922	14,727		5,543	9,767	16,185		58,885	17.93
The Geo. T. Stagg Co. Bardstown, Ky.	32,634	510	9,614	1,284	2,991	10,428	18,222	10,309	19,719	105,711	
Frankfort, Ky.	49,972	23,492	31,842	19,593	43,242	92,417	114,147	58,934	133,601	567,240	
Joseph E. Seagram & Sons, Inc. Louisville, Ky.	12,459	23,900	39,558	16,459	26,330	17,598	5,308	11,089	21,825	174,576	641,003
Cynthiana, Ky.	1,762	3,616	8,351	4,898	2,143	661	1,389			22,820	10.43
Lawrenceburg, Ky.		2,575	1,145	369	75					4,164	
Huntington Creek Corp. Coxs Creek, Ky.	12,733	48,447	139,235	84,539	53,969	40,305	25,791	34,424		439,443	
Star Hill Distilling Co. Loretto, Ky.	462	1,188	2,789	3,648	4,934	6,001	6,491	5,637	4,975	36,125	.59
Willett Distilling Co. Bardstown, Ky.	5,349	1,271	4,210	5,343	4,711	75	2,875	3,942	4,522	37,328	.61
Totals Each Year Dec. 31, 1975	247,150	349,575	761,357	820,990	868,700	943,395	813,766	657,580	685,564		
Totals All Years Dec. 31, 1975										6,148,587	
Totals December 31, 1974	235,498	608,963	995,317	960,854	1,018,144	943,578	846,142	748,722		6,683,654	
Totals December 31, 1973	230,085	886,818	1,159,606	1,100,151	1,014,776	1,024,001	1,004,877			7,285,998	
Totals December 31, 1972	177,515	1,149,734	1,335,124	1,114,402	1,070,059	1,081,542				7,514,642	
Totals December 31, 1971	214,333	1,306,734	1,354,324	1,170,710	1,171,353					7,877,969	
Totals December 31, 1970	331,462	1,428,095	1,462,894	1,381,309						8,491,893	
Totals December 31, 1969	413,702	1,496,524	1,653,901							8,609,815	
Totals December 31,1968	504,299	1,731,446								8,706,688	

Note — Fractional barrels reduced to one full barrel. Storage does not necessarily represent ownership.

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

This document provides cost and engineering information on control of volatile organic emissions from whiskey warehousing. Included are a description of whiskey aging, warehousing, and of volatile organic emissions from warehousing; a development of emission factors and inventories for these emissions; a cost and engineering analysis of available control techniques for these emissions; and a discussion of volatile organic emissions from other whiskey manufacturing operations. The major control technique discussed is carbon adsorption.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Whiskey Warehousing Whiskey Aging Ethanol Carbon Adsorption	Air Pollution Control Stationary Sources Organic Vapors	

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Exhibit 5

Emission Factor Documentation for AP-42
Section 9.12.3

Distilled Spirits

Final Report

For U. S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Factor and Inventory Group

EPA Contract 68-D2-0159
Work Assignment No. 4-04

MRI Project No. 4604-04

March 1997

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Section 9.12.3

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Final Report

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Attn: Mr. Dallas Safriet (MD-14)

EPA Contract 68-D2-0159
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NOTICE

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PREFACE

This report was prepared by Midwest Research Institute (MRI) for the Office of Air Quality Planning and Standards (OAQPS), U. S. Environmental Protection Agency (EPA), under Contract No. 68-D2-0159, Work Assignment Nos. 2-03, 3-01, and 4-04. Mr. Dallas Safriet was the requester of the work.

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March 1997

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1. INTRODUCTION

The document *Compilation of Air Pollutant Emission Factors* (AP-42) has been published by the U. S. Environmental Protection Agency (EPA) since 1972. Supplements to AP-42 have been routinely published to add new emission source categories and to update existing emission factors. AP-42 is routinely updated by EPA to respond to new emission factor needs of EPA, State and local air pollution control programs, and industry.

An emission factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. Emission factors usually are expressed as the weight of pollutant divided by the unit weight, volume, distance, or duration of the activity that emits the pollutant. The emission factors presented in AP-42 may be appropriate to use in a number of situations, such as making source-specific emission estimates for areawide inventories for dispersion modeling, developing control strategies, screening sources for compliance purposes, establishing operating permit fees, and making permit applicability determinations. The purpose of this report is to provide background information from test reports and other information to support revisions to AP-42 Section 9.12.3, Distilled and Blended Liquors (formerly incorporated into Section 6.5, Fermentation).

This background report consists of five sections. Section 1 includes the introduction to the report. Section 2 gives a description of the distilled spirits industry. It includes a characterization of the industry, a description of the different process operations, a characterization of emission sources and pollutants emitted, and a description of the technology used to control emissions resulting from these sources. Section 3 is a review of emission data collection (and emission measurement) procedures. It describes the literature search, the screening of emission data reports, and the quality rating system for both emission data and emission factors. Section 4 details how the revised AP-42 section was developed. It includes the review of specific data sets and a description of how candidate emission factors were developed and a summary of changes to the AP-42 section. Section 5 presents the AP-42 Section 9.12.3, Distilled Spirits. Supporting documentation for the emission factor development is presented in the Appendices.

2. INDUSTRY DESCRIPTION

The section gives a brief review of trends in the distilled spirits industry and describes the process of whisky production. Emission information is only available for fermentation and aging. Sources of volatile organic compounds (VOC), principally ethanol, are discussed, and a brief description of emission control technology is given.

2.1 INDUSTRY CHARACTERIZATION[1-4]

The fermentation industry includes the production of malt beverages (beer); wines; brandy and brandy spirits; distilled spirits; and the secondary products of all of these industries. The most commonly produced distilled spirits for beverage purposes include whiskies, gins, vodkas, rums, and brandies.[a] Whiskies are produced from fermented grain mashes and aged. Vodkas are produced from fermented grain mashes, but are not aged. Gins generally are produced from the fermented product, grain neutral spirits (GNS), to which either botanical extracts and/or flavors are added to the GNS and bottled, or dried botanicals (e.g., juniper berries) are added to the GNS to extract their oils and then distilled. Rums are made from fermented sugar cane products, such as molasses. Gins and rums may be aged in barrels. Brandies are distilled from wine or other fermented fruit juices, and are generally aged in barrels. Distilled spirits production (e.g., whisky, vodka, or gin) may produce secondary products, such as distillers dried grains used as livestock feed.

Distilled spirits are produced throughout the United States (see Table 2-1). The data presented in Table 2-1 represent production of distilled spirits as reported to the Bureau of Alcohol, Tobacco, and Firearms (BATF), U. S. Department of the Treasury. The classification of distilled spirits (SIC 2085) includes the production of distilled spirits for both beverage purposes and medicinal purposes; quantities for both of these purposes are included in the "alcohol and spirits" column of Table 2-1. Establishments engaged in manufacturing alcohol for industrial purposes are classified under SIC 2869; quantities of ethanol produced from grain for industrial purposes may also be included in Table 2-1. In Table 2-1, the production quantities for vodka are no longer reported separately by the BATF but are included in the larger category of "alcohol and spirits."

The remainder of this document is concerned primarily with the emissions resulting from the production of distilled spirits for beverage purposes. Over the last several years, the distilled spirits industry has experienced large decreases in sales. United States distilled spirits sales peaked in 1981 at approximately 189 million 9-liter cases and decreased to approximately 137 million 9-liter cases in 1994, a decline of almost 28 percent.

2.2 PROCESS DESCRIPTION[4-5]

Distilled spirits can be produced by a variety of processes. Typically, whisky production utilizes malted grains which are mashed and fermented to produce an alcohol/water solution that is distilled to concentrate the alcohol. This is not necessarily true for production of other distilled spirits, such as vodka, rum and brandy. The concentrated alcohol is usually aged in wooden barrels to provide natural color and impart flavor and aroma. Recognizing that not all distillers employ identical techniques and materials, this

[a]Brandies are discussed in AP-42, Section 9.12.2, Wines and Brandy.

TABLE 2-1. PRODUCTION OF DISTILLED SPIRITS--1995[a,b]

State	Whisky[c]		Brandy	Rum	Gin	Alcohol & spirits	
	160° and under	Over 160°				190° and above	Under 190°
CA	789	0	9,089,118	0	0	15,682,949	785,878
FL	0	0	1,860,633	918,372	0	4,366,642	(88,444)
IL	0	0	0	0	2,399,822	817,619,465	3,928,243
IN	833,937	3,496,625	0	0	8,237,141	10,007,598	774,646
IA	0	0	0	0	1,341,305	429,460,453	4,336,322
KY	45,755,633	396,505	0	0	0	10,367	293,990
MI	0	0	0	0	0	0	470,141
MN	0	0	0	0	0	2,945,614	0
OH	0	0	0	0	0	866,647	0
TN	16,894,626	0	0	0	0	77,943,406	0
TX	0	0	0	0	0	36,069,118	139,225
VA	78,593	0	0	0	0	935,098	0
Other[d]	39,780	0	6,061	0	1,786,200	78,398,481	1,486,938
TOTAL	63,603,358	3,893,130	10,955,812	918,372	13,764,468	1,474,305,838	12,126,939

Source: Reference 3.

[a] Represents gross production (original plus redistillation) minus the products used in redistillation. Vodka production quantities are no longer reported separately; they are incorporated into a larger category of "alcohol and spirits."

[b] All quantities in proof gallons. Proof gallon is a U.S. gallon of proof spirits or the alcoholic equivalent thereof, i.e., a U.S. gallon containing 50 percent of ethyl alcohol (ethanol) by volume (Reference 4).

[c] Gross production of whisky includes bourbon, light, corn, and other whisky in new barrels.

[d] Includes Connecticut, Georgia, Kansas, Maryland, Massachusetts, Missouri, New Hampshire, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Puerto Rico, Washington, and Wisconsin.

section attempts to provide a generic description of distilled spirits (distillery) operations. The focus of this discussion will be on Bourbon whisky production. Processes for other distilled spirits will differ from Bourbon whisky production.

Under the standards of identity set forth by the BATF, whisky refers to an alcoholic distillate from a fermented mash of grain produced at less than 190° proof ethanol (95 percent by volume) in such a manner that the distillate possesses the taste, aroma, and characteristics generally attributed to whisky, stored in oak containers (except that corn whisky need not be so stored), and bottled at no less than 80° proof, and also includes mixtures of such distillates for which no specific standards of identity are prescribed.[b] (See Reference 6). Types of whisky and classes and types of other distilled spirits also are defined in BATF standards of identity.[6] Figure 2-1 provides a simple diagram of a typical whisky production process.

In the distilled spirits industry, there are two terms commonly used to describe the volume of the spirits: "proof gallons" and "wine gallons." The term "proof gallon" refers to a U. S. gallon of proof spirits, or the alcoholic equivalent thereof, containing 50 percent of ethyl alcohol by volume. Since excise taxes are paid on the basis of proof gallons, this term is synonymous with tax gallons. The term "wine gallon" refers to a measure of the actual volume regardless of the proof of the spirits.[4]

2.2.1 Grain Handling and Preparation (Milling)

Distilleries utilize premium cereal grains, such as hybrid corn, rye, malted barley, and wheat, to produce the various types of whisky and other distilled spirits. United States distilleries purchase malted grain instead of performing the malting process onsite. The grains have particular specifications, especially with regard to the elimination of grain with objectionable odors which may have developed in the field or during storage, handling, or drying at the elevators.

Grain receiving, handling, and cleaning are potential sources of particulate matter (PM) emissions. Grain is generally received in either hopper railcars or trucks. Grain handling is the transfer from the unloading pit by pneumatic conveyor system, auger system, and bucket elevators to and from the grain storage silos. Although it usually has been subjected to a cleaning process at the elevator, the grain may be subjected to additional cleaning, which may include a series of vibrating screens that sift out foreign materials and magnetic separators used to remove any ferromagnetic items. Dust collectors and air jets may be used to remove light materials and aid in the control of PM emissions.

Milling, which breaks the outer cellulose protective wall around the kernel and exposes the starch to the cooking and conversion process, can be accomplished by several milling methods. For example, hammer mills use a series of hammers rotating at 1,800 to 3,600 rpm within a close-fitting casing. These hammers shear the grain to a meal that is removed through a screen with different mesh sizes for various types of grain. Cage mills use a series of counter rotating bars at high speed to grind the grain by impact. Roller mills use a series of close tolerance serrated rollers to crush the grain. Distillers require an even grind, generally with a particle size as small as can be physically handled by the facility.

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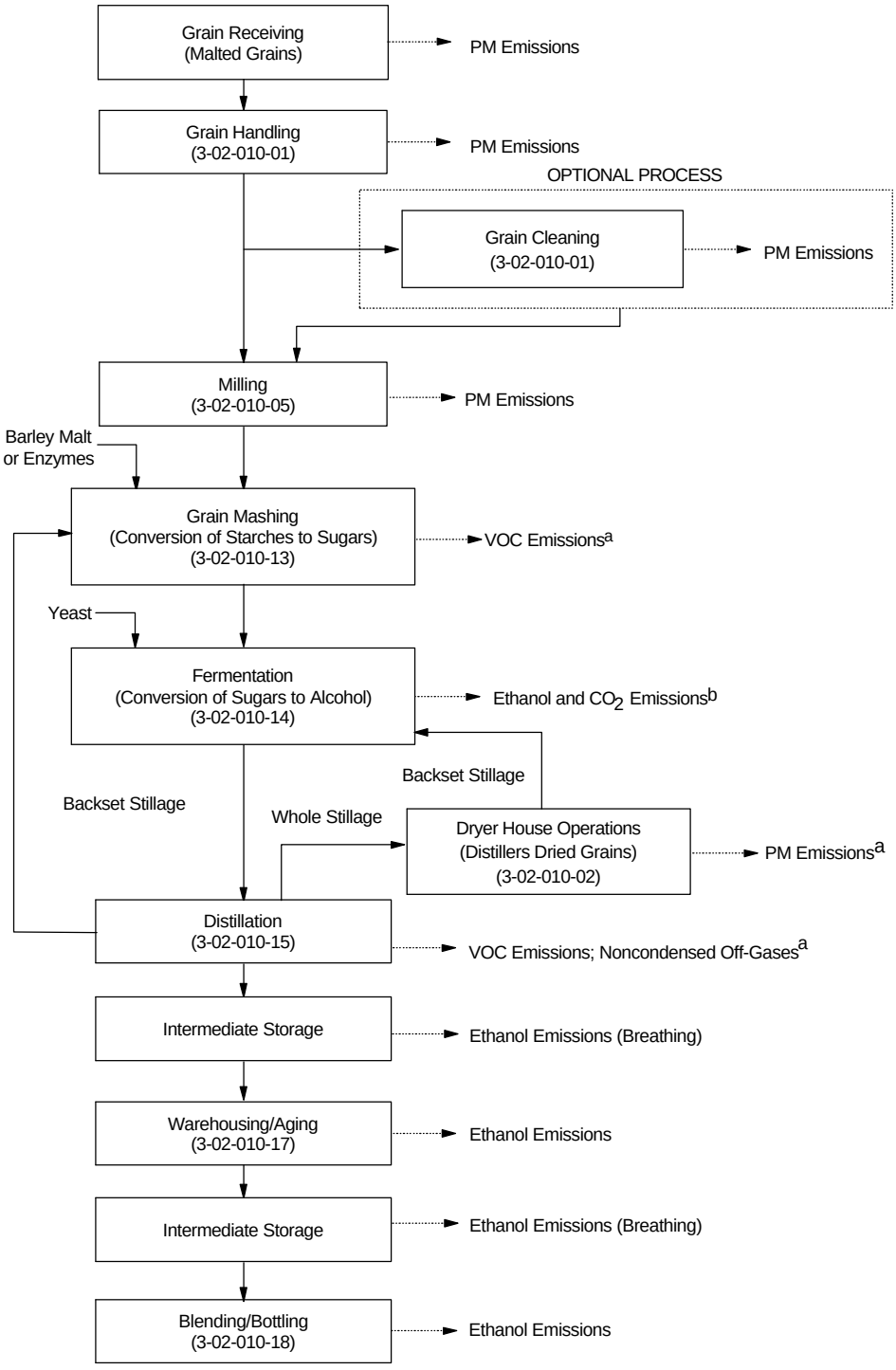
[b]In the United States, 100° proof equals 50% ethanol content by volume at 15.6°C (60°F). In Canada and the United Kingdom, 87.7° proof equals 50% ethanol by volume at 10.6°C (51°F).



[a] Processes require heat. Emissions generated (e.g., CO, CO_2, NO_x, SO_2, PM, and VOCs) will depend on the source of fuel.
[b] Other compounds can be generated in trace quantities during fermentation including ethyl acetate, fusel oil, furfural, acetaldehyde, sulfur dioxide, and hydrogen sulfide. Acetaldehyde is a hazardous air pollutant (HAP).

Figure 2-1. Whisky production process.

2.2.2 Mashing

The mashing process consists of cooking (gelatinization) of the grain in water to solubilize the starches from the kernels and converting (saccharification) of the starch to "grain sugar" (primarily glucose and maltose). In general, cooking can be carried out at or above atmospheric pressure in either a batch or continuous process. During mashing, trace VOC emissions may result from constituents in the grain. Small quantities of malted barley are sometimes added prior to grain cooking. After partial cooling, conversion of the starch to sugar is accomplished by adding barley malt and/or enzymes (from other sources) to the cooked grain at approximately 63°C (145°F). The mash then passes through a noncontact cooler to a fermenter. Between the mashing and fermentation, the process generally is closed during cooling, with no emissions. Distillers may vary mashing procedures, but generally conform to basic principles, especially in the maintenance of sanitary conditions.

2.2.3 Fermentation

Fermentation, which usually lasts 3 to 5 days for whisky, involves the use of a yeast to convert the grain sugars into ethanol and carbon dioxide (CO_2). The converted grain mash is cooled prior to entering the fermenter or tank and inoculated with yeast. It is common practice to dilute the hot grain mash to its final solids concentration by adding backset stillage and/or water. Backset is liquid stillage which is screened or centrifuged from the distillation "beer still bottoms." The use of backset provides water conservation, nutrient supplements, pH adjustment of the fermentation, and some flavor components (e.g., sour mash).

The fermentation process varies slightly for the production of other distilled spirits. For instance, rum fermentations takes 1 to 2 days. In rum production, black strap molasses is the source of fermentable sugars and is stored in tanks prior to fermentation. The black strap molasses also is not "mashed" (i.e., cooked) prior to being diluted with water to obtain the proper concentration of fermentable sugars.

Congeners are flavor compounds which are produced during fermentation, as well as during the aging process. These congeners include trace aldehydes, esters, and higher alcohols (i.e., fusel oils). Lactic acid bacteria (*lactobacillus*) may simultaneously ferment within the mash and contribute to the overall whisky flavor profile. On rare occasions *lactobacillus* may provide some pH control. On other occasions, the addition of sulfuric acid, though rarely used, may result in trace hydrogen sulfide emissions from the fermentation tank.

In whisky production, significant increases in the amount of yeast consumed occur during the first 30 hours of fermentation, when over 75 percent of the carbohydrate (sugar) is converted to ethanol and carbon dioxide. Many fermentation vessels are equipped with agitation and/or cooling means that facilitate temperature control. Fermentation vessels may be constructed of wood or metal and may be open or closed top.

The final fermented grain alcohol mixture, called "beer," is agitated to resuspend its solids and may be transferred to the "beer well" storage vessel for holding until it is pumped to the "beer still." Distillers use mechanical or air agitation during transfer and storage to prevent settling of solids. In the instance of air agitation, trace amounts of aldehydes may be produced. The beer passes from the beer well through a preheater where it is warmed by the alcohol vapors leaving the still and then enters the still for distillation. The beer still vapors condensed in the preheater generally are returned to the beer still as reflux.

2.2.4 Distillation

The distillation process separates and concentrates the alcohol products from the fermented grain mash. In addition to the alcohol and congeners, the fermented mash contains solid grain particles, yeast cells, water-soluble proteins, mineral salts, lactic acid, fatty acids, and traces of glycerol and other trace congeners. Although many distillation processes exist, the most common systems used in the United States are the continuous beer still, with or without a doubler unit. Other distillation processes include the continuous multicolumn extractive and rectifying systems, and the batch rectifying pot still and condensing unit. Whisky stills are usually made of copper, especially in the rectifying section, although stainless steel may be used in some stills.

In a general whisky distillation process using a beer still, the whisky separating column consists of a cylindrical shell having three sections: stripping, entrainment removal, and rectifying. The stripping section contains approximately 14 to 21 perforated plates, spaced 56 to 61 cm (22 to 24 inches) apart. The fermented mash is introduced at the top of the stripping section and descends from plate to plate until it reaches the base where the stillage is discharged. Steam is introduced at the base of the column, and the vapors from the bottom of the still pass up through the perforations in the plates. Whisky stills are usually fitted with entrainment removal sections that consist of a plate above the stripping plate to remove fermented grain particles entrained in the vapor. Distillation columns operate under reflux (sealed) conditions and most vapors are condensed and collected, although small amounts of noncondensable gases will be emitted to the atmosphere. The rectifying section contains several bubble cap or valve rectifying plates in the top section of the still that produce distillates (ethanol) up to 190° proof.

The diameter of the still, the number of stripping and rectifying plates, capacity of any doubler, and proof of distillation are factors that can contribute characteristics to a particular whisky. The doubler is a type of pot still that is used to redistill the distillate from the beer still to enhance and refine the flavors desired in a specific whisky. Following distillation, the whisky, at high proof, is pumped to stainless steel tanks and diluted with demineralized water to the desired alcohol concentration prior to filling into oak barrels.

The distillation of other spirits, such as rum, is similar. Tennessee Whisky utilizes a different process than Bourbon, in that the distillate is passed through sugar maple charcoal in mellowing vats prior to dilution with demineralized water.

2.2.5 Grain and Liquid Stillage ("Dryer House Operations")

At most distilleries, after the removal of alcohol, still bottoms (known as whole stillage) are pumped from the distillation column to a dryer house. Whole stillage may be sold, land applied (with appropriate permitting), sold as liquid feed, or processed and dried to produce distillers dried grains (DDG). The DDG consists of proteins, fats, minerals, vitamins, and fibers which are concentrated three-fold by the removal of the grain starch in the mashing and fermentation process. Distillers' secondary products are divided into four groups: DDG, distillers dried solubles (DDS), DDG with solubles (DDG/S), and condensed distillers solubles (CDS).

Solids in the whole stillage are separated using centrifuges or screens. The liquid portion “thin stillage” may be used as a backset or may be concentrated by vacuum evaporation. The resultant syrup may be recombined with the solid portion or dried separately. This remaining mixture is then dried using one of a variety of types of dryers (usually steam-heated or flash dryers). The majority of DDG are used in

animal feed, although increasing quantities are being sold as food ingredients for human consumption due to its nutrient and fiber content.

2.2.6 Warehousing/Aging

In the aging process, both the charred oak barrel in which beverage alcohol is stored and the barrel environment are key to producing distilled spirits of desired quality and uniqueness. The aging process gives whisky its characteristic color and distinctive flavor and aroma. Variations in the aging process are integral to producing the characteristic taste of a particular brand of distilled spirits. Aging practices may differ from distillate to distiller, and even for different products of the same distiller.

Ambient atmospheric conditions, such as temperature and humidity, as well as seasonal variation, are important factors in the aging process. Aging practices vary considerably--some distillers, for example, keep their warehouse windows open during certain months to promote interaction of the aging whisky with outdoor atmospheric conditions. An EPA report observed that the aging process, in particular, depends upon the interaction of whisky in oak barrels with ambient air and particularly the temperature, humidity, and ventilation promoted by the different types of warehouse construction utilized in the industry.[5] While each distiller alters the barrel environment to produce a product with the distinctive characteristics of its brand, the fundamentals of the natural aging process are inviolate. The various distillers control the barrel environment differently by operating their warehouses in different manners; all of these variations illustrate the number of differing aging philosophies and traditions.[5]

Ethanol emissions are a natural and integral consequence of creating the distinctive qualities of various whisky production and aging embodied in the federal law. In producing Bourbon whisky, for example, ethanol from the raw beverage alcohol is unavoidably released because the wooden barrels, in which it is aged, are porous to ethanol vapors. Bourbon is typically aged for 4 years. (Not all distilled spirits are aged the same; for example, rum may be aged from 3 months to more than 1 year.)

In keeping with federal regulations and because of constituents of the barrel imparted to Bourbon in the aging process, only new charred oak barrels can be used in Bourbon production. Charred white oak barrels encourage reactions within the whisky and between the whisky and the wood to produce the desired whisky flavor. White oak is used because it is one of the few woods that holds liquids while allowing breathing (gas exchange) through the wood. These barrels used to age Bourbon are typically reused for aging other whiskies and other distilled spirits products, such as cognac, Scotch whiskey, and brandies. Most whisky barrels are reused for approximately 20 to 30 years for aging other whiskies and distilled spirits that utilize barrel aging.

When whisky ages, the alcohol extracts and reacts with constituents in the barrel wood, producing its distinctive color, taste and aroma. Constituents in the wood are transferred to the bulk liquid in the barrel by simple diffusion, by convection currents in the bulk liquid, and by temperature cycling. As the barrel heats up, the gas above the liquid increases in pressure and forces liquid into the barrel wood. When the barrel cools and the gas pressure drops, the liquid flows out of the wood into the bulk liquid, carrying wood constituents with it. The distinctive qualities of whisky are added during aging as trace substances called congeners which occur through (1) extraction of organic substances from the wood and their transfer to the whisky, (2) oxidation of the original substances and of the extracted wood material, and (3) reaction between various organic substances present in the liquid to form new products. The amber color develops and the taste of the whisky mellows during aging as the concentration of congeners increases. Similar

reactions between the barrel liquid and barrel constituents characterize aging of other distilled spirits, such as brandy and rum.

In aging or maturation, the rate of extraction of wood constituents, transfer, and reaction depend on both ambient conditions such as temperature and humidity and the concentrations of various whisky constituents. For instance, higher temperatures increase the rate of extraction, transfer by diffusion, and reaction. Diurnal and seasonal temperature changes also cause convection currents in the liquid and pressure changes in the gas affecting transfer. The rate of diffusion will depend upon the difference in concentrations of constituents in the wood, liquid, and air blanketing the barrel. The rates of reaction will increase or decrease with the concentration of constituents. Thus, changes in the airflow around the barrel would change the alcohol concentration around the barrel and impact the diffusion rate. All of these variables are integral to a particular product brand which will have its own unique taste, color, and aroma. According to the 1978 EPA report, when ventilation was artificially increased, the quality of the product was greatly impaired.

In the aging process, both the oak barrel in which the beverage is stored and the barrel environment are key to producing distilled spirits of desired quality and uniqueness. The oak barrels used for aging distilled spirits play a significant role in determining the final flavor and aroma of the beverage. Newly distilled whisky is colorless with a strong, harsh and unpalatable odor. The new whisky distillate undergoes many types of physical and chemical changes in the aging process that impart the distinctive color, taste and aroma of the whisky and gives it character. These changes include extraction of the wood compounds, decomposition and diffusion of the wood macromolecules into the alcohol, reactions of the wood and distillate compounds with each other, and oxidation produced by diffusion to ambient atmosphere. As whisky ages, the alcohol grain distillate (containing grain flavors) extracts wood flavors and color from the barrel. These congeners (oxidation products) are produced by chemical reaction induced by simple diffusion, by convection currents in the bulk liquid, and by diurnal and seasonal temperature cycling. As the barrel heats up, the gas in the headspace above the liquid increases in pressure and forces the liquid into the wood. When the barrel cools and the gas pressure drops, the liquid flows out of the wood into the bulk liquid, carrying wood constituents with it. These constituents give whisky its distinctive color, taste, and aroma. The amber color develops and the taste of the whisky mellows as it undergoes the aging cycle. Ethanol and water vapor result from the breathing phenomenon of the white oak barrels and are emitted during the aging process. As the staves become saturated with whisky, ethanol is emitted to the atmosphere as an ethanol/water vapor mixture. This phenomenon of the wood acting as a semipermeable membrane is complex and not well understood. Figure 2-2 shows a simplified illustration of the mechanisms of the whisky aging process.

The barrel environment is extremely critical in whisky aging and varies considerably by distillery and warehouse and even by location of the barrel within a warehouse. Ambient atmospheric conditions, such as seasonal variation in temperature and humidity, have a great effect on the aging process. For instance, higher temperatures in the aging warehouse increase the equilibrium rate of extraction, rate of transfer by diffusion, and rate of reaction. Furthermore, diurnal and seasonal temperature changes affect transfer rates by creating convection currents in the liquid and pressure changes in the gas. For these reasons, distillers may selectively open warehouse windows during certain months to promote interaction of the barrels with outdoor atmospheric conditions. Furthermore, the equilibrium concentrations of the various whisky components depend heavily on the air flow around the barrel. All of these variables are utilized by each distiller to produce its distinctive brand with its own unique taste, color, and aroma.

Distillers utilize various warehouse designs, which include single- or multistory buildings constructed of metal, wood, brick, or masonry. Most warehouses have no climate control systems and rely on natural ambient temperature and humidity changes to drive the aging process; in a few warehouses, temperature is adjusted in the wintertime. However, no whisky warehouses have the capability of controlling humidity, which varies with natural climatic conditions.

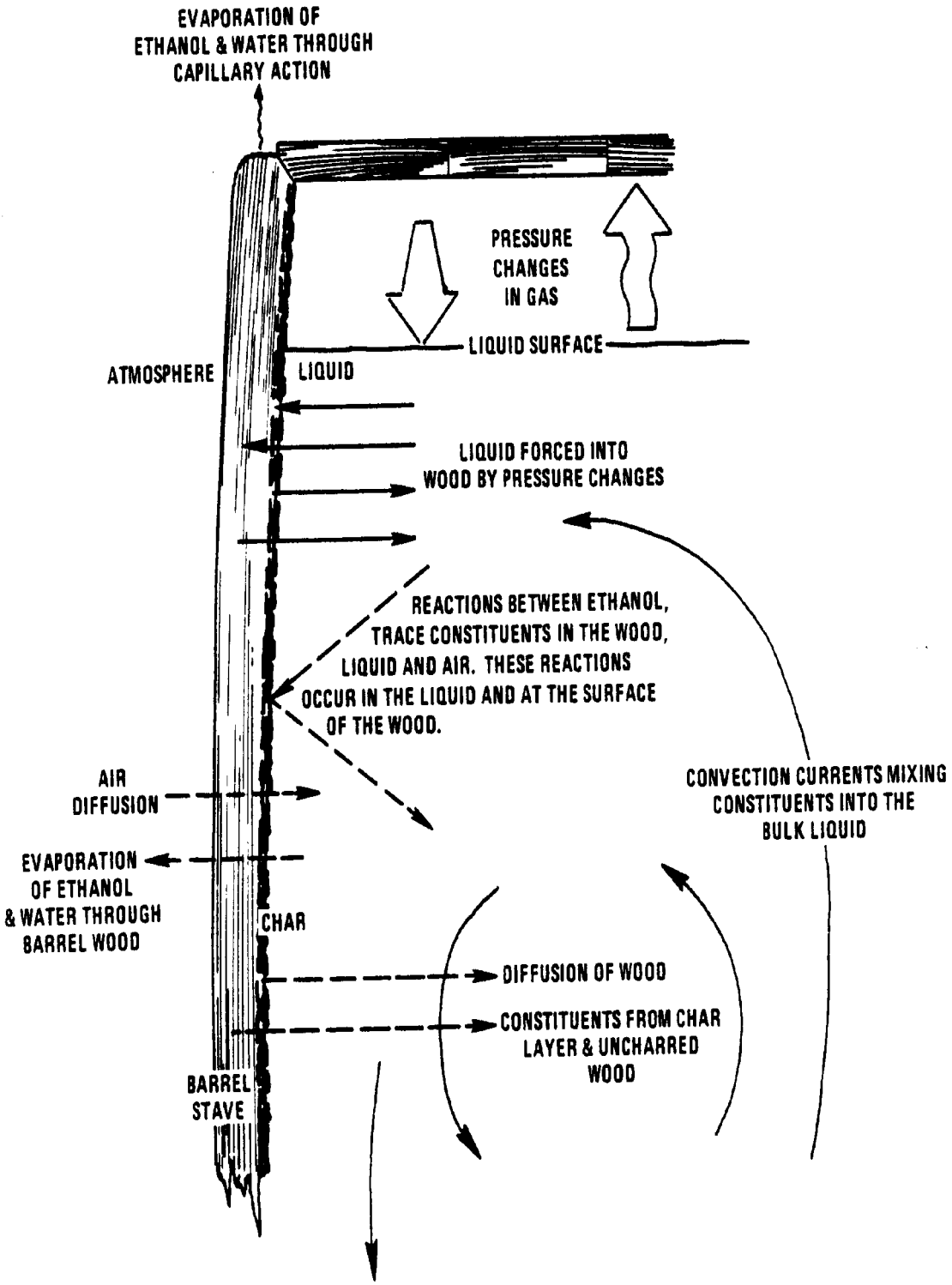


Figure 2-2. Mechanisms of whisky aging.[5]

2.2.7 Blending/Bottling

After the whisky has completed its desired aging period, it is dumped or pumped from barrels into stainless steel tanks and reduced in proof to the desired alcohol concentration by adding demineralized water. The diluted whisky is processed and filtered. Following a filtration process the whisky is pumped to a tank, proof adjusted, and bottled.

Due to their value and salability, used barrels are not generally stored but either refilled with other whiskies or bung sealed and sold to manufacturers of Scotch Whiskey, Canadian Whiskey, rum, brandy, Tequila, or wines.

New bottles are unloaded from cases and put on a conveyor belt, where they are air cleaned, filled, capped, and labeled. At the end of the conveyor belt, the final product is put into cases, which are sealed, labeled, and shipped to distributors.

2.3 EMISSIONS[4-5]

The principal emission from the production of distilled spirits is ethanol, and occurs primarily during aging/warehousing. In addition to ethanol, other volatile compounds produced in trace quantities during aging may include acetaldehyde (a HAP), ethyl acetate, glycerol, fusel oil, and furfural. A comparatively small source of ethanol emissions also results from fermentation. Carbon dioxide is also produced during fermentation; in addition, trace quantities of ethyl acetate, isobutyl alcohol, and isoamyl alcohol are also produced. Particulate matter emissions may result from the grain receiving, grain handling, grain cleaning, milling and grain drying processes; data for those emissions are contained in Section 9.9.1, Grain Elevators and Processes. Whisky production emissions are indicated by process in Figure 2-1. Other emissions, including SO_2, CO_2, CO, NO_x, VOC, and PM, may be generated by fuel combustion from power production in a typical distilled spirits plant.

The emissions from evaporation from the barrel during aging are not constant. During the first 6 to 18 months, the evaporation rate from a new barrel is low because the dry wood must become saturated (known as "soakage") before evaporation from the barrel begins. After saturation, the evaporation rate is greater, but then decreases as evaporation lowers the liquid level in the barrel. The lower liquid level decreases the surface area of the liquid in contact with the wood and thus reduces the surface area subject to evaporation. Loss rates are also affected by temperature and relative humidity. Higher temperatures expand whisky volume, force more whisky into the wood, and increase emission rates. Higher relative humidity reduces water vaporization from the barrel, reducing the emission rate. In addition, humidity affects the barrels themselves; barrels with an initial high wood moisture content shrink as relative humidity decreases, causing increased vaporization from the barrel. This shrinkage also can result in leaks, which are another potential source of emissions.

Minor VOC emissions may be generated when the whisky is drained or pumped from the barrels for blending and bottling, but no emission data are available. In addition, some residual whisky remains in used barrels as both a surface film ("heel") and within the wood ("soakage"). Much of the alcohol in this residue would eventually evaporate if the barrel is left exposed to the atmosphere for a sufficient time. For economic reasons, many distillers collect as much residual whisky as possible by using various processes, such as rinsing with water and vacuum methods.

2.4 EMISSION CONTROL TECHNOLOGY[5]

With the exception of devices for controlling PM emissions, there are few emission controls at distilleries. Grain handling and processing emissions are controlled through the use of cyclones, baghouses, and other PM controls (see AP-42 Section 9.9.1). There are no control technologies for VOC emissions from fermenters because the significant amount of grain solids that would be carried out of the fermenters by vapor entrainment could render systems, such as carbon adsorption, inoperable. Add-on air pollution control devices for whisky aging warehouses are not used because of the anticipated adverse impact that such systems would have on product quality. For economic reasons, distillers ensure that barrel construction is of high quality to minimize leakage, and processes are operated to give the highest finished product alcohol yield. If feasible without impairment of product quality, ethanol recovery would require the use of a collection system to capture gaseous emissions in the warehouse and to process the gases through a recovery system prior to venting them to the atmosphere or recirculating them through the warehouse.

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4. Bujake, J. E., "Beverage Spirits, Distilled," *Kirk-Othmer Encyclopedia of Chemical Technology*, 4th. Ed., Volume No. 4, John Wiley & Sons, Inc., 1992.

5. *Cost and Engineering Study Control of Volatile Organic Emissions from Whiskey Warehousing*, EPA-450/2-78-013, Emissions Standards Division, Chemical and Petroleum Branch, Office of Air Quality Planning and Standards, U. S. Environmental Protection Agency, Research Triangle Park, NC, April 1978.

6. "Standards of Identity for Distilled Spirits", 27 CFR Part 1, Subpart C, Office of the Federal Register, National Archives and Records Administration, Washington, D.C., April 1, 1996.

3. GENERAL DATA REVIEW AND ANALYSIS PROCEDURES

3.1 LITERATURE SEARCH AND SCREENING

Data for this investigation were obtained from a number of sources within the Office of Air Quality Planning and Standards (OAQPS) and from outside organizations. The AP-42 background files located in the Emission Factor and Inventory Group (EFIG) were reviewed for information on the industry, processes, and emissions. The Factor Information and Retrieval (FIRE), Crosswalk/Air Toxic Emission Factor Data Base Management System (XATEF), and VOC/PM Speciation Data Base Management System (SPECIATE) data bases were searched by SCC code for identification of the potential pollutants emitted and emission factors for those pollutants. A general search of the Air CHIEF CD-ROM also was conducted to supplement the information from these data bases.

Information on the industry, including number of plants, plant location, and annual production capacities, was obtained from the *Census of Manufactures* and other sources. A search of the Test Method Storage and Retrieval (TSAR) data base was conducted to identify test reports for sources within the distilled spirits industry. The EPA library was searched for additional test reports. Publications lists from the Office of Research and Development (ORD) and Control Technology Center (CTC) were also searched for reports on emissions from the distilled spirits industry. In addition, the distilled spirits trade association, Distilled Spirits Council of the United States (DISCUS), was contacted for assistance in obtaining information about the industry and emissions.

To screen out unusable test reports, documents, and information from which emission factors could not be developed, the following general criteria were used:

1. Emission data must be from a primary reference:

a. Source testing must be from a referenced study that does not reiterate information from previous studies.

b. The document must constitute the original source of test data. For example, a technical paper was not included if the original study was contained in the previous document. If the exact source of the data could not be determined, the document was eliminated.

2. The referenced study should contain test results based on more than one test run. If results from only one run are presented, the emission factors must be down rated.

3. The report must contain sufficient data to evaluate the testing procedures and source operating conditions (e.g., one-page reports were generally rejected).

A final set of reference materials was compiled after a thorough review of the pertinent reports, documents, and information according to these criteria.

3.2 DATA QUALITY RATING SYSTEM[1]

As part of the analysis of the emission data, the quantity and quality of the information contained in the final set of reference documents were evaluated. The following data were excluded from consideration:

1. Test series averages reported in units that cannot be converted to the selected reporting units;

2. Test series representing incompatible test methods (i.e., comparison of EPA Method 5 front half with EPA Method 5 front and back half);

3. Test series of controlled emissions for which the control device is not specified;

4. Test series in which the source process is not clearly identified and described; and

5. Test series in which it is not clear whether the emissions were measured before or after the control device.

Test data sets that were not excluded were assigned a quality rating. The rating system used was that specified by EFIG for preparing AP-42 sections. The data were rated as follows:

A—Multiple test runs that were performed using sound methodology and reported in enough detail for adequate validation. These tests do not necessarily conform to the methodology specified in EPA reference test methods, although these methods were used as a guide for the methodology actually used.

B—Tests that were performed by a generally sound methodology but lack enough detail for adequate validation.

C—Tests that were based on an unproven or new methodology or that lacked a significant amount of background information.

D—Tests that were based on a generally unacceptable method but may provide an order-of-magnitude value for the source.

The following criteria were used to evaluate source test reports for sound methodology and adequate detail:

1. Source operation. The manner in which the source was operated is well documented in the report. The source was operating within typical parameters during the test.

2. Sampling procedures. The sampling procedures conformed to a generally acceptable methodology. If actual procedures deviated from accepted methods, the deviations are well documented. When this occurred, an evaluation was made of the extent to which such alternative procedures could influence the test results.

3. Sampling and process data. Adequate sampling and process data are documented in the report, and any variations in the sampling and process operation are noted. If a large spread between test results cannot be explained by information contained in the test report, the data are suspect and are given a lower rating.

4. Analysis and calculations. The test reports contain original raw data sheets. The nomenclature and equations used were compared to those (if any) specified by EPA to establish equivalency. The depth of review of the calculations was dictated by the reviewer's confidence in the ability and conscientiousness of the tester, which in turn was based on factors such as consistency of results and completeness of other areas of the test report.

3.3 EMISSION FACTOR QUALITY RATING SYSTEM[1]

The quality of the emission factors developed from analysis of the test data was rated using the following general criteria:

A—Excellent: Developed from A- and B-rated source test data taken from many randomly chosen facilities in the industry population. The source category is specific enough so that variability within the source category population may be minimized.

B—Above average: Developed only from A- or B-rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industries. The source category is specific enough so that variability within the source category population may be minimized.

C—Average: Developed only from A-, B- and/or C-rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. In addition, the source category is specific enough so that variability within the source category population may be minimized.

D—Below average: The emission factor was developed only from A-, B-, and/or C-rated test data from a small number of facilities, and there is reason to suspect that these facilities do not represent a random sample of the industry. There also may be evidence of variability within the source category population. Limitations on the use of the emission factor are noted in the emission factor table.

E—Poor: The emission factor was developed from C- and D-rated test data, and there is reason to suspect that the facilities tested do not represent a random sample of the industry. There also may be evidence of variability within the source category population. Limitations on the use of these factors are footnoted.

The use of these criteria is somewhat subjective and depends to an extent upon the individual reviewer. Details of the rating of each candidate emission factor are provided in Section 4.

REFERENCE FOR SECTION 3

1. *Procedures for Preparing Emission Factor Documents*, Second Revised Draft Version, EPA-454/R-95-___, Office of Air Quality Planning and Standards, U. S. Environmental Protection Agency, Research Triangle Park, NC, September 1995.

4. REVIEW OF SPECIFIC DATA SETS

4.1 INTRODUCTION

This section describes the data evaluated and methodology used to develop pollutant emission factors for the manufacture of distilled spirits. In general, the information presented in Section 9.12.3, Distilled Spirits, is new to Chapter 9 of AP-42. The section narrative presented in the current AP-42, Section 6.5 (Fourth Edition), only briefly discusses distilled spirits processes. In this new section, the distilled spirits production process is discussed with emphasis on the whisky-aging process and associated emissions.

4.2 REVIEW OF SPECIFIC DATA SETS

The literature search yielded two documents (References 1 and 2) from which emission factors could be developed. A review of these two documents is given below; full citations for these references are given at the end of this section. Pertinent excerpts from these references are provided in the Appendices. In addition, other references were identified in the literature search or by the industry.

4.2.1 Reference 1

This reference is a 1974 study of emissions from grain fermentation units at a U.S. whisky distillery. It consists of two parts: a 1974 journal article titled "Gaseous Emissions from Whisky Fermentation Units" and an undated preliminary paper with the same title and authors reporting the same data. The results provide the basis for a VOC emission factor from whisky fermentation tanks. Appendix A provides a copy of both references.

Emission source tests were conducted on four closed, steel fermentation vats at an unnamed integrated whisky distillery. Each vat held approximately 121,000 L (32,000 gal) of grain slurry, which yielded 5.14 proof gallons per bushel of grain. Chemical analysis indicated that fermentable sugars in the grain slurry were converted to CO_2, ethyl alcohol, and other VOCs; CO_2 and ethyl alcohol were produced in equivalent molecular quantities. Although carbon dioxide was the bulk constituent of the gas stream, ethyl alcohol and other VOCs also were emitted in the gas stream.

The tests were conducted by sealing off all effluent vents except for the emergency vent. Concurrent velocity and temperature measurements were taken at the emergency vent while sampling. Samples were collected by drawing headspace vapor through charcoal-filled glass tubes at 10-hour intervals. The charcoal sections were analyzed individually by extraction with carbon disulfide and injection into a gas chromatograph equipped with hydrogen flame ionization detectors. The chromatographic results detected six VOCs in the vat emissions; ethyl alcohol represented 99.6 percent of the total VOCs detected. The remaining compounds were: ethyl acetate, *n*-propyl alcohol, isobutyl alcohol, isoamyl acetate, and isoamyl alcohol. Isoamyl acetate and *n*-propyl alcohol were present in trace quantities and could not be quantified.

An emission factor based on quantity of emissions/quantity of grain fermented was developed. The authors' calculations were not given and, therefore, cannot be verified. The test was based on a new methodology conducted at one distillery and lacks sufficient data for confirmation of emission factors. This reference was given a rating of D.

4.2.2 Reference 2

Reference 2 is a 1978 EPA document which discusses the process by which alcohol is emitted from whisky barrels during aging and gives a detailed description of whisky warehouses and operations. Control technologies also are discussed, including ethanol capture and potential reuse, but it is recognized that the utilization of any control technology in a whisky aging warehouse potentially would have an adverse impact on product quality.

Four sets of data were used to estimate emission factors. The first set was U.S. Internal Revenue Service data;[c] distilleries report stocks, withdrawals, and losses to the BATF, which uses the data for taxation purposes. The data used were for the years 1974, 1975, and 1976. The emission factor derived from this data set includes both evaporation and soakage losses because the alcohol loss calculation is based on initial whisky stocks less withdrawals. The estimated emission factors range from 2.99 kg/bbl/yr (6.6 lb/bbl/yr) to 3.27 kg/bbl/yr (7.2 lb/bbl/yr) with an average of 3.15 kg/bbl/yr (6.9 lb/bbl/yr). This emission factor was calculated by subtracting the amount of distilled spirits taken from storage for consumption from the original amount of distilled spirits stored. The other three data sets were from individual distillers, emissions from whisky in bonded warehouses, and losses based on age distribution of bonded whisky in Kentucky in 1975. The emission factor developed from the individual distillers data set was 3.65 kg/bbl/yr (8.0 lb/bbl/yr). For emissions from whisky in bonded warehouses, the emission factor was 3.02 kg/bbl/yr (6.6 lb/bbl/yr). The emission factor developed based on the age distribution data was 3.46 kg/bbl/yr (7.6 lb/bbl/yr). The average emission factor based the three data sets was 3.38 kg/bbl/yr (7.4 lb/bbl/yr). This emission factor includes both evaporative losses and losses due to soakage.

The original calculations for this reference were not available to review. The data were rated D. Pertinent excerpts from the reference are presented in Appendix B.

4.2.3 Reference 3

Reference 3 is a 1992 letter from the Commonwealth of Kentucky adopting an ethanol evaporative emission factor of 7.6 lb/bbl/yr for the aging process. This value was based upon information received from EPA based on Reference 2. Because the emission factor was based on the same data presented in Reference 2, this reference was not used in Section 4.3.2. Reference 3 does not contain actual emission measurements for the industry and is graded D. Appendix C contains a copy of Reference 3.

4.2.4 Reference 4

This report discusses a waste minimization assessment for an unidentified Bourbon distillery that annually produces approximately 5 million gallons of Bourbon and 16,000 tons of distillers dried grains. Annual ethanol emissions (lb/yr) were estimated for five different emission sources but no information was presented for the method used to estimate these emission levels. No descriptions of the production process or any details of the emissions were provided because of facility confidentiality issues.

The data quality are rated D. No data from this reference were used to develop emission factors. An EPA research brief and report cover page are provided in Appendix D.

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[c]The reference refers to these as IRS data, although the publication cited was the Bureau of Alcohol, Tobacco, and Firearms (BATF), U.S. Treasury Department.

4.2.5 Reference 5

Reference 5 is a compilation of regauged tax gallon (RTG) data over a series of aging periods for Bourbon, corn whisky, and light whisky developed by Seagram Americas. The data represent measured whisky volumes (in proof gallons) from barrels after varying stages of the aging process. Based on these data, average total ethanol losses were calculated over an aging time between 4 and 10.5 years for each of the three types of whisky. The average total ethanol losses include both evaporation losses and soakage losses. Calculated total ethanol losses were 3.3 kg/bbl/yr (7.3 lb/bbl/yr) for Bourbon, 3.1 kg/bbl/yr (6.8 lb/bbl/yr) for corn, and 3.9 kg/bbl/yr (8.5 lb/bbl/yr) for light whisky; the average total ethanol loss for the three types is 3.4 kg/bbl/yr (7.5 lb/bbl/yr).

Soakage losses were calculated for each of the three types based on the reported data; the soakage value for Bourbon was confirmed by Seagrams based on actual weight measurements. The average total proof gallon loss, excluding soakage, should be an estimate of losses due to evaporation. The average total ethanol losses due to evaporation were 2.7 kg/bbl/yr (6.0 lb/bbl/yr) for Bourbon, 3.0 kg/bbl/yr (6.5 lb/bbl/yr) for corn, and 3.7 kg/bbl/yr (8.2 lb/bbl/yr) for light whisky; for the three types, the average total ethanol loss due to evaporation is 3.1 kg/bbl/yr (6.9 lb/bbl/yr).

The original data and calculations for this reference were not available to review. The data were rated D. Appendix E contains the data submitted by Seagram Americas and the pertinent calculations for this reference.

4.2.6 Reference 6

Reference 6 is a compilation of whisky loss data over a series of aging periods for Bourbon and corn whisky developed by Jim Beam Brands. The data represent measured whisky losses determined as the difference between proof gallons (PG) entered minus the proof gallons regauged for tax purposes when emptied. Based on these data, average total ethanol losses were calculated over an aging time between 4.7 and 10.5 years for Bourbon whisky and 3.9 and 8.4 years for corn whisky. The average total ethanol losses include both evaporation losses and soakage losses. Calculated total ethanol losses were 4.2 kg/bbl-yr (9.3 lb/bbl/yr) for Bourbon and 3.4 kg/bbl/yr (7.5 lb/bbl/yr) for corn whisky; the average total ethanol loss for the two types is 3.8 kg/bbl/yr (8.4 lb/bbl/yr).

Soakage loss for Bourbon was calculated based on the reported data. The average total PG loss, excluding soakage, should be an estimate of losses due to evaporation. For Bourbon whisky, the total ethanol loss due to evaporation was 3.1 kg/bbl/yr (6.8 lb/bbl/yr).

The original data and calculations for this reference were not available to review. The data were rated D. Appendix F contains the data submitted by Jim Beam Brands and the pertinent calculations for this reference.

4.3 DEVELOPMENT OF CANDIDATE EMISSION FACTORS

Candidate emission factors for the fermentation and for aging are developed below. An alternative estimation method for losses during aging is also presented. No data were available for ethanol or VOC emissions from any source other than fermentation and aging. No data were available for particulate (PM) emissions from grain receiving, handling, cleaning, and milling, and dryer house operations. Emission

factors for grain receiving, handling, and cleaning may be found in AP-42 Section 9.9.1, Grain Elevators and Processes.

4.3.1 Whisky Fermentation

The candidate emission factors for four VOCs in whisky fermentation vats (Table 4-1) were taken directly from Reference 1. Distillers report that bushel weights may vary between distilled spirits operations therefore introducing a potential source of error in the application of the emission factor. Because the emission factor was based upon D-rated test data, the emission factor is rated E.

TABLE 4-1. EMISSION FACTORS FOR WHISKY FERMENTATION VATS

EMISSION FACTOR RATING: E

VOC	Emission factor	
	g/m^3 (ppm)	lb/1,000 bu grain input
Ethyl acetate	0.59	0.046
Ethyl alcohol	182.2	14.15
Isobutyl alcohol	0.051	0.004
Isoamyl alcohol	0.17	0.013
Total VOCs	183	14.21

Source: Reference 1 (see Appendix A).

4.3.2 Whisky Aging

A summary of references 2, 5, and 6 for ethanol emissions during the whisky aging process is shown in Table 4-2. Full citations for these references are given at the end of this section. Pertinent excerpts from these references are provided in the Appendices B, E, and F. References 3 and 4 did not contain appropriate emissions data and were not used for emission factor development.

An average ethanol emission factor for total losses during whisky aging was calculated based on the four data sources cited in Table 4-2. The candidate emission factor for total ethanol loss during whisky aging is 3.45 kg/bbl/yr (7.6 lb/bbl/yr). Because the emission factor was based upon D-rated test data, the emission factor is rated E.

An average ethanol emission factor for evaporation losses (total losses minus soakage) during whisky aging was calculated based on the two data sources cited in Table 4-2. The candidate emission factor for ethanol evaporation loss during whisky aging is 3.1 kg/bbl/yr (6.9 lb/bbl/yr). Because the emission factor was based upon D-rated test data, the emission factor is rated E.

TABLE 4-2. SUMMARY OF ETHANOL EMISSION DATA FOR WHISKY AGING

Source	Type of loss	No. of data sets	Data rating	Emission factor range, kg/bbl/yr (lb/bbl/yr)	Average emission factor, kg/bbl/yr (lb/bbl/yr)	Ref. No.
BATF reports	Total[a]	3	D	3.0-3.3 (6.6-7.2)	3.2 (6.9)	2
Distillery data	Total	3	D	3.0-3.7-(6.6-8.0)	3.4 (7.4)	2
Seagrams America	Total Evaporation[b]	3 3	D D	3.1-3.9 (6.8-8.5) 2.7-3.7 (6.0-8.2)	3.4 (7.5) 3.1 (6.9)	5 5
Jim Beam Brands	Total Evaporation	2 1	D D	3.4-4.2 (7.5-9.3) NA	3.8 (8.4) 3.1 (6.8)	6 6

[a]Total loss incorporates all losses including soakage.
[b]Evaporation loss is defined as total loss minus soakage loss.

Alternatively an ethanol emission factor for total losses during aging and for evaporative losses can be calculated based on annual emissions per barrel in proof gallons (PG). This calculation method is derived from the gauging of product that a distiller is required to perform by the federal government for federal revenue protection purposes. This method measures the difference in the amount of product when the barrel was filled and when the barrel was emptied. Fugitive evaporative emissions, however, are not the sole difference between these two amounts. During the aging period, product soaks into the barrel, test samples are drawn, and other losses (e.g., spillage, leakage) may occur. Soakage only applies to new barrels. Soakage and other losses not volatilized are not evaporative emissions, and thus are subtracted from total product losses. Average annual ethanol emissions per barrel per year is obtained as follows:

1. Divide the total annual proof gallons (PG) sent to aging by the number of barrels filled to obtain the original PG per barrel;

2. Divide the total annual PG emptied by the number of barrels emptied to give regauged PG, which is the amount of ethanol recovered after the entire aging process;

3. Subtract the regauged PG from the original PG to give the total quantity of ethanol per barrel lost (TQL) during the aging process;

4. Total ethanol evaporative emissions, in PG, are obtained by adjusting the TQL for non-volatilized losses such as soakage and samples withdrawn for quality control; and

5. Total evaporative emissions are divided by the number of years of aging to obtain the average annual evaporative emissions, in PG, per barrel.

The annual emissions in proof gallons are then converted to pounds of ethanol per barrel per aging year by dividing by two (2) and multiplying by 6.6097 lb per gallon for 100 percent ethanol at 15.6°C (60°F).

There are a number of methods to calculate barrel soakage. Soakage is the ethanol that soaks into and saturates the new barrel wood during the aging process. This ethanol is retained in the barrel wood when the product is emptied from the barrel and will only be released to the atmosphere at a source if the

barrel is not reused within a reasonable period of time. Since barrels generally are put back into service immediately for aging various other products, the differences in losses between new Bourbon barrels and reused barrels can closely approximate the amount of soakage that occurs during the life of a barrel. One estimation method involves determining total ethanol losses per barrel, based on steps 1 through 5 above, for new and reused barrels. For new barrels, total ethanol losses include soakage losses but not for reused barrels. The difference between total ethanol losses for new barrels and for reused barrels can be used as an estimate of soakage losses. With this method, it is important that entry proofs of both new and used barrels be close to the same strength and that the barrels are stored under similar warehouse conditions. There is no exclusive method to calculate soakage and factors such as entry proof, individual barrel characteristics, differences in the water content of the wood, and differences in aging practices, can impact the amount of soakage. In addition, the method for estimating soakage may differ between distillers.

4.4 SUMMARY OF CHANGES TO AP-42 SECTION

4.4.1 Section Narrative

The previous AP-42 section incorporated distilled spirits production into an overall section entitled "Fermentation" but no process description or process flow diagram was provided. This new section provides a description of the current production practices and a process flow diagram for a typical whisky production facility.

4.4.2 Emission Factors

The previous AP-42 section presented emission factors based on outdated production processes. This new section replaces the existing emission factors with data consistent with current practices in the distilled spirits industry.

REFERENCES FOR SECTION 4

1. Carter, R. V., and B. Linsky, "Gaseous Emissions from Whiskey Fermentation Units," *Atmospheric Environment*, 8:57-62, January 1974; also a preliminary paper of the same title by these authors (undated).

2. *Cost and Engineering Study-Control of Volatile Organic Emissions from Whiskey Warehousing*, EPA-450/2-78-013, Emissions Standards Division, Chemical and Petroleum Branch, Office of Air Quality Planning and Standards, U. S. EPA, Research Triangle Park, NC, April 1978.

3. Written communication from J. E. Hornback, Department For Environmental Protection, Commonwealth of Kentucky, Frankfort, KY, to H. E. O'Daniel, Jr., Kentucky Distillers Association, Springfield, KY, September 18, 1992.

4. Fleischman, M., et al., "Waste Minimization Assessment to a Bourbon Distillery", EPA/600/5-95/002, Risk Reduction Engineering Laboratory, U. S. Environmental Protection Agency, Cincinnati, OH, April 1995.

5. Written communication from R. J. Garcia, Seagrams Americas, Louisville, KY, to T. Lapp, Midwest Research Institute, Cary, NC, March 3, 1997. RTG's versus age for 1993 standards.

6. Written communication from L. J. Omlie, Distilled Spirits Council of the United States, Washington, DC, to T. Lapp, Midwest Research Institute, Cary, NC, February 6, 1997. Ethanol emissions data from Jim Beam Brands Company.

Exhibit 6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OCT 23 2000

OFFICE OF
AIR AND RADIATION

The Honorable Robert C. Smith
Chairman, Committee on Environment
& Public Works
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

This letter is in response to your question as to whether the Environmental Protection Agency (EPA) has identified reasonably available control technology (RACT) for ethanol emissions from alcohol beverage aging warehouses. One control technology which has been suggested in this regard is carbon adsorption which conceivably could be applied to the warehouse ventilation exhaust to capture ethanol fumes. However, in order to capture the warehouse fumes it may be necessary to modify the air flowing through the warehouse which could affect temperature, humidity and ventilation in the warehouse. The industry has raised questions about whether these changes would adversely affect the product quality.

Due to this unresolved issue, EPA has not, at this time, declared that such add-on control devices are RACT for alcohol beverage aging warehouses. Nor has EPA currently identified any other available technology which it considers to be RACT for alcohol beverage aging warehouses. Therefore, EPA is not requiring states to control these sources in order to meet ozone control state implementation plan requirements.

I appreciate this opportunity to be of service and trust that this information will be helpful to you.

Sincerely,

John C. Beale
Deputy Assistant Administrator
for Air and Radiation

cc: The Honorable Max Baucus

EXHIBIT
tabbies 6

Exhibit 7

GOVERNMENT OF THE VIRGIN ISLANDS OF THE UNITED STATES

DEPARTMENT OF PLANNING AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
45 MARS HILL
FREDERIKSTED. ST. CROIX. VI 00840
PHONE: (340) 773-1082. FAX: (340) 773-9310

MINOR SOURCE PERMIT

AUTHORITY TO CONSTRUCT

Mr. Gabriel Bisio, Company Secretary
Diageo USVI
901 W 143rd St.
Plainfield, IL 60544-8555

REF: Rum Storage Warehouse facility (A/C)

Dear Mr. Bisio:

Enclosed you will find Authority to Construct Permit Number **STX-792-A-B-09** for the construction of one (1) **350 kW Detroit diesel generator, model # 350-XC6DT3 and two ethanol storage containment areas and all appurtenances.**

This equipment is located at **Parcel #25, #1 Estate Diamond, Frederiksted, St. Croix U.S.V.I.** This Authority to Construct is valid for a period of one (1) year.

Be advised that, in accordance with the Virgin Islands Air Pollution Control Act Rules and Regulations, the Commissioner may modify, suspend or revoke an authority to construct or permit to operate on any of the following grounds:

(1) Materially false or inaccurate statements in the application or supporting papers;
(2) Failure by the permittee to comply with any terms and conditions of the permit;
(3) Exceeding the scope of the project as described in the application;
(4) Newly discovered information or significant physical changes since the permit was issued; and

(5) Non-compliance with any provisions of the Virgin Islands Code and Rules and Regulations directly related to the permitted activity.

This Authority to Construct is issued subject to the following binding conditions:

I. OPERATING REQUIREMENTS

A. **Diageo USVI** emergency (stand-by) generator is subject to New Source Performance Standards (NSPS), 40 CFR Part 60, Subpart IIII, Compression Ignition Internal Combustion Engine (CIICE).

B. **Diageo USVI** must install and configure this unit in accordance with the manufacturer's specifications. [40CFR60.4211(c)]

C. **Diageo USVI** shall limit the use of this generator for standby use only. The use of the generator for prime power is prohibited.

D. **Diageo USVI** emergency generator shall be limited to burning fuel oil with a sulfur content not to exceed 0.3% by weight.

E. **Diageo USVI** shall install a non-resettable hour meter prior to startup of the engine. [40CFR60.4209(a)]

F. **Diageo USVI** shall equip the unit with an operable fuel flow meter prior to startup of the engine.

G. **Diageo USVI** shall calibrate and continuously maintain the fuel flow meter in good working condition and shall comply with 40 CFR 60.4211.

H. **Diageo USVI** shall limit the use of this standby generator to no more than five hundred (500) hours of operation on a 365-day rolling average.

I. In the event of natural disaster or unforeseen circumstances, **Diageo USVI** shall submit a written notification requesting the additional hours beyond the set forth in above-stated condition I-(H).

J. Except during startup, **Diageo USVI** shall not operate, or cause to be operated in any new facility within the Virgin Islands, any internal combustion engines which emit from any source of emission

whatsoever any air contaminant that causes an opacity of more than twenty percent (20%).

K. **Diageo USVI** shall **not** operate or cause to be operated during startup in any new facility within the Virgin Islands, any internal combustion engines which emit from any source of emission whatsoever, any air contaminant that causes an opacity of more than forty percent (40%) for three (3) minutes.

L. Mobile Sources. **Diageo USVI** shall **not** operate or cause to be operated, upon any street, highway, public place or private premises within the Virgin Islands, any internal combustion engines, while idling or moving, which emit from any source whatsoever any air contaminants that causes an opacity of twenty (20%) or more measured for a period of time equal to one minute.

M. **Diageo USVI** shall not cause or permit any materials to be handled, transported, or stored in a building, its appurtenances, or cause a road to be used, constructed, altered, repaired, or demolished without taking the necessary precautions specified in Virgin Islands Rules and Regulations, Section 206-25(a)(1) through (9) to prevent particulate matter from becoming airborne.

N. The Commissioner may require other reasonable measures as may be necessary to prevent particulate matter from becoming airborne.

O. **Diageo USVI** shall not cause or permit the discharge of visible emissions of fugitive dust beyond the boundary line of the property on which the emissions originate.

P. When air pollutants escape from a building or equipment and cause a nuisance or violate any regulations, the Commissioner may order that the building or equipment in which processing, handling, and storage are done, be tightly closed and/or ventilated so that all emissions from the building or equipment are controlled to remove or destroy such air pollutants before being discharge to the open air. The implementation of this measure shall not create occupational health hazards.

Q. Every area, lot, or part of a piece of land intended for parking with a capacity for accommodating more than forty (40) vehicles at the same time must be paved with concrete, asphalt, or equivalent hard surface on all its roads and parking areas.

R. **Diageo USVI** shall not cause or permit the discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, annoyance to persons or to the public or which endanger the comfort, repose, health, or safety of any such persons or the public or which cause or have tendency to cause injury or damage to business or property. [VIRR 204-27(a)]

S. Nothing in any other regulation concerning emission of air contaminants or any other regulations relating to air pollution shall in any manner be construed as authorizing or legalizing the creation or maintenance of a nuisance as described in the above-mentioned Condition I. R. [VIRR 204-27(b)]

T. **Diageo USVI** shall not build, erect, install or use any article, machine, equipment or other contrivance, the sole purpose of which is to dilute or conceal an emission without resulting in a reduction in the total release of air contaminants to the atmosphere.

U. At all times, including periods of startup, shutdown, and malfunction, **Diageo USVI** shall maintain and operate the facility in a manner consistent with good air pollution practices for minimizing emissions.

V. It shall be the duty of **Diageo USVI** to report any discontinued or dismantled fuel burning, combustion or process equipment or device coming under the jurisdiction of the permit.

II. MONITORING AND RECORDKEEPING REQUIREMENTS

A. **Diageo USVI** shall record and maintain the number of hours of operation and the quantity of fuel consumed (used) by the emergency generator unit. These hours of operation shall be recorded on a 365-day rolling basis.

B. **Diageo USVI** shall monitor and maintain records of the sulfur content of the fuel oil received through the Supplier's Invoice with the attached Certificate of Analysis performed or through independent fuel analysis performed by your facility on each delivery.

C. **Diageo USVI** shall notify EPA in writing of any laboratory results that indicate a sulfur content greater than 0.3% by weight within five (5) working days from the date of Diageo's receipt of the results.

D. **Diageo USVI** shall keep a daily operation log for tracking hours and fuel consumption for the generating unit. This log is required to be maintained in a permanent form suitable for inspection and submission to the Department and to the EPA.

E. **Diageo USVI** shall retain all records on site for a period of no less than five (5) years following the date of entry and shall be made available for review upon request.

III. REPORTING REQUIREMENTS

A. **Diageo USVI** shall submit a written notification of the date of commencement of construction (installation). This notification shall be postmarked no later than thirty (30) days after such date.

B. **Diageo USVI** shall submit a written notification of the actual date of the initial startup of the facility. This notification shall be postmarked within fifteen (15) days after such date.

C. **Diageo USVI** shall submit a copy of the Certificate of Conformity for the EPA Certified Engine, once purchase, to the Department..

D. In the event that any source or related equipment breaks down, malfunctions, ruptures, leaks or is rendered partially or totally inoperative such that releases of an air contaminant are in excess of allowable emission limit, **Diageo USVI** of such equipment shall, within four (4) hours, report to the Commissioner such failure or incident and provide all pertinent available facts, including the estimated duration of the incident.

E. **Diageo USVI** shall submit a written notification to the Commissioner no later than one (1) week after the incident. This report shall include specific data concerning the affected source and other related equipment, date, hour and the duration of the incident, and corrective measures taken or to be taken.

IV. OTHER PROVISIONS

A. This Authority to Construct Permit is not a Permit to Operate. This is a permit to construct only.

B. Authority to construct this source does not relieve **Diageo USVI – Rum Storage Warehouse Facility** (the Permittee) of the responsibility of compliance with the provisions of any federal or territorial laws, rules, or regulations.

C. Each Authority to Construct shall automatically become invalid one (1) year after the date of its issuance, unless the construction or modification has commenced or application for extension, in the form of a letter to the Commissioner is made thirty (30) days prior to the expiration date of the permit. The permit may only be extended for one (1) additional year.

D. The source shall be constructed or modified only in accordance with the conditions set forth in this permit, as well as those described in the application and supporting documents submitted by the **Diageo USVI** to Virgin Islands Department of Planning and Natural Resources (VIDPNR-DEP).

E. **Diageo USVI** must report to VIDPNR-DEP any physical change or changes in construction which increase the amount of air pollutants or process production.

F. Construction of the source must not result in the contravention of any federal or territorial ambient air quality standards.

G. During construction, any source responsible for contravening ambient air quality standards will be required to be modified to bring operation into compliance.

H. **Diageo USVI** shall meet all other applicable federal (including but not limited to the NSPS), state and local requirements.

I. VIDPNR-DEP reserves the right to inspect **Diageo USVI's** facilities. **Diageo USVI, Inc.** shall give VIDPNR-DEP whatever aid is necessary to perform said inspections in a safe and timely manner.

J. **Diageo USVI, Inc.** who has been granted a permit under the provisions of 12 V.I.R. & Regs. 206-20(a), shall firmly affix such Authority to Construct Permit, an approved facsimile, or other approved identification bearing the permit number upon the article, machine, equipment, or other contrivance in such a manner as to be clearly visible and accessible. In the event that the article, machine, equipment, or other contrivance is constructed or operated in such a manner that the Authority to Construct Permit cannot be so placed, the permit should be maintained so as to be readily available at all times on the premises.

K. The Permittee is required to be in compliance with 12 V.I.R. & Regs. § 206-26.

Each authority to construct shall automatically become invalid one (1) year after the date of its issuance, unless the construction or modification has commenced or application for extension, in the form of a letter to the Commissioner, is made thirty (30) days prior to the expiration date of the permit. The permit may only be extended for one (1) additional year.

Your cooperation in complying with these regulations will be most appreciated.

Sincerely,

Nadine Noorhasan, Ph.D
Director

Enclosure: Two (2) Certificates

Government Of
The Virgin Islands of the United States

DEPARTMENT OF PLANNING & NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
Charlotte Amalie, St. Thomas, Virgin Islands

AIR POLLUTION CONTROL

■ AUTHORITY TO CONSTRUCT ☐ PERMIT TO OPERATE

a. ☐ Permit Renewal
b. ■ New Permit

For: **Diageo USVI**
901 W 143rd St.
Plainfield, IL 60544-8555

Permit No.: STX-792-B-09
Phone: (815) 436-2050
Pursuant to the provisions of Title 12, Chapter 9, Section 206, Sub-Section 20 of the Virgin Islands Air Pollution Control Act Rules and Regulations. This Permit is issued to:

Diageo USVI – Rum Storage Warehouse Facility

For the operation of the following: Two (2) ethanol storage containment warehouses with a capacity of 180,000 barrels of rum produced.

Located at: Parcel #25, #1 Estate Diamond, Frederiksted, St. Croix, U.S.V.I. 00840

In accordance with the application dated May 15, 2009 and in conformity with the statements and supporting data entered therein, all of which are filed with the Department and are considered a part of this Permit.

This Permit shall be effective from the date of: August 31, 2009 for a one (1) year period ending on: August 31, 2010.

Nadine N. Noorhasan, Ph.D
Director

Government Of
The Virgin Islands of the United States

DEPARTMENT OF PLANNING & NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
Charlotte Amalie, St. Thomas, Virgin Islands

AIR POLLUTION CONTROL

■ AUTHORITY TO CONSTRUCT ☐ PERMIT TO OPERATE

a. ☐ Permit Renewal
b. ■ New Permit

For: **Diageo USVI**
901 W 143rd St.
Plainfield, IL 60544-8555

Permit No.: **STX-792-A-09**
Phone: **(815) 436-2050**
Pursuant to the provisions of Title 12, Chapter 9, Section 206, Sub-Section 20 of the Virgin Islands Air Pollution Control Act Rules and Regulations. This Permit is issued to:

Diageo USVI – Rum Storage Warehouse Facility

For the operation of the following: **One (1) 350 kW Detroit diesel generator, Model #350-XC6DT3**

Located at: **Parcel #25, #1 Estate Diamond, Frederiksted, St. Croix, U.S.V.I. 00840**

In accordance with the application dated **May 15, 2009** and in conformity with the statements and supporting data entered therein, all of which are filed with the Department and are considered a part of this Permit.

This Permit shall be effective from the date of: **August 31, 2009** for a one (1) year period ending on: **August 31, 2010.**

/s/ Nadine N. Noorhasan, Ph.D
Director

Exhibit 8

GOVERNMENT OF THE VIRGIN ISLANDS OF THE UNITED STATES

DEPARTMENT OF PLANNING AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
45 MARS HILL
FREDERIKSTED, ST. CROIX, VI 00840
PHONE: (340) 773-1082, FAX: (340) 773-9310

MINOR SOURCE

PERMIT TO OPERATE

April 13, 2011

Mr. Dan Kirby, Vice President
Diageo USVI
RR1 Box 9400
Kiingshill, VI 00850

REF: Rum Storage Warehouse facility (P/O)

Dear Mr. Kirby:

Enclosed you will find Permit to Operate Number **STX-792-A-B-11** for the operation of **one (1) 350 kW Cummins diesel generator, Model # 350-QSX15-G9, Serial #79420819 and two ethanol storage containment areas and all appurtenances.**

This equipment is located at **Parcel #25, #1 Estate Diamond, Frederiksted, St. Croix U.S.V.I.** This Permit to Operate is valid for a period of three (3) years.

Be advised that, in accordance with the Virgin Islands Air Pollution Control Act Rules and Regulations, the Commissioner may modify, suspend or revoke an authority to construct or permit to operate on any of the following grounds:

(1) Materially false or inaccurate statements in the application or supporting papers;
(2) Failure by the permittee to comply with any terms and conditions of the permit;
(3) Exceeding the scope of the project as described in the application;
(4) Newly discovered information or significant physical changes since the permit was issued; and
(5) Non-compliance with any provisions of the Virgin Islands Code and Rules and Regulations directly related to the permitted activity.

This Permit to Operate is issued subject to the following binding conditions:

I. OPERATING REQUIREMENTS

A. **Diageo USVI** emergency stand-by generator is subject to New Source Performance Standards (NSPS), 40 CFR Part 60, Subpart IIII, Compression Ignition Internal Combustion Engine (CIICE).

B. **Diageo USVI** must operate this unit in accordance with the manufacturer's specifications. [40CFR60.4211(c)]

C. **Diageo USVI** shall limit the use of this generator for standby use only. The use of the generator for prime power is prohibited.

D. **Diageo USVI** shall continuously maintain the non-resettable hour meter in good working condition for the duration of the engine. [40CFR60.4209(a)]

E. **Diageo USVI** shall continuously maintained the fuel meter in good working condition and shall comply with 40 CFR 60.4211

F. **Diageo USVI** shall be limited to 100 hours per year for maintenance checks and readiness testing. There is no limit on the use of emergency generators in emergency situations. [40CFR60.4211(e)]

G. **Diageo USVI** may petition the Administrator and Commissioner for approval for additional hours to be used for maintenance checks and readiness testing beyond the 100 hours per year. [40CFR60.4211(e)]

H. Except during startup, **Diageo USVI** shall operate, or cause to be operated in any new facility within the Virgin Islands, any internal combustion engines which emit from any source of emission whatsoever any air contaminant that causes a opacity of more than twenty percent (20%). [VIRR 204-28(b)(i)]

I. **Diageo USVI** shall operate or cause to be operated during startup in any new facility within the Virgin Islands, any internal combustion engines which emit from any source of emission whatsoever, any air contaminant that causes an opacity of more than forty percent (40%) for three (3) minutes. [VIRR 204-28(b)(ii)]

J. Mobile Sources. **Diageo USVI** shall operate or cause to be operated, upon any street, highway, public place or private premises within the Virgin Islands, any internal combustion engines, while idling or moving, which emit from any source whatsoever any air contaminants that causes an opacity of twenty (20%) or more measured for a period of time equal to one minute. [VIRR 204-28(a)]

K. **Diageo USVI** shall not cause or permit any materials to be handled, transported, or stored in a building, its appurtenances, or cause a road to be used, constructed, altered, repaired, or demolished without taking the necessary precautions specified in Sec. 206-25(a)(1) through (9) to prevent particulate matter from becoming airborne. [VIRR 204-25(a)]

L. The Commissioner may require other reasonable measures as may be necessary to prevent particulate matter from becoming airborne. [VIRR 204-25(b)]

M. **Diageo USVI** shall not cause or permit the discharge of visible emissions of fugitive dust beyond the boundary line of the property on which the emissions originate. [VIRR 204-25(c)]

N. When air pollutants escape from a building or equipment and cause a nuisance or violate any regulations, the Commissioner may order that the building or equipment in which processing, handling, and storage are done, be tightly closed and/or ventilated so that all emissions from the building or equipment are controlled to remove or destroy such air pollutants before being discharge to the open air. The implementation of this measure shall not create occupational health hazards.[VIRR 204-25(d)]

O. **Diageo USVI** shall not cause or permit the discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, annoyance to persons or to the public or which endanger the comfort, repose, health, or safety of any such persons or the public or which cause or have tendency to cause injury or damage to business or property. [VIRR 204-27(a)]

P. Nothing in any other regulation concerning emission of air contaminants or any other regulations relating to air pollution shall in any manner be construed as authorizing or legalizing the creation or maintenance of a nuisance as described in the above-mentioned Condition I. O. [VIRR 204-27(b)]

Q. **Diageo USVI** shall not build, erect, install or use any article, machine, equipment or other contrivance, the sole purpose of which is to dilute or conceal an emission without resulting in a reduction in the total release of air contaminants to the atmosphere. [VIRR 204-30]

R. It shall be the duty of **Diageo USVI** to report any discontinued or dismantled fuel burning, combustion or process equipment or device coming under the jurisdiction of the permit provision of this chapter to report to Department within thirty (30) days of the permanent discontinuance or dismantlement of such equipment or device. [VIRR 204-31]

II. MONITORING AND RECORDKEEPING REQUIREMENTS

A. **Diageo USVI** shall record and maintain the number of hours of operation and the quantity of fuel consumed (used) by the emergency generator unit. These hours of operation shall be recorded on a 365-day rolling basis.

B. **Diageo USVI** shall maintain records of the engine during emergency service and non-emergency service (maintenance checks and readiness testing) that are recorded through the non-resettable hour meter. During the time of operation, **Diageo USVI** shall document the reason that each engine was in operation at the time.

C. **Diageo USVI** shall monitor and maintain records of the sulfur content of the fuel oil received through the Supplier's Invoice with the attached Certificate of Analysis performed or through independent fuel analysis performed by your facility.

D. **Diageo USVI** shall notify DPNR in writing of any laboratory results that indicate a sulfur content greater than 15 ppm within five working days from the date of **Diageo's** receipt of the results.

E. **Diageo USVI** shall keep a daily operation log for tracking running hours, fuel consumption and status (reason) of operation for the generating unit. This log is required to be maintained in a permanent form suitable for inspection and submission to the Department and to the EPA.

F. **Diageo USVI** shall retain all records on site for a period of no less than five (5) years following the date of entry and shall be made available for review upon request.

III. REPORTING REQUIREMENTS

A. In the event that any source or related equipment breaks down, malfunctions, ruptures, leaks or is rendered partially or totally inoperative such that releases of an air contaminant are in excess of allowable emission limit, **Diageo USVI** of such equipment shall, within four (4) hours, report to the Commissioner such failure or incident and provide all pertinent available facts, including the estimated duration of the incident.

B. **Diageo USVI** shall submit a written notification to the Commissioner no later than one (1) week after the incident. This report shall include specific data concerning the affected source and other related equipment, date, hour and the duration of the incident, and corrective measures.

C. Any operation of the equipment which may cause off-property effects, including odors, shall be immediately reported to the VIDPNR-DEP by **Diageo USVI**, in writing and/or by phone.

IV. OTHER REQUIREMENTS

A. Permit to Operate this source does not relieve **Diageo USVI – Rum Storage Warehouse Facility** (the Permittee) of the responsibility of compliance with the provisions of any federal or territorial laws, rules, or regulations.

B. An application for renewal for a Permit to Operate shall be filed by the owner or operator at least sixty (60) calendar days prior to the expiration of the existing Permit to Operate (**on or before: January 28, 2014**), in accordance with 12 V.I. R.&R § 206-27(b)(3)(1995).

C. Revisions to this permit will not alter its effective date or expiration date.

D. The source shall be operated only in accordance with the conditions set forth in this permit, as well as those described in the application and supporting documents submitted by the **Diageo USVI** to Virgin Islands Department of Planning and Natural Resources (VIDPNR-DEP).

E. **Diageo USVI** must report to VIDPNR-DEP any physical change or changes in construction which increase the amount of air pollutants or process production.

F. Operation of the source must not result in the contravention of any federal or territorial ambient air quality standards.

G. During operation, any source responsible for contravening ambient air quality standards will be required to be modified to bring operation into compliance.

H. **Diageo USVI** shall meet all other applicable federal (including but not limited to the NSPS), state and local requirements.

I. VIDPNR-DEP reserves the right to inspect **Diageo USVI's** facilities. The Permittee shall give VIDPNR-DEP whatever aid is necessary to perform said inspections in a safe and timely manner.

J. **Diageo USVI** who has been granted a permit under the provisions of 12 V.I.R. & Regs. 206-20(c), shall firmly affix such Permit to Operate, an approved facsimile, or other approved identification bearing the permit number upon the article, machine, equipment, or other contrivance in such a manner as to be clearly visible and accessible. In the event that the article, machine, equipment, or other contrivance is constructed or operated in such a manner that the Permit to Operate cannot be so placed, the permit should be maintained so as to be readily available at all times on the premises.

K. The Permittee is required to be in compliance with 12 V.I.R. & Regs. § 206-26.

Your cooperation in complying with these regulations will be most appreciated.

Sincerely,

Melissa McCall
Director

Enclosure: Two (2) Certificates

Government Of
The Virgin Islands of the United States

DEPARTMENT OF PLANNING & NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
Charlotte Amalie, St. Thomas, Virgin Islands

AIR POLLUTION CONTROL

☐ AUTHORITY TO CONSTRUCT ■ PERMIT TO OPERATE

a. ☐ Permit Renewal
b. ■ New Permit

For: **Diageo USVI**
RR1 Box 9400
Kingshill, VI 00850

Permit No.: **STX-792-B-11**
Phone: **(340) 713-8520**
Pursuant to the provisions of Title 12, Chapter 9, Section 206, Sub-Section 20 of the Virgin Islands Air Pollution Control Act Rules and Regulations. This Permit is issued to:

Diageo USVI – Rum Storage Warehouse Facility

For the operation of the following: **Two (2) Ethanol Storage Containment areas and all appurtenances.**

Located at: **Parcel #25, #1 Estate Diamond, Frederiksted, St. Croix, U.S.V.I. 00840**

In accordance with the application dated **May 15, 2009** and in conformity with the statements and supporting data entered therein, all of which are filed with the Department and are considered a part of this Permit.

This Permit shall be effective from the date of: March 28, 2011 for a three (3) year period ending on: **March 28, 2014.**

Melissa Mc[illegible]
Director

Government Of
The Virgin Islands of the United States

DEPARTMENT OF PLANNING & NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
#45 Mars Hill, Frederiksted, St. Croix, Virgin Islands

AIR POLLUTION CONTROL

☐ AUTHORITY TO CONSTRUCT ■ PERMIT TO OPERATE

a. ☐ Permit Renewal
b. ■ New Permit

For: **Diageo USVI**
RR1 Box 9400
Kingshill, VI 00850

Permit No.: **STX-792-A-11**
Phone: **(340) 713-8520**
Pursuant to the provisions of Title 12, Chapter 9, Section 206, Sub-Section 20 of the Virgin Islands Air Pollution Control Act Rules and Regulations. This Permit is issued to:

Diageo USVI, Inc. – Rum Production Warehouse Facility

For the operation of the following: **(1) 350 kW Cummins diesel generator, Model # QSX15-G9, Serial # 79420819**

Located at: **Parcel #25, #1 Estate Diamond, Frederiksted, St. Croix, U.S.V.I. 00840**

In accordance with the application dated **May 15, 2009** and in conformity with the statements and supporting data entered therein, all of which are filed with the Department and are considered a part of this Permit.

This Permit shall be effective from the date of: March 28, 2011 for a three (3) year period ending on: **March 28, 2014.**

Melissa McCall
Director

CERTIFICATE OF USE

GOVERNMENT OF THE UNITED STATES VIRGIN ISLANDS
Department of Planning and Natural Resources
Division of Permits

NAME OF OWNER: *DIAGEO USVI, INC.*

LOCATION OF BUILDING: *Plot #25 Estate Diamond Fredericksted*

USE: *INDUSTRIAL*

BUILDING PERMIT NO.: *398-09/065-10* DATE ISSUED: *11/23/2009*

ELECTRICAL PERMIT NO.: *465-09* DATE ISSUED: *09/25/2009*

PLUMBING PERMIT NO.: *009-10* DATE ISSUED: *10/07/2009*

****

This is to certify that this building has been built in accordance with the Virgin Islands Building Code and has been dully inspected and approved for use and/or occupancy.

FINAL BUILDING INSPECTION BY: *Alexis Doward* DATE: *07/30/2010*

FINAL ELECTRICAL INSPECTION BY: *Leonard Farrante* DATE: *04/28/2011*

FINAL PLUMBING INSPECTION BY: *Lindsay Thomas* DATE: *07/30/2010*

OCCUPANCY PERMIT NO. *074-11* DATE ISSUED: *05/16/2011*

REMARKS:
Barrel Warehouse and Administrative Building

APPROVED DATE: *5/13/11*

TERRITORIAL DIRECTOR

CZX - -
FZP –

CERTIFICATION OF SUPERVISION

UPON APPLICATION FOR A CERTIFICATE OF USE AND/OR OCCUPANCY.

TO: The Commissioner of Planning & Natural Resources
(through the Division of Building Permits)

FROM: Certifying Building Supervisor of construction mentioned below

SUBJECT: **CERTIFICATION OF SUPERVISION AND TRADE WORKMANSHIP**

LEGAL DESCRIPTION

NAME OF OWNER: DIAGEO USVI

LOCATION OF BUILDING: #25 Estate Diamond, Fredericksted St. Croix

BUILDING PERMIT NUMBER: 398-09 / 065-10 DATE ISSUED: 09/2/09, 11/23/10

NAME OF DESIGNER: Silverberg & Associates TITLE: Architect

NAME OF CERTIFYING SUPERVISOR: JAMES BENTON

I hereby certify that the above mentioned project has been built under my supervision and that in its construction all the provisions of the V.I. Building Code and all other applicable laws are complied with. Also, pursuant to V.I. Code, Title 29, Chapter 5, §294 (c) and §298 (b) the work done is in compliance with the work proposed on Building Permit.

Signature: _____ Date: 7/26/10

Certifying Supervisor PRESIDENT

FINAL ELECTRICAL CERTIFICATE

Department of Planning and Natural Resources
Division of Permits

DATE: *May 16, 2011*

A) LEGAL INFORMATION

NAME OFOWNER: *DIAGEO USVI, INC.*

LOCATION OF BUILDING: *Plot #25 Estate Diamond Fredericksted*

USE OF BUILDING: RES: _____ COM: _____ IND: X OTHER: _____

NAME OF ELECTRICIAN: *N.R. Electric, Inc. - Neil Ruan*

ELECTRICAL PERMIT NO.: *465-10* DATE ISSUED: *09/25/2009*

V.I. LICENSE NO.: *C-100013270-2010*

B) GENERAL DESCRIPTION

TYPE OF FLOOR: *Concrete* WALLS: *Gal./Conc.* ROOF: *Galvanize*

ESTIMATED CURRENT: *315A* AMPS VOLTAGE: *277/460*

C) SERVICE ENTRANCE

SIZE: *15KVA* TYPE: *350MCM*

NO. OF DISTRIBUTION PANELS: *5 (five)* NO. OF METERS: *1 (one)*

D) CIRCUIT DISTRIBUTION

NO. OF 120v CIRCUITS: *36 Thirty-six* NO. OF 240v CIRCUITS: *0 (Zero)*

NO. OF 208v CIRCUITS: *8 eight* TOTAL NO. OF CIRCUITS: *83*

E) REMARKS

As per NEC-2005 & V.I. Code Title 29 Section 294 Compliance

Barrel Warehouse and Administrative Building

This is to certify that the electrical installation has been inspected by the undersigned and has been found to be done in accordance with the provisions of the Virgin Islands Code. This Certificate is issued pursuant to Subchapter 11, Section 292 (c) of Title 29 of the V.I. Building Code.

INSPECTED BY: _____ DATE: 5/16/2011
ELECTRICAL INSPECTOR

OCCUPANCY NO.: *074-11* DATE ISSUED: *05/13/2011*

APPROVED BY: _____ DATE: 5/13/11
TERRITORIAL DIRECTOR

Exhibit 9

GOVERNMENT OF THE UNITED STATES VIRGIN ISLANDS

DEPARTMENT OF PLANNING AND NATURAL RESOURCES
45 Mars Hill, Frederiksted
St. Croix, U.S. Virgin Islands 00840-4474

Office of the Commissioner

Telephone: (340) 773-1082
FAX: (340) 773-1716

July 08, 2013

Dan Kirby
Vice President
Diageo USVI
RR1 Box 9400
Kingshill, VI 00850

Dear Mr. Kirby:

The Department of Planning and Natural Resources-Division of Environmental Protection (DPNR-DEP) has received over thirty (30) complaints from residents and businesses in areas neighboring the Diageo Rum Storage Warehouse Facility. The facility's rum aging warehouse is located at #1 Estate Diamond, in Frederiksted. The complaints were within the areas of Enfield Green, Williams Delight and Cane Carlton Estates. These complaints were in regard to Baudoinia Compniacensis, a fungal species, formed from the ethanol vapors referred to as "Angel's Share." This fungal growth which resembles black soot has accumulated on properties in the vicinity of the warehouse.

DPNR-DEP, along with the Environmental Protection Agency (EPA), responded to the above referenced complaints by conducting site inspections. In some instances, preliminary samples were taken. The result of sampling confirmed the presence of Baudoinia Compniacensis spores. The department understands that the presence of this fungus can cause damage to property as it grows and diminishes the affected property's value. The department further recognizes that some of the property owners of the residences and businesses have cleaned this substance at their expense, while others have not.

The agency has concluded that this matter constitutes an environmental nuisance as defined in the Virgin Islands Rules and Regulation, Air Pollution Control, Title 12, Chapter 9 section 204-27. However, in lieu of an enforcement action, DPNR-DEP hereby requests that Diageo implement measures to reduce their related ethanol

EXHIBIT
tabbies
9

emission. In addition, the department is requesting that Diageo accrue half the cost of sampling all residences and businesses impacted by this fungus. If the sampling results return positive for Baudoinia Compniacensi, Diageo will cover half the cost of cleaning the respective properties. If the facility fails to comply, the department will proceed with the necessary enforcement actions

Thank you for your prompt attention in this matter. If you have any question, please feel free to contact David Alvaro Simon, P.E., Director, Division of Environmental Protection at (340)774-3320 ext. 5108.

Sincerely,

DAS

Alicia Barnes
Commissioner

Exhibit 10

GOVERNMENT OF THE UNITED STATES VIRGIN ISLANDS
--------()--------
DEPARTMENT OF PLANNING AND NATURAL RESOURCES
45 Mars Hill, Frederiksted
St. Croix, U.S. Virgin Islands 00840-4474

Office of the Commissioner

Telephone: (340) 773-1082
FAX: (340) 773-1716

July 08, 2013

Gary C. Nelthropp
Vice President
Virgin Islands Rum Industries, Ltd. / Cruzan Rum
P.O. Box 218
Frederiksted, VI 00841

Dear Mr. Nelthropp:

The Department of Planning and Natural Resources-Division of Environmental Protection (DPNR-DEP) has received over thirty (30) complaints from residents and businesses in areas neighboring the Virgin Islands Rum Industries, Ltd (VIRIL) Rum Storage Warehouse Facility. The facility's rum aging warehouse is located in Estate Diamond, in Frederiksted. The complaints were within the areas of Enfield Green, Williams Delight and Cane Carlton Estates. These complaints were in regard to Baudoinia Compniacensis, a fungal species, formed from the ethanol vapors referred to as "Angel's Share." This fungal growth which resembles black soot has accumulated on properties in the vicinity of the warehouse.

DPNR-DEP, along with the Environmental Protection Agency (EPA), responded to the above referenced complaints by conducting site inspections. In some instances, preliminary samples were taken. The result of sampling confirmed the presence of Baudoinia Compniacensis spores. The department understands that the presence of this fungus can cause damage to property as it grows and diminishes the affected property's value. The department further recognizes that some of the property owners of the residences and businesses have cleaned this substance at their expense, while others have not.

The agency has concluded that this matter constitutes an environmental nuisance as defined in the Virgin Islands Rules and Regulation, Air Pollution Control, Title 12, Chapter 9 section 204-27. However, in lieu of an enforcement action, DPNR-DEP hereby requests that VIRIL implement measures to reduce their related ethanol

emission. In addition, the department is requesting that VIRIL accrue half the cost of sampling all residences and businesses impacted by this fungus. If the sampling results return positive for Baudoinia Compniacensi, VIRIL will cover half the cost of cleaning the respective properties. If the facility fails to comply, the department will proceed with the necessary enforcement actions

Thank you for your prompt attention in this matter. If you have any question, please feel free to contact David Alvaro Simon, P.E., Director, Division of Environmental Protection at (340)774-3320 ext. 5108.

Sincerely,

DAS

Alicia Barnes
Commissioner

Exhibit 11

43303

July 21, 1992 **WARRANTY DEED** No. 4126/1992

THIS INDENTURE, made this 9th day of July, 1992, by and between 1845 CORPORATION, (herein called the "GRANTOR"), and **ENID V. ALLEYNE and RYAN ALLEYNE, residing at P.O. BOX 3178, KINGSHILL, ST. CROIX, VIRGIN ISLAND 00851-3178,** (herein called the "GRANTEE");

WITNESSETH: That for and in consideration of TEN ($10.00) DOLLARS and other good and valuable consideration, receipt of which is hereby acknowledged;

THE GRANTOR HEREBY GRANTS AND CONVEYS to the GRANTEE, their heirs and assigns, the property known and designated as:

> Plot No. 6 of Estate Enfield Green, Prince Quarter, St. Croix, U.S.Virgin Islands, consisting of 0.500 U.S. acre, more or less, as more fully described on DPNR drawing 4547 dated January 10, 1989, revised August 13, 1990

TOGETHER WITH any improvements thereon and the rights, privileges, and appurtenances belonging thereto; to all strips and gores; together with all the right, title and interest, if any, in and to any roads abutting the above described premises to the centerline thereof, and to any easement of ingress and egress on, over and through adjoining or remaining premises of the GRANTOR.

TO HAVE AND TO HOLD said premises in fee simple forever;

SUBJECT, HOWEVER, to any covenants, restrictions, and easements of record;

AND THE GRANTOR WARRANTS that it is seized of the premises in fee simple and has good right to convey the premises; that the GRANTEE shall quietly enjoy the premises; that the premises are free from encumbrances except as referred to herein; that the GRANTOR will execute or procure any further necessary assurances of title to the premises; the GRANTOR will forever warrant and defend title to the premises.

IN WITNESS WHEREOF the GRANTOR has caused this instrument to be signed on its behalf by its duly authorized officer and its corporate seal to be affixed hereto as of the day and date first above written.

ATTEST:

Catherine O. Ogg
Asst Secretary

1845 CORPORATION

Peter Knobel, President

WITNESS:

Faye Reed

LT. GOVERNOR'S OFFICE
RECORDER OF DEEDS ST. CROIX
1992 JUL 21 PM 3:00

311

TERRITORY OF THE VIRGIN ISLANDS)
) ss:
DISTRICT OF ST. CROIX)

On this 21st day of August, 1992 before me personally came Franklin Knobel, to me known, who being by me duly sworn, did depose and say that he resides at #165 La Grange, Frederiksted, St. Croix VI and that he is the Vice-President of 1845 CORPORATION, the corporation described in and which executed the foregoing instrument. That he knows the seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he signed his name thereto by like order.

Catherine O. Ogg
Notary

CERTIFICATE OF VALUE

IT IS HEREBY CERTIFIED that the deed is issued to clear title and no additional Revenue Stamps are required.

Franklin Knobel

CERTIFICATE OF THE PUBLIC SURVEYOR

IT IS HEREBY CERTIFIED that, according to the records in the Office of the Public Surveyor, the property described in the foregoing instrument has not undergone any change in respect to boundary and area, Drawing No. 4790-A dated August 18, 1992.

Dated: AUG 2 [illegible] 1992

Fee $ 150

EINAR D. CLENDENENK K.

Received for recording on the 3rd day of Sept
1992 at 2:55 o'clock P M. and
Recorded and Entered in Recorder's Book for the
District of St. Croix, Virgin Islands of the U.S.A. at
Photo-copy 447 Page
No. 4935/92 and noted in Real Property Register
Page
Beatrice F. Robertson
FEE: $ 5.00

TERRITORY OF THE VIRGIN ISLANDS
DISTRICT OF ST CROIX

I, ALTHEA A. PEDRO, Recorder of said district, do hereby certify that the foregoing instrument contains a true and complete copy of Quitclaim Deed as same appears of record or on the file in P.C. 442 Page 30 No. 4985/92 of the records of St. Croix District, Virgin Islands. Given under my hand and seal this 12th day of July, 2013

ALTHEA A. PEDRO, RECORDER

Althea A Pedro

FEE: $ 11.00

Spacer

(Intentionally Blank)

42,388

September 3, 1992 **QUITCLAIM DEED** No. 4985/1992

INDENTURE MADE this 21st day of August, 1992, by and between **1845 CORPORATION**, of P.O. Box 1517, Frederiksted, St. Croix, VI 00841 (hereinafter referred to as "Grantor"), and **ENID V. ALLEYNE and RYAN ALLEYNE**, of P.O. Box 3178, Kingshill, St. Croix, VI 00851 (hereinafter referred to as "Grantee");

W I T N E S S E T H

In consideration of the sum of Ten Dollars ($10), and other good and valuable consideration, to it their hand paid, receipt whereof is hereby acknowledged, Grantor has and by these present does hereby grant, convey and quitclaim unto Grantee, their heirs and assigns, all of its rights, title and interest in and to the following described real property situate in St. Croix, Virgin Islands of the United States, to wit:

Plot 6 of Estate Enfield Green, Prince Quarter, St. Croix, U.S. Virgin Islands, consisting of 0.500 U.S. acre, more or less, as more fully described in Drawing 4790-A dated August 18, 1992.

TOGETHER WITH all the tenements, hereditaments and appurtenances.

SUBJECT, HOWEVER, to all restrictions, covenants and conditions as of record appear.

TO HAVE AND TO HOLD said described real property unto the said Grantee in fee simple forever.

IN WITNESS WHEREOF, the Grantor has hereunto set its hand and seal as of the day and year first above written.

Attest:

Susan M. Shell
Asst. Secretary

1845 Corporation

Franklin Knobel, Vice-President

Witness:

Elizabeth Carlin

STATE OF NEW YORK)
) ss:
COUNTY OF NEW YORK)

On this 9th day of July, 1992 before me personally came Peter Knobel, to me known, who being by me duly sworn, did depose and say that he resides at 239 Central Park West Street, New York, NY 10024 and that he is the President of 1845 CORPORATION, the corporation described in and which executed the foregoing instrument. That he knows the seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he signed his name thereto by like order.

FRANKLIN KNOBEL
Notary Public State of New York
No. 31-4970094
Qualified in New York County
Commission Expires July 30,1994

CERTIFICATE OF VALUE

IT IS HEREBY CERTIFIED that the value of the property conveyed by this instrument is: $ 139,500.00

Peter Knobel

CERTIFICATE OF THE PUBLIC SURVEYOR

IT IS HEREBY CERTIFIED that, according to the records in the Office of the Public Surveyor, the property described in the foregoing instrument has not undergone any change in respect to boundary and area. Drawing No. 4547 as revised on August 13, 1990

Dated: JUL 17 1992

Fee $ 1.50

Enal D. Clendenen Jr.

Received for recording on the 21st day of July 1992 at 3:00 o'clock P M. and Recorded and Entered in Recorder's Book for the District of St. Croix, Virgin Islands of the U.S.A. at Photo-copy 437 Page ____ No. 4126/92 and noted in Real Property Register ____ Page ____

Beatrice P. Roberton

FEE: $ 142.00

TERRITORY OF THE VIRGIN ISLANDS
DISTRICT OF ST CROIX

I, ALTHEA A. PEDRO, Recorder of said district, do hereby certify that the foregoing instrument contains a true and complete copy of Warranty Deed as same appears of record or on the file in P.C. 437 Page 311 No. 4126/92 of the records of St. Croix District, Virgin Islands. Given under my hand and seal this 12th day of July, 2013

ALTHEA A. PEDRO, RECORDER

Althea A Pedro

FEE: $ 11.00

Doc# 2005003772

#22479
3326623,34-25
Atty Otte

480.-
100.-penalty

60,029

WARRANTY DEED

INTERNAL REVENUE STAMP
480 00
GOVERNMENT OF THE U.S. VIRGIN ISLANDS
PBE0007

RECORDS & DEEDS
ST. CROIX

THIS DEED is executed this 21st day of April, 2005, between **GREGORY MICHAEL BILLMAN and DANIA DOUGLAS BILLMAN,** whose address is 690 JACKSON PORT, SATELLITE BEACH, FL 32937 (collectively "Grantor") and **MARCO A. BLACKMAN**, whose address is P.O. BOX 5067, KINGSHILL, VI 00851 ("Grantee").

W I T N E S S E T H :

In consideration of the sum of Ten Dollars ($10.00) and other good and valuable consideration paid, the receipt and sufficiency of which is hereby acknowledged, Grantor hereby sells, grants and conveys unto Grantee, Grantee's heirs, representatives, successors and assigns, the following described real property lying and situated in St. Croix, U.S. Virgin Islands, to wit:

> **Plot 77** (comprising 0.648 U.S. acre(s), more or less), **Estate Enfield Green**, Prince Quarter, St. Croix, U.S. Virgin Islands, as more particularly shown on OLG Drawing No. 4386, dated July 1, 1987, revised June 9, 1992;

TOGETHER WITH all the tenements, hereditaments, and appurtenances thereunto belonging, and any and all improvements located thereon.

SUBJECT TO all easements, right of ways, conditions, covenants, agreements, and restrictions of public record; all zoning, building, environmental and other laws and regulations affecting the use or occupancy of the Property; and real property taxes for the year 2004 and all years thereafter (collectively "Permitted Exceptions").

TO HAVE AND TO HOLD the Property unto Grantee, Grantee's heirs, representatives, successors and assigns, in fee simple forever.

GRANTOR further covenants that Grantor is lawfully seised of the Property and has full right to convey the Property; that the Property is free and clear of all liens and encumbrances except the Permitted Exceptions; that Grantee shall quietly enjoy the Property; and Grantor shall forever warrant and defend the right and title to the Property to Grantee against the lawful claims of all persons, except for claims arising under or by virtue of the Permitted Exceptions.

IN WITNESS WHEREOF, this Deed has been duly executed by Grantor the day and year first above written.

WITNESSES: [AS TO BOTH]

GREGORY MICHAEL BILLMAN

DANIA DOUGLAS BILLMAN

ACKNOWLEDGMENT

STATE OF FLORIDA
COUNTY OF BREVARD

The foregoing instrument was acknowledged before me this 29 day of APRIL, 2005, by **GREGORY MICHAEL BILLMAN and DANIA DOUGLAS BILLMAN.**

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

(NOTARY SEAL)

JEROME RAUPP
MY COMMISSION # DD 073771
EXPIRES: November 25, 2005
Bonded Thru Notary Public Underwriters

Notary Public
My commission expires: 25NOV05

CERTIFICATE OF VALUE

It is hereby certified that the value of the Property described in the foregoing instrument does not exceed $19,000.00. In 2003 the Property was assessed at $24,024.00.

CERTIFICATE OF PUBLIC SURVEYOR

It is hereby certified that according to the records in the Public Surveyor's Office, the Property described in the foregoing instrument has not undergone any change in regard to boundary and area of Plot 77 Estate Enfield Green.

Office of the Public Surveyor, Christiansted, St. Croix, U.S. Virgin Islands.

Dated: MAY 1 1 2005

By: for: Bernadette C. Williams
Assistant Tax Assessor

FEE: 20.00

lele

Doc# 2005003772
Book: 987
Pages: 65
Filed & Recorded
08/09/2005 12:29PM
ALTHEA PEDRO
RECORDER OF DEEDS
ST CROIX

RECORDING FEE	$	31.00
PER PAGE FEE	$	2.00
DEED DOC STAMP	$	480.00

Althea A Pedro
Recorder

TERRITORY OF THE VIRGIN ISLANDS
DISTRICT OF ST CROIX

I, ALTHEA A. PEDRO, Recorder of said district, do hereby certify that the foregoing instrument contains a true and complete copy of Warranty Deed as same appears of record or on the file in P.C. 98 Page 65 No. 3772/05 of the records of St. Croix District, Virgin Islands. Given under my hand and seal this 12th day of July 2013.

ALTHEA A. PEDRO, RECORDER

Althea A Pedro

FEE: $ 13.00

TRD-E-537

GOVERNMENT OF
THE VIRGIN ISLANDS OF THE UNITED STATES
ST. CROIX, V.I.
0

CHRISTIANSTED 00820
4008 EST. DIAMOND
LOT NO. 7-B
TEL: (340)-773-1105
FAX: (340)-778-5002

DEPARTMENT OF FINANCE
TREASURY DIVISION

FREDERIKSTED 00840
COMMERCIAL BLDG. NO. 3
LAGOON COMPLEX
TEL: (340)-772-0120
FAX: (340)-772-5580

TO: **THE RECORDER OF DEEDS**

FROM: **THE TREASURY DIVISION**

IN ACCORDANCE WITH TITLE 28, SECTION 121 AS AMENDED,

THIS CERTIFICATION THAT THERE ARE NO REAL PROPERTY

TAXES OUTSTANDING FOR: Gregory & Dania Billman
(NAME OF TAXPAYER ON RECORD)

#77 Est. Enfield Green (PROPERTY DESCRIPTION)

4-09500-0314-00 (PARCEL NUMBER)

Edna Winston & Flavia Logie, Esq. (REQUESTED BY)

719-8181 (TELEPHONE NUMBER)

TAXES HAVE BEEN RESEARCHED UP TO AND INCLUDING 2003 *ONLY.*

RESEARCHED BY: Roger M. Adams

TITLE: RPT Enf Off III

DATE: 23 June 2005

VERIFIED BY:

TITLE: T-A

DATE: 6/23/05

COLLECTOR NO. 8504

68

Spacer

(Intentionally Blank)

Doc# 2009001911

#42698
793384
Atty Otto

Ule, 532

QUITCLAIM DEED

INDENTURE made this 16 day of March 2nd, 2009, by MARCO A. BLACKMAN, of P.O. Box 5067 Kingshill, St. Croix, U.S. Virgin Islands, 00851, hereinafter referred to as "Grantor," to MARCO A. BLACKMAN and MARLENE PREVOST BLACKMAN, husband and wife, of P.O. Box 5067 Kingshill, St. Croix, U.S. Virgin Islands, 00851, hereinafter referred to as the "Grantees."

WITNESSETH:

That in consideration of the sum of Ten Dollars ($10.00) and other good and valuable consideration, the receipt whereof is hereby acknowledged, Grantor hereby grants, remises, releases and forever quitclaims unto the Grantees, and their heirs and assigns thereto, all of the right, title and interest that Grantor has in and to the parcel of land, situate on St. Croix, Virgin Islands of the United States, to-wit:

> Plot No. 77 of Estate Enfield Green, Prince Quarter, St. Croix, US Virgin Islands, consisting of 0.648 US Acres more or less, as more fully shown in O.L.G. drawing No. 4386 dated July 1, 1987, revised June 9, 1992

TOGETHER with all the tenements, hereditaments and appurtenances thereunto belonging.

TOGETHER with all the rights of the Grantor in the premises.

TO HAVE AND TO HOLD the premises with all appurtenances, unto the said Grantees, their heirs and assigns, in fee simple forever, joint tenancy by the entirety, with full rights of survivorship.

SUBJECT, HOWEVER, to covenants, restrictions and easements of record.

Doc# 2009001911
Book: 1189
Pages: 173
Filed & Recorded
05/11/2009 10:09AM
ALTHEA PEDRO
RECORDER OF DEEDS
ST CROIX

RECORDING FEE	$	24.00
PER PAGE FEE	$	2.00
ATTACHMNT FEE	$	2.50

Althea A Pedro
Recorder

1/2 value $12,012.-

28.50

IN WITNESS whereof the Grantor has executed this instrument as of the day and year first above written.

IN WITNESS:

MARCO A. BLACKMAN

ACKNOWLEDGMENT

On this 1st day of June, 2009, before me personally appeared ***Marco A. Blackman***, known to me to be the person described in and who executed the foregoing instrument, and he acknowledged that he executed the same freely and voluntarily for the uses and purposes therein contained.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

NOTARY PUBLIC

Doc# 2009001911
Book: 1189
Pages: 173
Filed & Recorded
05/11/2009 10:09AM
ALTHEA PEDRO
RECORDER OF DEEDS
ST CROIX
RECORDING FEE 24.00
PER PAGE FEE 2.00
ATTACHMNT FEE .50

Althea Pedro
Recorder

CERTIFICATE OF VALUE

IT IS HEREBY CERTIFIED that this is an intra-family transfer from husband to husband and wife and the conveyance is not subject to transfer stamp tax as per 33 V.I.C. §128(8) (2000). The 2005 tax assessed value of the real property described in the foregoing instrument is $24,024.00.

CERTIFICATE OF THE PUBLIC SURVEYOR

IT IS HEREBY CERTIFIED that, according to the records in the Office of the Public Surveyor, the property described in the foregoing instrument has not undergone any change in respect to boundary and area.

Office of the Public Surveyor, Christiansted, St. Croix, U.S. Virgin Islands.

Date: MAY 0 8 2009

Fee: 20.00

for: Bernadette C. Williams
Acting Tax Assessor

Doc# 2009001911
Book: 189
Pages: 173
Filed & Recorded
05/11/2009 10:09AM
ALTHEA PEDRO
RECORDER OF DEEDS
ST CROIX
RECORDING FEE $ 24.00
PER PAGE FEE $ 2.00
ATTACHMENT FEE $ 2.50

Althea A Pedro
Recorder

AFFIDAVIT

IN SUPPORT OF STAMP TAX EXEMPTION
ON THE TRANSFER OF PLOT 77 ESTATE ENFIELD GREEN

I, MARCO A. BLACKMAN, being first duly sworn, do hereby depose and state the following:

1. I am the Grantor of the following described real property:

   Plot No. 77 of Estate Enfield Green, Prince Quarter, St. Croix, US Virgin Islands, consisting of 0.648 US Acres more or less, as more fully shown in O.L.G. drawing No. 4386 dated July 1, 1987, revised June 9, 1992

2. I am transferring my interest in the above described real property to Marlene Prevost Blackman and myself.

3. This transfer is exempt from transfer stamp tax pursuant to Title 33 V.I.C. §128(8), this being an intrafamily conveyance, as Marlene Prevost Blackman is my wife.

FURTHER AFFIANT SAYETH NAUGHT.

DATED: March 2nd 2009

Marco A Blackman
MARCO A. BLACKMAN

ACKNOWLEDGMENT

TERRITORY OF THE VIRGIN ISLANDS)
DISTRICT OF ST. CROIX) ss:

On this the 2nd day of March, 2009, before me personally came and appeared ***Marco A. Blackman***, known to me to be the person described in and who signed the foregoing instrument, and he acknowledged to me that he executed the same freely and voluntarily for the uses and purposes therein expressed.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

ST CROIX USVI NOTARY PUBLIC

NOTARY PUBLIC

GOVERNMENT OF
THE UNITED STATES VIRGIN ISLANDS

—o—

OFFICE OF THE LIEUTENANT GOVERNOR

GREGORY R. FRANCIS
LIEUTENANT GOVERNOR

VALENCIO JACKSON
TAX COLLECTOR

COMMISSIONER OF FINANCE
CHAIRMAN, V.I. LOTTERY BOARD

REAL PROPERTY TAX CLEARANCE LETTER

To: THE RECORDER OF DEEDS

From: OFFICE OF THE TAX COLLECTOR

In accordance with Title 28, Section 121 as amended, this is certification that there are no real property taxes outstanding for:

Parcel Number: 4-09500-0314-00
Legal Description: PLOT NO.77 ESTATE ENFIELD GREEN
Owner's Name: BLACKMAN, MARCO A.

TAXES RESEARCHED UP TO AND INCLUDING 2006 .

Certified correct by: Roger Adams, Sup RPT Enf Off

Signature: Roger M. Adams

Date: 3/11/2009

RA/jrJr

NUMBER 1105 KING STREET, CHRISTIANSTED * ST CROIX, VI 00820* TEL 340-773-6449 * FAX 340-773-0330
NUMBER 1151 KING STREET SUITE 101, CHRISTIANSTED * ST. CROIX, VI 00820 *340-773-6459*FAX 340-773-4052
LAGOON STREET COMMERCIAL BUILDING NO. 1, FREDERIKSTED * ST. CROIX, VI 00840 * TEL 340-772-0120 * FAX 340-772-5580
NUMBER 18 KONGENS GADE * ST THOMAS, VI 00802 * TEL 340-774-2991 * FAX 340-774-6953
BUILDERS EMPORIUM BUILDING 52E & 52EA ESTATE THOMAS, ST. THOMAS VI 00802 * TEL 340-776-8505 FAX 340-774-1270
http://ltg.gov.vi/

TERRITORY OF THE VIRGIN ISLANDS
DISTRICT OF ST CROIX

I, ALTHEA A. PEDRO, Recorder of said district, do hereby certify that the foregoing instrument contains a true and complete copy of Quitclaim Deed as same appears of record or on the file in P.C. 1189 Page 173 No. 1911/09 of the records of St. Croix District, Virgin Islands. Given under my hand and seal this 12th day of July, 2013

ALTHEA A. PEDRO, RECORDER

Althea A. Pedro

FEE: $ 13.00

Doc# 2005000927

59699

* 19914
1878723
C. Robles

260.00

WARRANTY DEED

THIS INDENTURE, made this 16th day of February, 2005, by and between CARMEN ROBLES, residing at 95-G Estate Whim, ~~P.O.~~ Box 992, Kingshill, St. Croix 00851, (herein called the "GRANTOR"), and MICHAEL BICETTE and GABINUS BICETTE residing at 327 Enfield Green, P. O. Box 243, St. Croix, V.I. 00840, (herein called the "GRANTEES");

WITNESSETH: That for and in consideration of TEN DOLLARS ($10.00) and other good and valuable consideration, receipt of which is hereby acknowledged;

INTERNAL REVENUE STAMP — 260.00 — GOVERNMENT OF THE US VIRGIN ISLANDS

RECORDS & DEEDS ST. CROIX

THE GRANTOR HEREBY GRANTS AND CONVEYS to the Grantees, their heirs and assigns, the property known and designated as:

> Plot No. 329 of Estate Enfield Green, Prince Quarter, St. Croix, U.S. Virgin Islands, consisting of 0.2342 U.S. Acre, more or less, as more fully described on Drawing No. 4766 dated March 23, 1992 and revised June 9, 1992.

TOGETHER WITH any improvements thereon and the rights, privileges, and appurtenances belonging thereto; to all strips and gores; together with all the right, title and interest, if any, in and to any roads abutting the above described premises to the centerline thereof, and to any easement of ingress and egress on, over and through adjoining or remaining premises of the GRANTOR.

TO HAVE AND TO HOLD said premises in fee simple forever;

SUBJECT, HOWEVER, to any covenants, restrictions, and easements of records;

AND THE GRANTOR WARRANTS that it is seized of the premises in fee simple and has good right to convey the premises; that the GRANTEES shall quietly enjoy the premises; that the premises are free from encumbrances except as referred to herein; that the GRANTOR will execute or procure any further necessary assurance of title to the premises; the GRANTOR will forever warrant and defend title to the premises.

IN WITNESS WHEREOF, this instrument has been duly executed as of the day and year first above written.

ATTEST:

Carmen Robles
CARMEN ROBLES

WITNESS:

Raymond W. Williams

Olga López

1/16

Doc# 2005000927
Book: 403
Pages: 178
Filed & Recorded
02/25/2005 7:54AM
ALTHEA PEDRO
RECORDER OF DEEDS
ST CROIX
RECORDING FEE $ 25.00
PER PAGE FEE $ 2.00
DEED DOC STAMP $ 260.00

Althea A Pedro
Recorder

ACKNOWLEDGMENT

TERRITORY OF THE VIRGIN ISLANDS)
JUDICIAL DIVISION OF ST. CROIX) SS.:

On this 16TH day of February, 2005, before me personally appeared **CARMEN ROBLES**, to me known and known to me to be the individual whose name is subscribed to the within Warranty Deed, and she acknowledged to me that she read this Warranty Deed before she executed it, and that was executed for the purposes stated therein.

WITNESS my hand and official seal on the day and year first above written.

TIFFANY E. MOORHEAD
St. Croix, U.S. Virgin Islands
NOTARY PUBLIC NP-112-03
Commission Expires August 1, 2007

Tiffany E Moorhead
NOTARY PUBLIC

CERTIFICATE-OF-VALUE

IT IS HEREBY CERTIFIED that the value of the property conveyed by this instrument is: $13,000.00.

Carmen Robles

CERTIFICATE-OF-THE-PUBLIC SURVEYOR

IT IS HEREBY CERTIFIED that according to the records in the Office of the Public Surveyor, Christiansted, St. Croix, U.S. Virgin Islands, the within described property in the foregoing instrument has not undergone any change with respect to boundary and area.

Office of the Public Surveyor

By: Marguerite Hess
for: Bernadette C. Williams
Assistant Tax Assessor

DATED: FEB 25 2005

FEE: 20 cc

CASH ☐ OTHER ☐ _____

CHECK OR M/O

PA JAN 14 2005 ID

COLLECTORS NO. _____

COLLECTORS INITIALS _____

TRD-E-537

GOVERNMENT OF
THE VIRGIN ISLANDS OF THE UNITED STATES
ST. CROIX, V.I.
0

CHRISTIANSTED 00820
4008 EST. DIAMOND
LOT NO. 7-B
TEL: (340)-773-1105
FAX: (340)-778-5002

DEPARTMENT OF FINANCE
TREASURY DIVISION

FREDERIKSTED 00840
COMMERCIAL BLDG. NO. 3
LAGOON COMPLEX
TEL: (340)-772-0120
FAX: (340)-772-5580

TO: THE RECORDER OF DEEDS

FROM: THE TREASURY DIVISION

IN ACCORDANCE WITH TITLE 28, SECTION 121 AS AMENDED,

THIS CERTIFICATION THAT THERE ARE NO REAL PROPERTY

TAXES OUTSTANDING FOR: *ROBLES, CARMEN*
(NAME OF TAXPAYER ON RECORD)

PLOT 329 ENFIELD GREEN
(PROPERTY DESCRIPTION)

4-09502-0104-00
(PARCEL NUMBER)

CARMEN ROBLES
(REQUESTED BY)

772-2328
(TELEPHONE NUMBER)

TAXES HAVE BEEN RESEARCHED UP TO AND INCLUDING 2003 ONLY.

RESEARCHED BY: *Roger M. Adams* *ROGER M. ADAMS*

TITLE: RPT ENF OFF III

DATE: January 18, 2005

VERIFIED BY: _____

TITLE: T-II

DATE: 1/18/05

COLLECTOR NO. 8504

178

TERRITORY OF THE VIRGIN ISLANDS
DISTRICT OF ST CROIX
I, ALTHEA A. PEDRO, Recorder of said district, do hereby certify that the foregoing instrument contains a true and complete copy of Warranty Deed as same appears of record or on the file in P.C. 963 Page 176 No. 927/05 of the records of St. Croix District, Virgin Islands. Given under my hand and seal this 12th day of July, 2013

ALTHEA A. PEDRO, RECORDER

Althea A. Pedro

FEE: $ 12.00

Doc# 2007002881

#32740
176164
NAL&G

63,720

WARRANTY DEED

INDENTURE made this 31ST day of May, 2007 by and between **ARDELLE KASDAN** of 699 Closter Dock Road, Closter, NJ 07624 hereinafter referred to as GRANTOR, and **GEORGE N. JOHN and ANISTIA JOHN** of P.O. Box 4660 Kingshill, St. Croix, Virgin Islands 00851 hereinafter referred to as GRANTEES;

380.00

INTERNAL REVENUE STAMP 380.00 GOVERNMENT OF THE US VIRGIN ISLANDS PBE0007

RECORDS & DEEDS JUN 8'07 ST.CROIX

WITNESSETH that for and in consideration of the sum of TEN ($10.00) DOLLARS lawful currency of the United States of America in hand paid, the receipt whereof is hereby acknowledged, GRANTOR hereby grants, sells, conveys and confirms unto GRANTEES all her right, title and interest in and to the following described real property, situate on St. Croix, Virgin Islands of the United States, to wit:

> Plot No. 65-A Estate Cane (0.446 U.S. acre) West End Quarter, St. Croix, U.S. Virgin Islands, as more fully shown on O.L.G. Drawing No. 2325-B, dated July 1, 1971, revised June 12, 1992.

TOGETHER WITH all the tenements, hereditaments, privileges, advantages and appurtenances to the same belonging or in any wise appertaining;

SUBJECT HOWEVER to all restrictions, easements, rights of way, agreements, conditions and covenants of record; all zoning, building, environmental and other laws and regulations affecting the use or occupancy of the Property, and real property taxes for the year 2006 and all years thereafter, and for any prior years for which the Government of the Virgin Islands may issue a revised bill; (Collectively "Permitted Exceptions").

TO HAVE AND TO HOLD, the said described real property unto GRANTEES as Tenants by the entirety in fee simple forever.

AND GRANTOR covenants and warrants that she is lawfully seized of the said real property and has good and lawful right to sell and convey the same; that the premises

34.00

411

are free from encumbrances except the Permitted Exceptions, that Grantees shall quietly enjoy the property and that she will forever warrant and defend the title herein against any lawful claim whatsoever; except for claims arising under or by virtue of the Permitted Exceptions.

IN TESTIMONY WHEREOF, I have hereunto set my hand and seal on the day and year above noted.

IN WITNESS:

Witness

Witness

ARDELLE KASDAN by Scot F. McChain Attorney In Fact

ACKNOWLEDGMENT

TERRITORY OF THE VIRGIN ISLANDS)
DISTRICT OF ST. CROIX)

On this 4th day of ~~May~~ June, 2007 before me came and personally appeared **Ardelle Kasdan** by Scot F. McChain Attorney in Fact, to me known and known to me to be the individual(s) described in and whom executed the foregoing instrument, and she acknowledged that she signed the same, and that she did so freely and voluntarily for the purposes therein contained.

Notary Public

SHERRIFFA AHAMAD
Notary Public – St. Croix, USVI
Comm. No. – NP-011-06
Comm. Expires March 26, 2010

CERTIFICATE OF VALUE

IT IS HEREBY CERTIFIED that the value of the real property described in the foregoing instrument does not exceed the sum of Two Hundred Ninety Thousand Dollars and No Cents ($19,000.00). According to the 2005 real property tax bill the assessed value of the property is $ 12,807.00

SCOT F. MCCHAIN, ESQ.

CERTIFICATE OF PUBLIC SURVEYOR

IT IS HEREBY CERTIFIED that according to the records in the Office of the Lieutenant Governor, St. Croix, the property described as **Plot 65-A Estate Cane** has undergone no changes with respect to boundary or area.

OFFICE OF THE PUBLIC SURVEYOR:

DATED: JUN 0 7 2007

By: _____
for: Bernadette C. Williams
Assistant Tax Assessor

FEE: 20.00

Doc# 200700288 1
Book: 1089
Pages: 411
Filed & Recorded
06/07/2007 2:31PM
ALTHEA PEDRO
RECORDER OF DEEDS
ST CROIX
RECORDING FEE $ 31.00
PER PAGE FEE $ 3.00
DEED DOC STAMP $ 300.00
ATTACHMNT FEE $ 6.00

Althea L. Pedro
Recorder

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS that **ARDELLE KASDAN**, do hereby constitutes and appoints her attorney **SCOT F. MCCHAIN**, of No. 1142 King Street, Christiansted, St. Croix, U.S. Virgin Islands 00820, her true and lawful attorney in fact for her in her name, place and stead to Sell the following real property situate in St. Croix, U.S. Virgin Islands, and known and described as follows:

> Plot No. 65-A Estate Cane (0.446 U.S. acre) West End Quarter, St. Croix, U.S. Virgin Islands, as more fully shown on O.L.G. Drawing No. 2325-B, dated July 1, 1971, revised June 12, 1992.

Said Attorney-in-Fact shall have full and complete power, in her name to take whatever actions reasonable and necessary to Sell the above described property, including but not limited to the execution of the Warranty Deed, waivers, affidavit and the execution and acknowledgment of any and all documents and generally acting in the premises as her could do if personally present; and all such acts as said Attorney may lawfully do by virtue hereof are hereby ratified and confirmed.

This power of attorney is granted with full power of substitution. All acts taken by our attorney in fact consistent with this power of attorney are hereby ratified, whether taken prior to or after the date this power of attorney is signed. A copy or facsimile of this power of attorney shall have the same power and effect as the original. This power of attorney may be revoked at any time by written notice, however, this power of attorney shall remain effective for one year from the date it is signed as to all persons relying on it without receipt of notice of its revocation.

In Witness whereof, I have hereunto set my hand and seal this 31 day of May 2007 at Hackensack, N.J.

Witnesses:

ARDELLE KASDAN

ACKNOWLEDGMENT

STATE OF N.J.
COUNTY OF Bergen)ss:

On this 31 day of May, 2007, before me came and personally appeared **ARDELLE KASDAN,** to me known and known to me (or satisfactorily proved) to be the individual described in and who executed the foregoing instrument, and she acknowledged that she signed the same freely and voluntarily for the purposes therein contained.

Notary Public

JEREMIAH F. QUINLAN
NOTARY PUBLIC OF NEW JERSEY
MY COMMISSION EXPIRES MARCH 17, 2009

Doc# 2007002881
Book: 10889
Pages: 411
Filed & Recorded
06/07/2007 2:31PM
ALTHEA PEDRO
RECORDER OF DEEDS
ST CROIX
RECORDING FEE $ 31.00
PER PAGE FEE $ 3.00
DEED DOC STAMP $ 300.00
ATTACHMNT FEE $ 6.00
Recorder

AFFIDAVIT

TERRITORY OF THE VIRGIN ISLANDS
DIVISION OF ST. CROIX

Before me, the undersigned officer, personally appeared **SCOT F. MCCHAIN**, who, being first duly sworn, deposed and stated as follows:

1. I am over the age of eighteen (18) years and have personal knowledge of the matters set forth herein.

2. On or about May 31st, 2007, **ARDELLE KASDAN** appointed me as attorney-in-fact pursuant to a Power of Attorney which is attached to this Affidavit.

3. At the time of execution of this Affidavit, I do not have actual knowledge of termination of the attached Power of Attorney by revocation, by the death, disability or incapacity of **ARDELLE KASDAN**, by lapse of time, or by any other manner.

4. I hereby warrant and certify that the attached Power of Attorney remains in full force and effect and that I remain fully authorized by **ARDELLE KASDAN** to exercise any and all powers conferred upon me thereby as attorney-in-fact.

5. I have executed this Affidavit with the intent and knowledge that **THE BANK OF NOVA SCOTIA** will rely on my representations set forth herein in advancing a mortgage loan to **GEORGE N. JOHN, JR. a/k/a GEORGE N. JOHN a/k/a GEORGE JOHN** to encumber Plot 65-A of Estate Cane, West End Quarter, St. Croix, U.S. Virgin Islands, and that **Chicago Title Insurance Company and Virgin Islands Title & Trust Company** will rely on my representations set forth herein in providing title insurance for the mortgage.

FURTHER AFFIANT SAYETH NOT.

SCOT F. MCCHAIN

SUBSCRIBED AND SWORN TO before me
this 7th day of June, 2007.

Notary Public

ld/c /oldlobak/adocs/bns/JohnGeorge.seller.aaif

Doc# 2007002881
Book: 1089
Pages: 414
Filed & Recorded
06/07/2007 2:31PM
ALTHEA PEDRO
RECORDER OF DEEDS
ST CROIX
RECORDING FEE $ 31.00
PER PAGE FEE $ 3.00
DEED DOC STAMP $ 300.00
ATTACHMNT FEE $ 6.00

Althea Pedro
Recorder

SHERRIFFA AHAMAD
Notary Public – St. Croix, USVI
Comm. No. – NP-011-06
Comm. Expires March 26, 2010

CASH ☐ OTHER☐ _____
CHECK OR M/O_____

PA MAY 30 2007 **ID**

COLLECTOR NO._____
COLLECTORS INTIALS_____

TRD-E-537

GOVERNMENT OF
THE VIRGIN ISLANDS OF THE UNITED STATES
ST. CROIX, V.I.
_____0_____

CHRISTIANSTED 00820
4008 EST. DIAMOND
LOT NO. 7-B
TEL: (340)-773-1105
FAX: (340)-778-5002

DEPARTMENT OF FINANCE
TREASURY DIVISION

FREDERIKSTED 00840
COMMERCIAL BLDG. NO. 3
LAGOON COMPLEX
TEL: (340)-772-0120
FAX: (340)-772-5580

TO: **THE RECORDER OF DEEDS**

FROM: **THE TREASURY DIVISION**

IN ACCORDANCE WITH TITLE 28, SECTION 121 AS AMENDED

THIS IS CERTIFICATION THAT THERE ARE NO REAL PROPERTY

TAXES OUTSTANDING FOR: KASDAN, ARDELLE
(Name Taxpayer on Record)

No.65-A Cane Estate
(PROPERTY DESCRIPTION)

4-09412-0413-00
(PARCEL NUMBER)

(Nellie O'Reilly)
Law Offices of Scot F. McChain
(REQUESTED BY)

340-773-9688
(TELEPHONE NUMBER)

TAXES HAVE BEEN RESEARCHED UP TO AND INCLUDING 2004Only.

RESEARCHED BY: Jacqueline Rosario
JACQUELINE ROSARIO

TITLE: **Property Tax Collector I**

DATE: **June 7, 2007**

VERIFIED BY: Eloise A. Charles

TITLE: Teller I

DATE: June 7, 2007

COLLECTOR NO. **8503** / 8504

417

TERRITORY OF THE VIRGIN ISLANDS
DISTRICT OF ST CROIX

I, ALTHEA A. PEDRO, Recorder of said district, do hereby certify that the foregoing instrument contains a true and complete copy of Warranty Deed as same appears of record or on the file in P.C. 1089 Page 41 No. 2881/02 of the records of St. Croix District, Virgin Islands. Given under my hand and seal this 12th day of July, 2013

ALTHEA A. PEDRO, RECORDER

Althea A Pedro

FEE: $ 16.00

August 22, 1990 QUITCLAIM DEED No. 5986/1990

(HERNANDEZ - RIVERA)

INDENTURE MADE this 5th day of March, 1990, by and between JUANITO HERNANDEZ, of Plot No. 721 Estate Williams Delight, St. Croix, U. S. Virgin Islands, (hereinafter referred to as "Grantor"), and ANNA MARIA RIVERA of P. O. Box 561, Kingshill, St. Croix, U. S. Virgin Islands, (hereinafter referred to as "Grantee");

W I T N E S S E T H

THAT in consideration of the sum of TEN DOLLARS ($10.00) and other good and valuable consideration to him in hand paid, the receipt whereof is hereby acknowledged, Grantor does hereby grants, sells and quitclaim unto Grantee, her heirs and assigns, all of her interest in the following real property, situate in St. Croix, U. S. Virgin Islands, to-wit:

> Plot No. 721 consisting of 0.2324 U. S. Acres of Estate Williams Delight, Prince Quarter, St. Croix, U. S. Virgin Islands, as shown on P.W.D. Drawing No. 3069, dated September 20, 1970, filed in the office of the Public Surveyor, St. Croix, U. S. Virgin Islands.

TOGETHER WITH all the buildings, tenements, hereditaments and appurtenances thereunto belonging.

SUBJECT, HOWEVER, to all easements, restrictions, covenants and encumbrances as of public record appear.

TO HAVE AND TO HOLD the said above-described premises unto the Grantee, and to her heirs and assigns in fee simple forever.

IN WITNESS WHEREOF, the Grantor has hereunto set his hand and seal as of the day and year first above written.

IN WITNESS:

Iris M. Esperanza
Carmen Caraballo

Juanito Hernandez
JUANITO HERNANDEZ

ACKNOWLEDGEMENT

TERRITORY OF THE VIRGIN ISLANDS)
DISTRICT OF ST. CROIX) SS:

On this 5th day of March, 1990, before me personally came and appeared JUANITO HERNANDEZ, to me known and known to me to be the individual described in the foregoing instrument and he acknowledged to me that he executed same freely and voluntarily for the uses and purposes therein contained.

NOTARY PUBLIC

210

CERTIFICATE OF VALUE

IT IS HEREBY CERTIFY that the value of the property described in the foregoing instrument, for recording purposes, does not exceed $ 11,883.00. It is an intra-family transaction.

G. LUZ A. JAMES, ESQUIRE

CERTIFICATE OF THE PUBLIC SURVEYOR

IT IS HEREBY CERTIFIED that according to the records in the office of the Public Surveyor, the property described as Plot No. 721 Estate Williams Delight consisting of 0.2324 U. S. Acres, Prince Quarter, St. Croix, U. S. Virgin Islands, has not undergone any change with respect to boundary and area.

Office of the Public Surveyor, Christiansted, St. Croix, U. S. Virgin Islands.

By: _____
EJNAR D CHRISTENSEN K.K.

DATED: MAR 6 1990

FEE: $ 1.50

Received for recording on the 22nd day of August 1990 at 11:17 o'clock A. M. and Recorded and Entered in Recorder's Book for the District of St. Croix, Virgin Islands of the U.S.A. at Photo-copy 5 370 Page _____ No. 5981/90 and noted in Real Property Register _____ Page _____

Beatrice F. Roberts

FEE: $ 14.00

TERRITORY OF THE VIRGIN ISLANDS
DISTRICT OF ST CROIX

I, ALTHEA A. PEDRO, Recorder of said district, do hereby certify that the foregoing instrument contains a true and complete copy of Quitclaim Deed as same appears of record or on the file in P.C. 370 Page 210 No. 5986/90 of the records of St. Croix District, Virgin Islands. Given under my hand and seal this 12th day of July, 2013

ALTHEA A. PEDRO, RECORDER

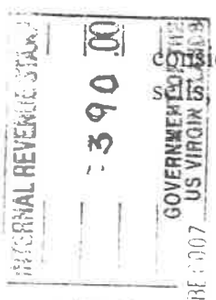
Althea A Pedro

FEE: $ 11.00

59436

October 12, 2000 **WARRANTY DEED** No. 3998/2000

THIS DEED is executed this September 11, 2000, between **JOHN NOEL,** whose address is P. O. Box 2526, Frederiksted, St. Croix, VI 00841 ("Grantor") and **SAMUEL GROUBY**, whose address is General Delivery, Kingshill, St. Croix, VI 00850 ("Grantee"). (Grantor and Grantee shall include their respective heirs, representatives, successors and assigns when the context requires or permits.)



IN CONSIDERATION of the sum of Ten ($10.00) Dollars and other good and valuable consideration paid, the receipt and sufficiency of which is hereby acknowledged, Grantor hereby sells, grants and conveys unto Grantee the following described real property ("Property"):

Plot 71-A (comprising 0.447 U.S. acres, more or less), **Estate Cane**, West End Quarter, St. Croix, U.S. Virgin Islands, as more particularly shown on Public Works Department Drawing No. 2325-B, dated July 1, 1971, latest revised September 14, 1999

TOGETHER WITH all the tenements, hereditaments, and appurtenances thereunto belonging, and any and all improvements located thereon.

SUBJECT TO all easements, right of ways, conditions, covenants, agreements, and restrictions of public record; all zoning, building, environmental and other laws and regulations affecting the use or occupancy of the Property; and real property taxes for the year 2000 and all years thereafter (collectively "Permitted Exceptions").

TO HAVE AND TO HOLD the Property unto Grantee, in fee simple forever.

GRANTOR further covenants that Grantor is lawfully seized of the Property and has full right to convey the Property; that the Property is free and clear of all liens and encumbrances except the Permitted Exceptions; that Grantee shall quietly enjoy the Property; and Grantor shall forever warrant and defend the right and title to the Property to Grantee against the lawful claims of all persons, except for claims arising under or by virtue of the Permitted Exceptions.

IN WITNESS WHEREOF, this Deed has been duly executed by Grantor the day and year first above written.

WITNESSES:

John Noel

ACKNOWLEDGMENT

TERRITORY OF THE VIRGIN ISLANDS
DISTRICT OF ST. CROIX

The foregoing instrument was acknowledged before me this 11th day of September, 2000. by **John Noel.**

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

(NOTARY SEAL)

Print Name: AKDA Sweeney
Notary Public
Territory of the Virgin Islands
No. 140-99
Qualified in Judicial District of St. Croix
My Commission Expires: 9-29-00

CERTIFICATE OF VALUE

It is hereby certified that the value of the Property described in the foregoing instrument does not exceed $19.500.00.

John Noel

CERTIFICATE OF PUBLIC SURVEYOR

It is hereby certified that according to the records in the Public Surveyor's Office, the Property described in the foregoing instrument has not undergone any change in regard to boundary and area.

Office of the Public Surveyor, Christiansted, St. Croix, U.S. Virgin Islands.

Dated: SEP 29 2000

Laurly K. Lynch
Deputy Surveyor

slh/win/re/GroubyNoelWD.doc

Received for recording on the 12th day of Oct. 2000 at 9:18 o'clock A M. and Recorded and Entered in Recorder's Book for the District of St. Croix, Virgin Islands of the U.S.A. at Photo-copy 739 Page 59 No. 5978 and noted in Real Property Register Page

FEE $ 33.00

Althea A. Ledo
Recorder

TRD-A-120

GOVERNMENT OF
THE VIRGIN ISLANDS OF THE UNITED STATES
-------o------
DEPARTMENT OF FINANCE
COMMERCIAL BUILDING #3
LAGOON COMPLEX, FREDERIKSTED
ST. CROIX, VI 00840

TREASURY DIVISION

TEL. NO: (340) 772-0120
FAX NO: (340) 772-5080

REQUEST FOR TAX LETTER

Today's Date September 6, 2000

CONTROL NUMBER ~~4-09412-0417-00~~ - 4- 9412 - 0409 - 00

PARCEL NUMBER 4-09412-0417-00

PROPERTY DESCRIPTION: Plot 71-A, Estate Cane, West End Quarter

REGISTERED IN THE NAME OF John Noel

LETTER REQUESTED BY Nichols Newman Logan & D'Eramo, P.C. (Sandi Harris)

TELEPHONE NUMBER 773-3200

RESEARCH

TAX YEAR	PAY DATE	TAX YEAR	PAY DATE
1999	8-30-00	1998	9-19-00
1997	9-19-00	1996	8-19-97
1995	2-25-97	1994	5-17-95
1993	8-17-94	1992	6-24-93
1991	9-11-92	1990	12-12-91
1989	3-15-91	1988	10-31-89

slhC:\Program Files\Microsoft Office\Real Estate\GroubyNoelTC.doc

Nichols Newman Logan & D'Eramo, P.C.
TRD-A-120

GOVERNMENT OF
THE VIRGIN ISLANDS OF THE UNITED STATES
-------o-------
DEPARTMENT OF FINANCE
COMMERCIAL BUILDING #3
LAGOON COMPLEX, FREDERIKSTED
ST. CROIX, VI 00840

TREASURY DIVISION

TEL. NO: (340) 772-0120
FAX NO: (340) 772-5080

TO: THE RECORDER OF DEEDS

FROM: THE TREASURY DIVISION

IN ACCORDANCE WITH TITLE 28, SECTION 121 AS AMENDED, THIS CERTIFICATION THAT

THERE ARE NO REAL PROPERTY TAXES OUTSTANDING FOR John Noel

Plot 71-A, Estate Cane, West End Quarter

PARCEL NO. 4-09412-0417-00
CONTROL NO. 4-09412-0417-00

Nichols Newman Logan & D'Eramo, P.C.
(Sandi Harris)
REQUESTED BY

CLEARED UP TO AND INCLUDING 1999 TAXES ONLY

RESEARCHED BY: Laurence Jacobs

TITLE: Rev. Clk. II

DATE: 9-21-07

VERIFIED BY:

TITLE:

DATE:

COLLECTOR NO.:

TERRITORY OF THE VIRGIN ISLANDS
DISTRICT OF ST CROIX

I, ALTHEA A. PEDRO, Recorder of said district, do hereby certify that the foregoing instrument contains a true and complete copy of Warranty Deed as same appears of record or on the file in P.C. 737 Page 58 No. 3998/00 of the records of St. Croix District, Virgin Islands. Given under my hand and seal this 12th day of July, 2013

ALTHEA A. PEDRO, RECORDER

Althea A. Pedro

FEE: $ 13.00

Spacer

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Doc# 2001002420 54310

#497
193657 +58
Ally Etto

DEED OF GIFT

INDENTURE made this 5th day of May, 2001, by SAMUEL GROUBY, General Delivery, Kingshill, St. Croix, U.S. Virgin Islands 00851, (hereinafter referred to as "Grantor"), and SAMUEL GROUBY as Trustee of the Grouby Family Trust dated May 25, 2001, General Delivery, Kingshill, St. Croix, U.S. Virgin Islands 00851, (hereinafter referred to as the "Grantee").

WITNESSETH:

That in consideration of the sum of Ten Dollars ($10.00) and other good and valuable consideration, the receipt whereof is hereby acknowledged, Grantor does hereby sell and convey unto the Grantee, and its successors and assigns thereto, all of the right, title and interest that Grantor has in or acquires in the future by inheritance and to the parcel of land, situate on St. Croix, Virgin Islands of the United States, to-wit:

> Plot 71-A (0.447 U.S. acre, more or less) of Estates Cane, Carlton & William's Delight, West End Quarter, as shown on PWD Drawing No. 2325-B dated July 1, 1971 and revised September 4, 1999;

TOGETHER with all the tenements, hereditaments and appurtenances thereunto belonging;

TOGETHER with all the rights of the Grantor in the premises;

SUBJECT TO all covenants, conditions, restrictions and easements, if any, as of record may appear.

TO HAVE AND TO HOLD the said described premises unto the said Grantee, or its successors and assigns with the unrestricted right to sell or encumber this property or to exercise any other rights provided by the Trust, in fee simple forever.

IN WITNESS whereof the Grantor has signed and acknowledged this Deed the day and year first above written.

488

Doc# 2001002420
Book: 764
Page: 489
Filed & Recorded
06/08/2001 03:42:08 PM
ALTHEA PEDRO
RECORDER OF DEEDS
ST CROIX
RECORDING FEE $ 31.00
PER PAGE FEE $ 2.00
ATTACHMENT FEE $ 0.00

Althea A. Pedro
Recorder

IN WITNESS:

x Samuel Grouby
SAMUEL GROUBY

ACKNOWLEDGMENT

TERRITORY OF THE VIRGIN ISLANDS)
DIVISION OF ST. CROIX) SS:

On this 25th day of May, 2001, before me personally appeared SAMUEL GROUBY, to me known and known to me to be the person described in and who executed the foregoing instrument, and he acknowledged to me that he executed the same freely and voluntarily for the uses and purposes therein stated.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

H. A. CURT OTTO
NOTARY PUBLIC NLP 98-20
ST. CROIX, U.S.V.I.
COMMISSION EXPIRES 8-20-2002

Notary Public

CERTIFICATE OF VALUE

IT IS HEREBY CERTIFIED that this is an intrafamily transfer and is exempt from stamp taxes pursuant to 33 V.I.C. §128(8). The value of the property for recording purposes does not exceed $19,500.00, but is exempt from transfer tax as this is an inter-family transfer from SAMUEL GROUBY to SAMUEL GROUBY as Trustee under Trust Agreement dated May 25, 2001, as per 33 V.I.C. §128(8)(2000).

x Samuel A Grouby

CERTIFICATE OF THE PUBLIC SURVEYOR

IT IS HEREBY CERTIFIED that, according to the records in the Office of the Public Surveyor, the property described in the foregoing instrument has not undergone any change in respect to boundary and area.

Office of the Public Surveyor, Christiansted, St. Croix, U.S. Virgin Islands.

Date: MAY 31 2001
Fee: 15.00

for: Bernadette C. Williams
Assistant Tax Assessor

489

Doc# 2001002420
Book: 764
Page: 488
Filed & Recorded
06/08/2001 03:42:08 PM
ALTHEA PEDRO
RECORDER OF DEEDS
ST CROIX
RECORDING FEE $ 31.00
PER PAGE FEE $ 3.00
ATTACHMENT FEE $ 2.50

Althea A Pedro
Recorder

AFFIDAVIT

IN SUPPORT OF STAMP TAX EXEMPTION ON THE TRANSFER OF PLOT 71-A ESTATES CANE, CARLTON & WILLIAM'S DELIGHT, ST. CROIX

I, SAMUEL GROUBY, being duly sworn, hereby state as follows:

1. I am the Grantor of the following-described real property situate in St. Croix, Virgin Islands of the United States, to-wit:

> Plot 71-A (0.447 U.S. acre, more or less) of Estates Cane, Carlton & William's Delight, West End Quarter, as shown on PWD Drawing No. 2325-B dated July 1, 1971 and revised September 4, 1999;

2. This transfer is being made to place the property into my *inter vivos* trust.

3. This transaction is exempt from transfer stamp tax pursuant to Title 33 V.I.C. §128(8), this being an intrafamily conveyance.

Dated: May 25, 2001

Samuel B Grouby
SAMUEL GROUBY, Grantor

ACKNOWLEDGMENT

TERRITORY OF THE VIRGIN ISLANDS)
)ss:
DISTRICT OF)

On this 25th day of May, 2001, before me personally came and appeared SAMUEL GROUBY, known to me to be the person described above and signed the foregoing instrument, and acknowledged to me that he executed the same freely and voluntarily for the uses and purposes therein expressed.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

H. A. CURT OTTO
NOTARY PUBLIC NLP 88-20
ST. CROIX, U.S.V.I.
COMMISSION EXPIRES 8-20-2002

Notary Public

Nichols Newman Logan & D'Eramo, P.C.
TRD-A-120

GOVERNMENT OF
THE VIRGIN ISLANDS OF THE UNITED STATES
~~~~~~~o~~~~~~
DEPARTMENT OF FINANCE
COMMERCIAL BUILDING #3
LAGOON COMPLEX, FREDERIKSTED
ST. CROIX, VI 00840

TREASURY DIVISION

TEL. NO: (340) 772-0120
FAX NO: (340) 772-5080

TO: THE RECORDER OF DEEDS

FROM: THE TREASURY DIVISION

IN ACCORDANCE WITH TITLE 28, SECTION 121 AS AMENDED, THIS CERTIFICATION THAT

THERE ARE NO REAL PROPERTY TAXES OUTSTANDING FOR John Noel

Plot 71-A, Estate Cane, West End Quarter

PARCEL NO. 4-09412-0417-00
CONTROL NO. 4-09412-0417-00

Nichols Newman Logan & D'Eramo, P.C.
(Sandi Harris)
REQUESTED BY

CLEARED UP TO AND INCLUDING 1999 TAXES ONLY

RESEARCHED BY: Lawrence Jacobs

TITLE: Enf. Off. II

DATE: 9-28-00

VERIFIED BY:

TITLE:

DATE: 9/29/00

COLLECTOR NO.: 8501

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4/91
~~~~~~~

TERRITORY OF THE VIRGIN ISLANDS
DISTRICT OF ST CROIX

I, ALTHEA A. PEDRO, Recorder of said district, do hereby certify that the foregoing instrument contains a true and complete copy of Deed of Gift as same appears of record or on the file in P.C. 764 Page 488 No. 2420/01 of the records of St. Croix District, Virgin Islands. Given under my hand and seal this 12th day of July, 2013

ALTHEA A. PEDRO, RECORDER

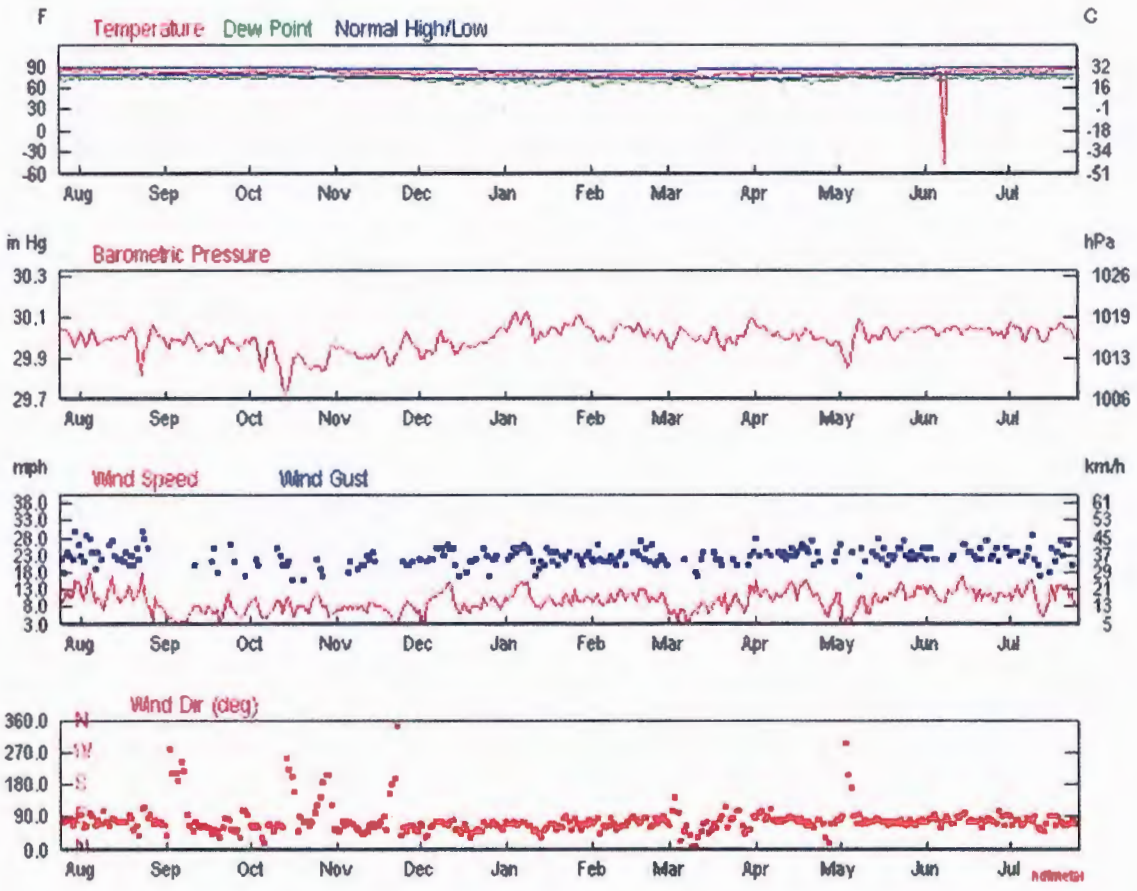
Althea A Pedro

FEE: $ 13.00

Exhibit 12

St. Croix, USVI (STX)

July 24, 2012 to July 24, 2013
Weather Conditions



Source: Weather Underground (Archives)

http://www.wunderground.com/history/airport/TISX/2012/7/24/CustomHistory.html?dayend=24&monthend=7&yearend=2013&req_city=NA&req_state=NA&req_statename=NA

EXHIBIT
tabbies
12

Exhibit 13

IN THE IOWA DISTRICT COURT FOR MUSCATINE COUNTY

LAURIE FREEMAN, JOSEPH PRESTON SHARON MOCKMORE, EUGENE W. MOCKMORE, BECCY BOYSEL, GARY D. BOYSEL, DARYLE SNYDER, LINDA L. GOREHAM, GARY R. GOREHAM, KELCEY BRACKETT and BOBBIE LYNN WEATHERMAN, Plaintiffs, vs. GRAIN PROCESSING CORPORATION, Defendant.	Case No. LACV 021232 RULING ON DEFENDANT'S MOTION FOR SUMMARY JUDGMENT

COURSE OF PROCEEDINGS

Plaintiffs commenced this lawsuit on April 23, 2012 in Muscatine County, Iowa alleging nuisance, negligence, and trespass by Defendant Grain Processing Corporation ("GPC"). Plaintiffs aver that their real and personal properties within a three-mile radius of Defendant's facility have been directly impacted by the continuous and increasing pollution by industrial methods and processes used by Defendant. The proposed class of Plaintiffs consists of approximately 17,000 individuals within a three-mile radius.

GPC is a corn-processing facility located in Muscatine, Iowa that engages in "corn wet milling." Through this process it transforms corn kernels into products for various commercial and industrial uses. This process involves the use of various acids

and chemicals, which results in the creation of by-products and chemicals that are subsequently released into the air.

Plaintiffs' Petition alleges that Defendant's operations release particulate matters and other harmful substances into the air and that it "has failed and refused to follow accepted industry standards of care, including appropriate maintenance, housekeeping and safety measures, pollution controls, and the utilization of available technology to eliminate or drastically reduce the adverse effects of its production activities on the neighboring community." (Pls.' Amended Class Action Pet. Para. 2.) It claims that Defendant uses outdated technologies that are ineffective in reducing levels of air pollution. (*Id.*) Plaintiffs also claim that the polluting particles and chemicals settle onto nearby homes, schools, and churches, noxious odors waft through the community causing them "to suffer persistent irritations, discomforts, annoyances and inconveniences" and putting them "at risk for a (sic) serious health effects" and diminishing their use and enjoyment of their property. (*Id.*) Plaintiffs assert claims pursuant to statutory and common law nuisance, trespass, and negligence. Plaintiffs deny that they are bringing their claims under the federal or state Clean Air Acts. Plaintiffs seek damages to remediate their properties, compensation for the loss of use and enjoyment of their properties, punitive damages, and possible injunctive relief.

Multiple motions have been filed in this case since its inception less than a year ago. On June 20, 2012, Defendant filed a Motion for a *Lone Pine*[1] case management

[1] In *Lone Pine*, the court required plaintiffs to provide reports from physicians and medical experts in order to support their claim of injury and causation from the Lone Pine landfill before discovery commenced. *Lore v. Lone Pine Corp.*, L-33606-85, 1986 WL 637507 (N.J. Super. Ct. Law Div. Nov. 18, 1986).

order, which was denied by ruling of this Court. Defendant also filed a Motion to Disqualify Plaintiffs' Attorney James C. Larew based on a purported conflict of interest between Larew's former employment as general counsel for Governor Chet Culver and the present action. This motion was denied on September 26, 2012. On October 9, 2012, Defendant filed a Motion for a Case Management Order. As a result, a hearing for class certification was scheduled for October 23, 2013, as well as other deadlines to facilitate management of the case.

On December 21, 2012, Defendant filed a Motion for Summary Judgment centered on preemption of Plaintiffs' claims by existing federal and state regulations. Plaintiffs filed their resistance to the Defendants' motion on February 4, 2013. Defendants replied to this resistance on February 20, 2013. Oral argument was heard on March 18, 2013. The Plaintiffs requested the Court allow them to file an amended petition which the Court granted since Defendant did not resist.

ANALYSIS

I. Summary Judgment Standard

Summary judgment is appropriate only "if the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to a judgment as a matter of law." Iowa R. Civ. P. 1.981(3) (2013). In reaching summary judgment, the court must review the record in the light most favorable to the non-moving party. *Wright v. American Cyanamid Co.*, 599 N.W.2d 668, 670 (Iowa 1999). The moving party must meet its burden to show the absence of a genuine issue of material

fact. *Id.* If the federal preemption doctrine applies, summary judgment is appropriate because it would deprive the court of subject matter jurisdiction. *Id.* at 671. But, summary judgment is not appropriate if reasonable minds could differ on how an issue should be resolved. *Id.* at 670.

II. Environmental Regulation under the Clean Air Act

The Clean Air Act ("CAA") was enacted in 1970 and is a comprehensive federal law that regulates air emissions under the Environmental Protection Agency ("EPA"). Congress enacted the law in response to evidence of the increasing amount of air pollution created by the industrialization and urbanization of the United States and its threat to the public health and welfare--including agriculture, property, and air and ground transportation. 42 U.S.C. § 7401(a)(1) (2012). The CAA states that air pollution prevention and control is the primary responsibility of individual states and local government, but that federal financial assistance and leadership is essential to accomplish these goals. § 7401(a)(3)-(4).

The EPA Administrator ("Administrator") maintains a list of air pollutants, which include "emissions of which, in his judgment, cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare." § 7408(a)(1)(A). He or she then issues "air quality criteria," which reflects the latest scientific knowledge on the adverse effects of the pollutant and the variables that can interact with the pollutant to make it better or worse. § 7408(2). The Clean Air Act also authorizes the Administrator to establish national primary and secondary ambient air quality standards ("NAAQS"). "Ambient" air is defined as "that portion of the

atmosphere, external to buildings, to which the general public has access." 40 C.F.R. § 50.1. "Primary NAAQS are intended to protect individuals, while Secondary NAAQS are set to protect the surrounding environment." *N. Carolina, ex rel. Cooper v. Tennessee Valley Authority*, 615 F.3d 291, 299 (4th Cir. 2010). The NAAQS currently regulate sulfur dioxide, particulate matter, carbon monoxide, ozone, nitrogen oxides, and lead. 40 C.F.R. §§ 50.4-50.13.

A. State Implementation Plans

Each state is then responsible for adopting and submitting to the EPA for approval a plan for implementation, maintenance, and enforcement of the NAAQs within the state. § 7410(a)(1). These plans are referred to as State Implementation Plans or "SIPs." *Id.* The SIPs cannot be adopted by the state until after reasonable notice and public hearing. *Id.* The SIPS are required to have several general elements set forth in 42 U.S.C. § 7410(a)(2). After the SIP is approved by the EPA, it is identified in 40 C.F.R. Part 52—Approval and Promulgation of Implementation Plans. The EPA is then authorized to take action against alleged violators. § 7413. Iowa's State Implementation Plan is set forth in the Iowa Administrative Code §§ 567-20.1-567-34.229.

The governors of each state must also submit to the Administrator a list of all areas in their state classified as either "attainment" or "nonattainment," or "unclassifiable," based on whether they have complied with NAAQS. § 7407(d). "Nonattainment" refers to an area that does not meet the primary or secondary NAAQs (or contributes to poor air quality in a nearby area). *Id.* "Attainment" is used to classify areas that meet the NAAQs. *Id.* "Unclassifiable" refers to areas that the governor does

not have sufficient evidence about to make a classification. *Id.* SIPs must include specific requirements for nonattainment areas, which are set forth in Part D of Title 1 of the CAA. 42 U.S.C. Ch. 85, Subch. I, Pt. D, Subpt. 1.

B. Department of Natural Resources Regulatory Process

The Iowa Department of Natural Resources ("DNR") is vested with the primary responsibility of protecting the environment in Iowa. Iowa Code § 455A.2 (2013). The governor appoints a Director who is in charge of running the DNR. § 455A.3. The Director is required to be knowledgeable in the general field of natural resource management and environmental protection. *Id.* An environmental protection commission ("commission") of nine members is also appointed by the governor. § 455A.6. Generally, the commission's duties include setting policy for programs under the DNR, advising other agencies of the state, engaging in rulemaking, and issuing orders and directives to ensure the administration of the DNR's programs. § 455B.105.

Section 455B, Division II specifically governs the DNR's regulation of air quality in Iowa. The commission has the responsibility to abate, control, and prevent air pollution. § 455B.133. The commission has extensive duties set out in § 455B.133, including developing comprehensive plans and programs, setting ambient air quality standards and emission limitations, and adopting rules consistent with the CAA's requirement that owners or operators of an air containment source obtain an operating permit. *Id.* The standards adopted under section 455B for air contaminant sources may not exceed the standards promulgated by the EPA administrator or the requirements of the Clear Air Act. § 455B.133(4).

The Director of the DNR has statutory duties in regards to air quality as well. § 455B.134. The Director publishes and administers the rules and standards established by the commission. *Id.* He or she also provides technical or scientific support to the commission and other agencies and administers permits for air contaminant sources. *Id.* Furthermore, the Director conducts studies, considers complaints, disseminates information, and holds public hearings in order to facilitate the protection of Iowa's air quality. *Id.*

Additionally, a citizen may commence a civil action in district court against an alleged violator of Chapter 455B. § 455B.111. The person must give at least sixty (60) days notice to the alleged violator and the Director prior to commencing the action. *Id.* However, a civil action may not be commenced if the DNR is already prosecuting a civil action or otherwise negotiating with the alleged violator to abate the violation. *Id.*

III. Preemption of Common Law Claims by the CAA

Defendant argues in its Motion for Summary Judgment that Plaintiffs' common law claims should be dismissed because they are preempted by the Clean Air Act and accompanying state laws. Defendant does not argue that the CAA expressly preempts these claims, but that they are impliedly precluded by field and conflict preemption principles. "Although courts should not lightly infer pre-emption, it may be presumed when the federal legislation is sufficiently comprehensive to make reasonable the inference that Congress 'left no room' for supplementary state regulation." *International Paper Co. v. Ouellette*, 479 U.S. 481, 491 (1987) (citations and quotation marks omitted). A state law is also invalid if it conflicts with federal law and "stands as an obstacle to the

accomplishment and execution of the full purposes and objectives of Congress." *Id.* at 491-92.

In 2010, the Fourth Circuit Court of Appeals rejected a state law public nuisance claim against power plants based on federal preemption. *Tennessee Valley Authority*, 615 F.3d at 296. In pertinent part, the court stated that:

> A field of state law, here public nuisance law, would be preempted if a scheme of federal regulation is so pervasive as to make reasonable the inference that Congress left no room for the States to supplement it. Here, of course, the role envisioned for the states has been made clear. Where Congress has chosen to grant states an extensive role in the Clean Air Act's regulatory regime through the SIP and permitting process, field and conflict preemption principles caution at a minimum against according states a wholly different role and allowing state nuisance law to contradict joint federal-state rules so meticulously drafted.

Id. at 303 (citations and quotation marks omitted). The court also noted that allowing district courts to hear these cases would result in a "balkanization of clean air regulations and a confused patchwork of standards, to the detriment of industry and the environment alike." *Id.* at 296.

In June 2011, the United States Supreme Court ruled in *American Electric Power Co., Inc. v. Connecticut*, 131 S. Ct. 2527 (2011), that the Clean Air Act displaces any federal common law right to seek abatement of carbon dioxide emissions from fossil-fuel fired power plants. *Id.* at 2530. The Court's holding rested on the test for federal preemption of federal common law, which requires only that congressional legislation "speaks directly to the question at issue." *Id.* at 2537 (citations omitted). It found that the CAA "speaks directly" to emissions from the defendant's plant and therefore the plaintiffs could not bring federal common law claims to address these same issues. *Id.*

The Court remarked that the EPA "is surely better equipped to do the job than individual district judges issuing ad hoc, case-by-case injunctions" because federal judges lack the expertise and means to make such decisions. *Id.* at 2539-40. However, it refrained from ruling on state common law claims because the parties did not brief state preemption issues, but stated that the availability of state lawsuits depends "on the preemptive effect of the federal Act." *Id.* at 2540.

With that question left unanswered by *American Electric Power*, federal courts have used the opinion's reasoning to determine whether state common law claims are preempted by the CAA. In *Bell v. Cheswick Generating Station*, No. 2:12-cv-929, 2012 WL 4857796 (W.D. Pa. Oct. 12, 2012), the plaintiffs brought a class action lawsuit against a coal-fired power plant, which they claimed deposited air emissions on their nearby property. *Id.* at *1. Plaintiffs sought compensatory and punitive damages under the common law theories of nuisance, negligence and recklessness, trespass, and strict liability, as well as injunctive relief. *Id.* at *2.

After the defendants brought a motion to dismiss based on preemption by the Clean Air Act and the Political Question Doctrine, the plaintiffs argued that (1) the savings clause in the citizen suit provision of the CAA preserved their right to bring suit, (2) that their complaint did not attack emissions standards, (3) that their claim was justiciable because "protection can be 'judicially molded' in this case just as it is molded in any other action to protect property rights", and (4) that they were not attempting to challenge the regulations of Cheswick's emissions in any way. *Id.* at *3.

In response, the defendant argued that the plaintiffs' complaint explicitly required the court to regulate Cheswick Generating Station's air emissions. *Id.* at *4. They cited the complaint's references to alleged permit violations as support that the plaintiffs were asking the court to regulate Cheswick's activities when they were already regulated by state and federal law. *Id.* The defendants also argued that the savings clause did not save the plaintiffs' claims because state environmental agencies "must now be afforded deference and that 'duality' with regard to federal and state common law claims has been ended." *Id.*

In *Bell,* the court found that the Cheswick Generating Station was extensively regulated by the EPA, Penn Department of Environmental Protection, and the Allegheny County Health Department to ensure compliance with the Clean Air Act. *Id.* at *5. The court also highlighted certain excerpts from the plaintiffs' complaint in support of its finding that the plaintiffs were asking the court to review emissions standards that were already regulated by administrative bodies. *Id.* These highlights included assertions that the Defendant's operation of the facility "has been the subject of numerous and constant complaints," Defendant "knew...or allowed the improper constructions, or maintenance and operation of the facility" and "knowingly continues to operate the...plant without proper or best available technology," and as a result, "Plaintiffs' person and[/]or property has been invaded by particulates and contaminants." *Id.*

The *Bell* court relied on *American Electric Power* and *Tennessee Valley Authority* in support of its finding that the plaintiffs' claims were preempted by the Clean Air Act.

Id. at *8. It noted that although *American Electric Power* did not address state common law nuisance claims, the Supreme Court had held that the Clear Air Act preempted federal common law nuisance claims because the EPA was better suited than a district judge to deal with air emission issues. *Id.* at *8. The *Bell* court also relied on *Tennessee Valley Authority's* caution against allowing state nuisance law to "contradict joint federal-state rules so meticulously drafted." *Id.* Thus, the *Bell* court dismissed the plaintiffs' claims because "[t]o conclude otherwise would require an impermissible determination regarding the reasonableness of an otherwise government regulated activity." *Id.*

Other district court cases decided since *American Electric Power* have followed the same reasoning as *Bell v. Cheswick Generating Station* and dismissed state common law claims based on preemption. *Comer v. Murphy Oil U.S.A., Inc.*, 839 F.Supp.2d 849 (S.D. Miss. 2012) held that the Clean Air Act preempted property owners' common law nuisance, trespass, and negligence claims against an oil company because the determination of whether the companies' emissions were "reasonable," as well as "what level of reduction is practical, feasible, and economically viable" had been entrusted by Congress to the EPA. *Id.* at 864. It did not matter to the court that the plaintiffs were not asking for injunctive relief and only compensatory and punitive damages, because it would have to make "reasonableness" determinations either way. *Id.* Another case from the Western District of Pennsylvania dismissed a public nuisance claim against a coal-fired power plant because "both the federal Clean Air Act and the Pennsylvania Air Pollution Control Act represent comprehensive statutory and

regulatory schemes that establish the standards by which...power plants must reduce their emissions of air pollutants." *United States v. EME Homer City Generation L.P.*, 823 F. Supp. 2d 274, 297 (W.D. Pa. 2011).

In their amended petition, Plaintiffs have pleaded claims in nuisance, negligence and trespass against the Defendant. The grounds for these actions arise from the Plaintiffs' allegations that:

> Defendant ... has used, and continues to use outworn machineries, outdated manufacturing technologies and outworn pollution-abating technologies. The result is that polluting chemicals and particles are released and blown from the facility onto nearby homes, schools, businesses and churches. Particulate matter, in the form of soot, is visibly deposited on and around these structures and upon plaintiffs' properties, yards and grounds. Chemical emissions carry noxious odors throughout the community. These emissions have caused Plaintiffs and their neighbors to suffer persistent irritations, discomforts, annoyances and inconveniences, put them at risk for a serious health effects (sic), and generally diminished Plaintiffs' ability to use and enjoy their properties.

(Pls.' Amended Pet. Para. 2.) They further allege that Defendant's practice of the corn wet milling process "generates hazardous by-products and harmful chemicals, including but ... not limited to particulate matter, volatile organic compounds including acetaldehyde and other aldehydes, sulfur dioxide, starch, and hydrochloric acid, which are released into the atmosphere." (*Id.* at Para. 5.) The Plaintiffs amended petition dispensed with the much more specific allegations of their original petition, such as the allegation that "Defendant has violated the Federal Clean Air Act in all twelve of the last twelve quarters. In the past five quarters, the EPA has designated Defendant as a 'High Priority Violator' under the Federal Clean Air Act." (Pls.' Original Class Action Pet. Para. 16, April 23, 2012.)

Like the plaintiffs in *Bell*, Plaintiffs contend that Defendant knowingly refuses to limit its air emissions and as a result has invaded their persons and property with particulate matter and other pollutants. (Pls.' Amended Pet. Para. 2.) Essentially Plaintiffs are asking the jury to make a judgment about the reasonableness of Defendant's air emissions. As the *Comer* court found, that is a judgment that has been entrusted by Congress to the EPA. Even as to Plaintiffs' claims for compensatory and punitive damages, the jury will have to make determinations as to whether Defendant's air emissions are reasonable. As the Supreme Court recognized in *American Electric Power*, the EPA is better equipped to make these decisions than district court judges or juries.

Similarly, the regulation of air emissions is not within the proper province of this Court when Congress has already prescribed a method for dealing with GPC's air emissions through the Clean Air Act and the DNR's role in carrying out the CAA. Although GPC may be in "nonattainment" with the NAAQs, the DNR has already taken action[2] and continues to take action to bring it within attainment of these standards. Furthermore, citizens can be involved in the rulemaking process and are entitled to notice, comment, and even public hearing before a conditional or construction permit can be issued to a major stationary source. Iowa Admin. Code r. 11-6.5(17A); Iowa Admin. Code r. 567-22.2(455B). They can also sue under the citizen suit provision of the CAA for a violation of an emission standard. 42 U.S.C. § 7604. To

[2] The State of Iowa filed a petition seeking civil penalties and injunctive relief more than a year ago. State of Iowa, ex rel., Iowa Department of Natural Resources v. Grain Processing Corp., No. CVCV 020979 (Dist. Ct. of Muscatine Cty filed December 1, 2011).

permit citizens to sue under the common law as well would conflict with these already established statutory procedures. Accordingly, this Court finds that Plaintiffs' claims are preempted because they conflict with the comprehensive regulatory scheme of the Clean Air Act.

IV. Savings Clause of the CAA

Plaintiffs argue that their common law claims are preserved under the CAA's general savings clause. When determining whether a savings clause preserves certain actions, the court must look to the goals and policies of the Act in determining whether the Act preempts any such action. *Ouellette*, 479 U.S. at 493. As mentioned previously, a state law action is pre-empted if it interferes with the methods by which the federal statute was designed to reach its goal. *Id.* at 494. It can also be preempted if Congress "left no room" for state action. *Tennessee Valley Authority*, 615 F.3d at 303.

In *Ouellette*, the Supreme Court held that Vermont landowners could not sue the operator of a New York paper mill under the Vermont common law of nuisance. 479 U.S. at 481. In *Ouellette*, the applicable savings clause appeared in the Clean Water Act. It stated:

> [N]othing in this chapter shall (1) preclude or deny the right of any State or political subdivision thereof or interstate agency to adopt or enforce (A) any standard or limitation respecting discharges of pollutants, or (B) any requirement respecting control or abatement of pollution; except that if [a standard] is in effect under this chapter, such State or political subdivision or interstate agency may not adopt or enforce any [standard]which is less stringent than the [standards] under this chapter.

33 U.S.C. § 1370. The Act also included a citizen suit provision that stated: "Nothing in this section shall restrict any right which any person (or class of persons) may have under any statute or common law to seek enforcement of any effluent standard or limitation or to seek any other relief." 33 U.S.C. § 1365. The Court found that Congress "left room" for state causes of action through the savings clause, but that regulation via Vermont law over a New York pollutant would disrupt the balance of public and private interests and undermine Congress's intent in crafting the EPA regulatory structure. *Ouellette*, 479 U.S. at 495-96. The Fourth Circuit applied this same reasoning to the Clean Air Act in *Tennessee Valley Authority* when it held that a North Carolina district court could not apply North Carolina law to Alabama and Tennessee generating plants. 615 F.3d at 296. "We... cannot allow non-source states to ascribe to a generic savings clause a meaning that the Supreme Court in *Ouellette* held Congress never intended." *Id.* at 304.

Nevertheless, in *Ouellette* the Court held that the Clean Water Act did not preclude common law nuisance claims pursuant to the law of the "source state" or state where the polluter was located. 479 U.S. at 485. The Court found that a nuisance action brought under New York law against the New York paper mill would not frustrate the goals of the CWA. *Id.* at 498. It stated that the Act "specifically allows source States to impose stricter standards" and although state nuisance law may set standards different from the EPA's permit program for the discharge of pollutants into navigable waters, "a source only is required to look to a single additional authority, whose rules should be relatively predictable." *Id.* at 499.

But in *Bell v. Cheswick Generating Station*, the district court declined to allow common law claims under the savings clause of the Clean Air Act. 2012 WL 4857796 at *9. The savings clause used by the plaintiffs in *Bell* was part of the CAA's citizen suit provision, which states that "[n]othing in this section shall restrict any right which any person (or class of persons) may have under any statute or common law to seek enforcement of any emission standard or limitation or to seek any other relief (including relief against the Administrator or a State agency)." 42 U.S.C. § 7604(e). The court relied on *Tennessee Valley Authority's* conclusion that allowing states to rely on the savings clause to bring common law claims would "be a serious interference with the achievement of the full purposes and objectives of Congress." *Bell*, 2012 WL 4857796 at *9 (*citing Tennessee Valley Authority*, 615 F.3d at 304). The *Bell* court also pointed to the U.S. Supreme Court's previous statement that "a federal statute's saving clause cannot in reason be construed as allowing a common law right, the continued existence of which would be absolutely inconsistent with the provisions of the act. In other words, the act cannot be held to destroy itself." *Id., citing AT&T Mobility LLC v. Concepcion*, 131 S. Ct. 1740, 1748 (2011) (citations, alterations, and quotation marks omitted). Thus, the plaintiffs' claims in *Bell* for monetary damages and injunctive relief were dismissed as inconsistent with the CAA's existing remedies to limit air emissions. *Id.* This ruling is consistent with the Supreme Court precedent on savings clauses. A savings clause "does not bar the ordinary working of conflict pre-emption principles." *Geier v. American Honda Motor Co., Inc.*, 529 U.S. 861, 869 (2000). In fact, the Supreme Court regularly refuses to "give broad effect to saving clauses where doing so would upset the

careful regulatory scheme established by federal law." *Id.* (further citations omitted). Thus, where conflict preemption principles warrant dismissal, a savings clause cannot rescue. *See id.* In this case, Plaintiffs cite to a section entitled "Retention of State Authority" under Part A: Air Quality and Emissions Limitations, which states that:

> [N]othing in this chapter shall preclude or deny the right of any State or political subdivision thereof to adopt or enforce (1) any standard or limitation respecting emissions of air pollutants or (2) any requirements respecting control or abatement of air pollution; except that if an emission standard or limitation is in effect under an applicable implementation plan or under section 7411 or section 7412 of this title, such State or political subdivision may not adopt or enforce any emission standard or limitation which is less stringent than the standard or limitation under such plan or section.

42 U.S.C. § 7416. They argue that with this clause, as well as with the other savings clauses included in the CAA, "Congress clearly and expressly provided that States are free to adopt stricter laws and apply them to pollution sources within the State." This clause is similar to the savings clause in the Clean Water Act, which the Court held preserved state common law nuisance claims pursuant to state law of the pollutant's source in *Ouellette*. Although the Court in *Ouellette* found that state common law claims would not frustrate the purposes of the Clean Water Act, the same cannot be said in this case. As the court acknowledged in *Bell*, common law suits interfere with the achievement and full purposes of the Clean Air Act. Congress has enacted a comprehensive scheme to regulate air emissions and has afforded states a large part in its enforcement. Thus, a savings clause preserving the State's prerogative to regulate its in-state emissions more stringently than the CAA cannot be construed to also preserve a common law right of action. To do so would contravene conflict preemption principles

and undermine the carefully crafted statutory and regulatory scheme they were meant to protect. To allow Plaintiffs to bring a common law action here would be inconsistent with the CAA's existing remedies to limit Defendant's air emissions.

V. Political Question Doctrine

Defendant also asserts that the claims Plaintiffs present to the Court are barred by the political question doctrine. "The political question doctrine excludes from judicial review those controversies which revolve around policy choices and value determinations constitutionally committed for resolution to the halls of Congress or the confines of the Executive Branch." *Japan Whaling Association v. American Cetacean Society*, 478 U.S. 221, 230 (1986). The U.S. Supreme Court has set forth a list of elements that make a claim non-justiciable.:

> (1) a textually demonstrable constitutional commitment to a coordinate political department; or (2) a lack of judicially discoverable and manageable standards for resolving [the issue]; or (3) the impossibility of deciding without initial policy determination of a kind clearly for nonjudicial discretion; or (4) the impossibility of a court's undertaking independent resolution without expressing lack of respect to coordinate branches of the government; or (5) an unusual need for unquestioning adherence to a political decision already made; or (6) the potentiality for embarrassment from multifarious pronouncements by various departments on one question.

Baker v. Carr, 369 U.S. 186, 217 (1962). *Comer* also dealt with the issue of the political question doctrine and the Clean Air Act. "It is unclear how this Court or any jury, regardless of its level of sophistication, could determine whether the defendants' emissions unreasonably endanger the environment or the public without making policy determinations that weigh the harm caused by the defendants' actions against the

benefits of the products they produce." *Comer*, 839 F. Supp. 2d at 864. Therefore, the court found the claims nonjusticiable because there were no judicially feasible standards for resolving issues that had already been entrusted to the EPA to resolve. *Id.* at 865.

Similarly, in this case, the court or a jury lacks judicially discoverable and manageable standards for resolving the complex environmental issues involved in this case. It would also be required to make policy determinations concerning GPC's costs and benefits to the surrounding community of Muscatine. The Court finds that these decisions have been entrusted by Congress to the EPA and that they are not properly reviewed in district court.

VI. State Preemption under § 455B

Defendant argues that Plaintiffs' claims are further precluded via preemption by state law, but the Plaintiff disputes the characterization and thus the applicability of the Defendant's cited authorities. Plaintiffs have styled their claims as common law actions, but include a statutory nuisance action under Iowa Code § 657.1. Iowa's statutory provisions regarding nuisance are merely "skeletal in form" and do not modify the existing common law. *Martins v. Interstate Power Co.*, 652 N.W.2d 657, 660 (Iowa 2002). Thus, the question is whether statutory and common law claims conflict with the state's air quality regulations embodied in Iowa Code § 455B. Whether this conflict is analyzed under the preemption doctrine or via rules of statutory construction, the result is the same.

Even if nuisance is statutory, whenever there is conflict or ambiguity between specific and general statutes, the specific statutes govern. *Oyens Feed & Supply, Inc. v.*

Primebank, 808 N.W.2d 186, 194 (Iowa 2011). But as to common law claims, "[w]here the legislature has provided a comprehensive scheme for dealing with a specified kind of dispute, the statutory remedy provided is generally exclusive." *Van Baale v. City of Des Moines*, 550 N.W.2d 153, 156 (Iowa 1996), *quoting* 1A C.J.S. *Actions* § 14 n. 55 (1985). Thus, the far more specific air quality provisions of § 455B, which via rulemaking govern the types of emissions released by GPC, must supplant the "skeletal" nuisance statute if it is used to regulate the same conduct. Furthermore, the comprehensive scheme created by § 455B creates statutory remedies regarding a specific kind of dispute: namely the discharge of deleterious emissions into the neighboring community. The bottom line is, deciding whether a lawful industry's operation constitutes a nuisance requires judging "the reasonableness of conducting it in the manner, at the place and under the circumstances in question." *Bates v. Quality Ready-Mix Co.*, 154 N.W.2d 852, 857 (Iowa 1967). The determination of "reasonableness" of emissions has been entrusted to government agencies because of their superior information-gathering resources. *American Electric Power*, 131 S. Ct. at 2539-40. While the Supreme Court refrained from ruling on state common law claims,[3] this court is left with the inescapable conclusion that its reasoning applied here precludes state common law claims as well. And just like the analysis above, the savings clause at § 455B.111 cannot rescue a common-law claim that would subvert the overall goals of the statute. *See Geier*, 529 at 869. For all the same reasons listed in the federal preemption analysis

[3] The Court declined to analyze state common law claims because none of the parties briefed the issue and thus, it was left for consideration upon remand. *American Electric Power Co., Inc.*, 131 S. Ct. at 2540.

above, the state's environmental regulations must necessarily govern in place of common law rights.

RULING

Plaintiffs claim they are damaged by air pollution emanating from the Defendant's facilities. Indeed, their expert's report of his observations inside the plant reveals troubling signs of such pollution:

> Over the past decade, GPC's compliance record has been poor. It has operated without careful monitoring of its discharges to air, without controlling its point source discharges for long periods of time, without investing in modern pollution controls, without conducting stack testing which is mandatory to demonstrating that pollution controls are effective, without controlling many fugitive emissions, without controlling spills and leaks in parts of its operations, without performing maintenance on pollution controls, bypassing pollution controls and discharging toxic chemicals uncontrolled into the atmosphere, not meeting reporting deadlines, at times not reporting emissions and major discharges to air, and by ignoring many other best practices that are required to be followed under its Title V permit.

(Pls.' Ex. A Pg. 6, attached to Motion for Leave to Submit Full Report.) The expert observed leaking valves, pumps and unions that "are sources of volatile, odorous and corrosive fugitive emissions which expose both workers and the community." (*Id.* at 11.) He reported "horrible neglect" of dryer units, "antiquated" control rooms and "a complete breakdown of environmental awareness and safety" in management operations. (*Id.*) If half the expert's findings are true, there has been blatant disregard for the environment and the community of Muscatine. The report also indicates that the above deficiencies have gotten worse in 2012, which is after the civil action was filed by the DNR.

However, the Clean Air Act, as implemented by the Iowa SIP and enforced by the Iowa DNR is the congressionally and legislatively determined method for balancing the harm done to the Plaintiffs and the community with the economic impact placed on the Defendant and its secondary effect on the community. If Plaintiffs' common law action was successful in obtaining an injunction specifying what GPC must do to remedy these problems and obtain substantial monetary compensation, this outcome may, and probably would, interfere with or contravene the DNR remedies for these very issues which are being litigated in Muscatine County. Congress, through the EPA, and the State of Iowa, through the DNR regulations, have comprehensively addressed these issues in a uniform manner. These regulations and statutes are designed to protect not only the citizens of this State, but also protect the alleged polluter from multiple court decisions which may conflict with each other as well as the agency enforcement protocols.

Of course, as pointed out by Plaintiffs, the downside of this agency approach is that it may not remedy the harm each individual plaintiff or class member may incur as a result of the polluter's actions or inactions. An individual's right to remedy wrongs through the courts via common law or statutes is the basis of our legal system. But when an individual's rights to seek damages for economic or physical harm conflict with the economic well-being of a large local employer, those rights must be carefully weighed and reconciled through political compromises achieved by the legislative and rule-making processes. The federal cases addressing these issues after *American Electric Power Co. v. Connecticut* have uniformly ruled that the statutes and regulations which

have been developed over decades through the legislative and regulatory process represent a much more thorough, comprehensive and uniform approach to the pollution problem than myriad court decisions could ever do.

The Supreme Court's reasoning regarding federal common law in *American Electric Power Co.* must be applied to lawsuits filed under state common or statutory law when they conflict with the purpose of the Clean Air Act and the State SIP. To do otherwise would allow the same regulatory patchwork proscribed by the U.S. Supreme Court.

IT IS THEREFORE THE RULING OF THIS COURT that Defendant's Motion for Summary Judgment is granted and this case is dismissed.

Dated this 27th day of March, 2013.

Mark J. Smith, District Court Judge
Seventh Judicial District, State of Iowa

Exhibit 14

SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

FINAL DRAFT STAFF REPORT FOR

New Draft Rule 4695 (Brandy Aging and Wine Aging)

August 20, 2009

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I. SUMMARY

A. Reasons for Rule Development and Implementation

The California Air Resources Board (ARB) and United States Environmental Protection Agency (EPA) classified the San Joaquin Valley Air Basin (SJVAB) as severe and serious non-attainment area for the state and federal ozone standards, respectively. In accordance with Federal Clean Air Act (CAA) requirements for non-attainment areas, the San Joaquin Valley Unified Air Pollution Control District (District) adopted the 2007 Ozone Plan to establish the strategy for attaining the federal eight-hour ozone standard. That plan is comprised of regulatory and incentive-based measures to reduce emissions of nitrogen oxides (NOx) and volatile organic compounds (VOC), which are the precursors to ground-level ozone.

The 2007 Ozone Plan contains a commitment to develop a control measure for VOC emissions from brandy aging and wine aging operations. Emission controls have already been installed on most of the large brandy aging operations as an emission reduction measure to comply with the requirements of Rule 4694 (Wine Fermentation and Storage Tanks), to which these emission reductions are credited. In addition to controlling VOC emissions from brandy aging operations, this control measure would require Reasonably Available Control Technology (RACT) controls on wine aging operations at Major Sources.

As stated in the 2007 Ozone Plan possible cost effective emission reductions could be achieved for brandy aging through adding emission control technologies. Such

additional technologies are considered to be beyond RACT but are not yet achieved in practice for these operations. After a more extended operational period and a determination that there would be no adverse impact on either the aging operation or the quality or consistency of the product, the District may revisit this for Best Available Control Technology (BACT) for new or modified sources. The identified control technologies are considered to be applicable to the aging of wine as well as to brandy since the basic process of aging in wooden tanks or barrels in a warehouse is very similar. Major differences exist in the level of emissions, between the two operations and the impact of this difference on technology transfer was examined by this project.

The proposed rule will fulfill the District's 2007 Ozone Plan commitment for control measure S-IND-14 (Aging of Brandy and Wine) in an effective, practicable, technologically feasible, and economically reasonable method, as determined by the District's Governing Board. This rule will also satisfy SIP commitments with the requirement of emission controls which help produce Reasonable Further Progress (RFP) for the Attainment Demonstration; will reduce emissions that are quantifiable, surplus, real, and enforceable; and will satisfy the federal requirement to design a plan to achieve ozone attainment.

B. Climate Change

The California Global Warming Solutions Act of 2006 (AB 32) created a comprehensive, multi-year program to reduce greenhouse gas (GHG) emissions in California, with the overall goal of restoring emissions to 1990 levels by the year 2020. In the coming years, ARB and the Legislature will be developing policies and programs to implement AB32.

The District believes that the evidence and the rationale that climate change is occurring is compelling and convincing. In addition to the long-term consequences of climate change, the District is concerned with the potential ramifications of more moderate but imminent changes in weather patterns. The Valley depends heavily on agriculture for its economy. Unanticipated and large fluctuations in these patterns could have a devastating effect on the Valley's economy.

While there are many win-win strategies that can reduce both GHG and criteria/toxic pollutant emissions, when faced with situations that involve tradeoffs between the two, District staff believes that the more immediate public health concerns that may arise from criteria or toxic pollutant emissions should take precedence.

C. Description of the Project

This proposed new rule would codify the requirement for Best Available Retrofit Control Technology (BARCT) and Reasonably Available Control Technology (RACT) VOC emission controls and management practices which have been employed by wine fermentation operators under Rule 4694's alternative emission reduction option. This

rule would specify RACT for major sources as the means to achieve the maximum amount of VOC emission reductions by using control technologies that are reasonably available. Any VOC emissions reduction from the control of brandy aging have already been accounted for by Rule 4694 and are not considered to be additive for SIP purposes.

This rule applies to all brandy aging and wine aging facilities but exempts those facilities which have a Stationary Source Potential to Emit of less than 10 tons per year since they are not Major Sources. The federal Clean Air Act (CAA) requires all operations at Major Sources to have RACT, so controls for aging operations at those facilities are included in the rule, regardless of the size of the aging operation, as long as it is conducted at a Major Source. Separate thresholds for brandy aging and wine aging operations were determined based on operating characteristics, emissions, and a cost effectiveness analysis.

Existing brandy aging control systems have been installed and operating on four warehouses for almost two years, but, due to the brandy aging process length, this is not sufficient time to judge the impact of the controls on operations and product quality. Therefore, the compliance date has been set to allow for time to reexamine rule requirements if operational or product quality issues are deemed to be seriously detrimental. District staff reviewed rules from other air districts in California, gathered information from the Federal Alcohol and Tobacco Tax and Trade Bureau, the Wine Institute, and from individual stakeholders to serve as guidance and as information sources for rule development. District staff found that, at this time, there are no air districts in the nation that have regulations to control VOC emissions from brandy aging and wine aging operations.

The District staff understands that the nature of whiskey aging operations differs from wine and brandy aging. Specifically, the ambient conditions, such as storage temperature and humidity, as well as seasonal variations, are important factors in the whiskey aging process. All aging processes, depends upon the interaction of product in oak barrels, whiskey aging operations strive for a particular blend of temperature, humidity, and ventilation, leading to different types of warehouse. (Source: EPA, *Final Report: Emission Factor Documentation for AP-42, Section 9.12.3, Distilled Spirits, p. 2-7* (March 1997).) Therefore, whiskey aging is not considered or included in this rule development process.

D. Rule Development Process

As part of the rule development process, District staff conducted a series of public work shops on February 4, April 9, and June 17, 2009. At these meetings, District staff presented the objectives of the proposed rulemaking project and solicited comments and suggestions, which were then used to develop the rule and amend/augment the staff report.

Pursuant to state law, District staff is required to perform a socioeconomic impact analysis prior to the adoption, amendment, or repeal of a rule that has significant air quality benefits or that will strengthen emission limitations. As part of the District's socioeconomic analysis process, District staff sought representatives from interested groups to participate as members of a Socioeconomic Focus Group. The Focus Group assisted District staff in determining the appropriate method for gathering information on regulatory compliance costs and business impacts resulting from compliance with the rule. The results of the socioeconomic analysis were compiled into a report that was presented along with the refined version of the proposed rule to the public and interested parties during the final workshop on June 17, 2009. The date for the public hearing to consider adoption of the proposed rule amendments is September 17, 2009.

II. DISCUSSION

A. CURRENT REGULATIONS

There are no existing rules in the nation that require controlling VOC emissions from brandy aging and wine aging operations. Rule 4623 (Storage of Organic Liquids) limits VOC emissions from the storage of organic liquids. Although not identified as a rule deficiency, EPA expressed concern that the rule provides an exemption for tanks used in wine fermentation and storage of resulting products, by-products, and spirits. EPA considers VOC emissions from this source category to be significant and recommended further study and analysis.

District Rule 4694 (Wine Fermentation and Storage Tanks) requires installation and operation of VOC emission control system to reduce emissions from wine fermentation and storage operations. As an alternative to controlling the emissions from wine fermentation and storage tanks, Rule 4694 allows operators to mitigate fermentation emissions by controlling alternative emission sources, such as reductions in surplus emissions from mobile sources, area sources, or other stationary sources. In lieu of installing VOC control devices on wine fermentation tanks to fulfill the Rule 4694 requirements, operators voluntarily offered to control surplus emissions from brandy aging operations to obtain equivalent reductions which could then be creditable as Certified Emissions Reduction Credits (CER) under Rule 4694.

To attain the CER, operators of brandy aging facilities modified existing brandy aging warehouses to meet the requirements for a Permanent Total Enclosure as specified in EPA Test Method 204. This enabled ethanol emissions to be captured and destroyed using regenerative thermal oxidizer technology. Until the successful demonstration that the operation of the capture and control system will not result in unacceptable impacts on brandy quality, consistency, or volume loss, the conditions of the operating permits are provisional and subject to revisions. Operation of these controls has demonstrated that they are technologically feasible as VOC controls and are tentatively considered applicable to both wine aging and brandy aging, pending final determination of the controls impacts on these operations.

B. SUMMARY OF PROPOSED RULE

Proposed new Rule 4695 would implement a VOC control measure (S-IND-14) in the Ozone Plan. The draft rule would serve as a "backstop" measure to codify the control of VOC emissions from the aging of brandy which are currently being implemented by operators as an alternative compliance option in lieu of controlling the emissions from wine fermentation and storage in order to comply with Rule 4694 (Wine Fermentation and Storage). This proposed new Rule will require appropriate VOC control measures for wine aging operations which are currently uncontrolled. The rule applies to wine aging and brandy aging operations at Major Sources, which have a Potential To Emit of at least 10 tons VOC per year. If the facility is a Major Source, the rule requirements apply to that facility's brandy and wine aging operations, regardless of aging operation's size, container size, or container material type. The rule requires the brandy aging and wine aging operations to be assessed separately with independent thresholds and application of control technologies.

The major rule requirements include RACT, Additional RACT, and BARCT based on the throughput or emissions from the brandy aging or wine aging operations:

- For a facility with brandy or wine aging operation which has either an inventory or emissions less than Table 1 thresholds, operators must implement Reasonable Available Control Technologies (RACT) to include record keeping and work emission minimization practices. Such work practices include: prevent, minimize, and restrict the unnecessary occurrence of brandy or wine exposure to the atmosphere; prevent, minimize, and restrict the occurrence of leaks and spills; implement immediate clean up of leaks and spills by rinsing leaks or spills with water and washing the rinse into a proper drain; and implement immediate corrective actions to prevent a reoccurrence of a similar leak or spill. These are all reasonable practices as this is currently being practiced.

- For a facility with brandy aging operation that equal or exceed both the applicable inventory and the emissions thresholds listed in Table 1, the operator shall implement brandy RACT by implementing record keeping and work emission minimization practices in addition to BARCT emission capture and control by use of a Permanent Total Enclosure (PTE) that is vented to a control device.
    - This emission control implementation is more stringent and has a total control efficiency of 90 percent through the use of the Permanent Total Enclosure (EPA Method 204) to encapsulate the emissions in the building (92% control efficiency) which are then vented to a Thermal Oxidizer (TO) that burns off the VOC emissions (98% control efficiency).
    - BARCT does not require refrigeration, but large warehouses usually practice refrigeration to minimize ethanol evaporative loss.
    - The rule requires warehouses to continuously meet the criteria for Normal Operation except for periods when the non-Personnel access doors are opened for personnel and equipment access as required for operational

or maintenance functions and/or when the VOC control device is shutdown for scheduled routine maintenance. Cumulative duration for all such periods are not exceed eight (8) percent of the total operating hours or 701 hours per year, whichever is less. This duration includes periods of downtime as required to perform scheduled routine maintenance, which are not to exceed Three (3) percent of the total hours of operations or 240 hours per year, whichever is less.

- The rule also provides for an alternative control measure which may be approved by the APCO, provided it is demonstrated that brandy emissions will not exceed 0.3 proof gallons per 50 gallons. This would be equivalent to a warehouse with a system capable of a 90% combined capture and control efficiency.

- For a facility with wine aging operation which equals or exceed both the applicable inventory and the emissions thresholds listed in Table 1, the operator shall implement RACT record keeping and work emission minimization practices in addition to Additional RACT. Additional RACT is RACT for larger sources based on the observed emission reduction techniques commonly used by such operations. Additional RACT is not applied to smaller operations and is not as stringent as BARCT for this class and category of source. Additional RACT specifies maintaining a nominal warehouse daily temperature, averaged over a calendar year, not to exceed 70 degrees Fahrenheit.
  - As explained later in this report, research into the affects of humidity and temperature has shown that controlling these factors can reduce evaporation and therefore control VOC emissions. The 70 degree temperature threshold was set high enough to allow for variations in aging practices and equipment limitations while still being low enough to produce meaningful reductions.
  - The applicability threshold of 590,000 gallons is based on a 10,000 barrels inventory and 59 gallons per barrel. Such an operation would have an Uncontrolled Aging Emission (UAE) of 16,000 pounds per year and was selected as a natural breakpoint between the large wine aging operations that implement refrigeration or temperature control and the small wine aging operations that do not implement refrigeration.
  - Two additional RACT control alternatives to the temperature option are provided in the rule. The first alternative would allow a control that reduces the VOC Uncontrolled Annual Emissions by 50%. This factor will be calculated by using the UAE calculation equation and an Aging Emission Factor (AEF) of 0.02783, which is based on the District default 3% evaporative loss rate, as explained below. This option is considered to produce equivalent reductions to the temperature option.
  - The second control alternative is to age wine in non-porous tanks. These tanks must be equipped with operable pressure-vacuum relief valves and the temperature of the aging wine must be maintained at or below 75 degrees Fahrenheit. This alternative is already achieved in practice on

tanks which are used for wine storage and must comply with Rule 4694 (Wine Fermentation and Storage) requirements.

Table 1 summarizes the thresholds and applicable requirements for the various sizes of operations, as discussed above.

Product Type	Total Annual Aging Inventory (gallons per year)	Uncontrolled Aging Emissions (lbs/yr)	Requirement	Control Technology Level
Brandy	< 40,000	< 8,000	Records & Work Practices	RACT
	≥ 40,000	≥ 8,000	Records & Work Practices & PTE vented to a control device	RACT and BARCT
Wine	< 590,000	<16,000	Records & Work Practices	RACT
	≥ 590,000	≥ 16,000	Records & Work Practices & Temperature control	RACT and Additional RACT

The difference between brandy aging and wine thresholds are due to the District calculating emission factors based on an average annual brandy evaporative loss rate of 3 proof gallons per barrel per year, and an average annual wine evaporative loss rate of 3% by volume per barrel per year, and a cost effectiveness of approximately $25,000 per ton for both. Using these emission factors, wine has an ethanol level of nearly one-sixth that of brandy and a proportionally lower emission rate. Because of the differences in emission rates, wine aging controls have much higher cost effectiveness values compared to a similarly-sized brandy aging warehouse. Cost effectiveness details are provided in Appendix C.

The rule allows facilities the opportunity to calculate and use their own Uncontrolled Aging Emissions (UAE) in relation to this rule's thresholds. To determine a specific operation's Uncontrolled Aging Emissions (UAE) use the following formula:

UAE = TAAI * AEF

Where:

UAE = Uncontrolled Aging Emissions, in pounds of ethanol per year.
TAAI = Total Annual Aging Inventory, in gallons per year.
AEF = Aging Emission Factor, in pounds of ethanol per gallon.

Total Annual Aging Inventory is an average of a calendar year inventory derived from TTB Form 5110.11 for brandy and Form 5120.17 (replaced From 702) for wine. The calculation is as follows:

$$TAAI = \sum GMI \div 12 \text{ months/year.}$$

TAAI = Total Annual Aging Inventory, in gallons per year.
GMI = Gallons in Monthly Inventory, in gallons per year.

The District's default Aging Emission Factors (AEF) are: brandy 0.1986 lb ethanol per 50 gallon barrel and wine 0.02783 lb ethanol loss per gallon wine. These values are based on the District default values of evaporative loss of 3 proof gallons per barrel per year. This loss rate is based on the average loss rate for all permitted facilities in the District, except one facility that is not industry representative and a wine evaporative loss rate of 3% by volume per barrel per year. This is explained in great detail below. Using these loss rates allows the aging emission factors to be calculated as follows:

Brandy Default AEF = 3 proof gallons loss/50 gallon barrel x 0.5 gallon ethanol/ proof gallon x 6.616 lb ethanol/gallon.
= 0.1986 pounds of ethanol/gallon of brandy aged

Wine Default AEF = 0.03 gallons loss/gallon wine x 8.14 lb wine/gallon wine x 0.114 lb ethanol/lb wine (simplified from Santa Barbara Air Pollution Control District's 'Wine Production Emission Factors).
= 0.02783 pounds of ethanol/gallon of wine aged

Operators have indicated that their site-specific loss rate may be significantly lower than the assumed 3% rate. The rule allows operators to calculate the AEF using such a site-specific loss rate in place of the District's default values. This allowance is to reflect the effects of individual practices that may be employed to reduce evaporative losses.

Additionally, the rule provides for two alternative emission controls for tanks that are not housed in a PTE and vented to a VOC control device. First, the rule allows use of such tanks if the operator can demonstrate that the aging emissions do not exceed 0.3% by volume. This fugitive emission value is equivalent the fugitive emissions released by a PTE and RTO that have a combined destruction efficiency of 90%. The basis for this allowance is as follows:

- Wine barrels have a District default evaporative loss rate of 3%.
- The PTE captures 92% of this 3% evaporative loss.
- The PTE is vented to a VOC control device that destroys 98% of the emissions captured by the PTE.
- Total capture and control of the system is
  0.92 x 0.98 = 0.90 capture and control destruction efficiency
- If 90% of the evaporative loss is captured and destroyed, then 10% of the ethanol (or 0.3% of the total wine) would be emitted to the atmosphere.

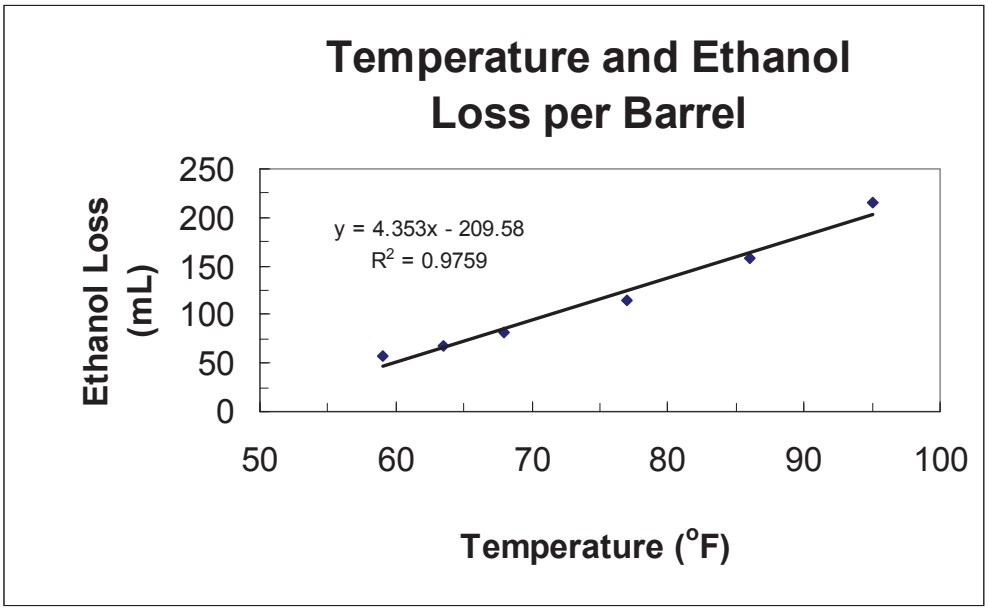
0.03 x (1 - 0.90) = 0.003 or 0.3% of the total wine

- Therefore, a system with VOC emissions of less than 0.3% of the total wine is equivalent to a PTE and VOC control having a 90% capture and control efficiency.

Secondly, the rule allows operators to use non-wooden tanks if they are equipped with a pressure vacuum relief valves (PVR) and temperature controls. The combination of the PVR and temperature control reduces or eliminates evaporation and emissions from the aging operations by maintaining the tank contents in a static state. The PVR valves stay closed during aging since refrigerating the tank contents prevents them from evaporating and expanding and contracting due to temperature variability. Tank contents are maintained at or below 75^{o}F. Volumetric loss rates for these tank controls are expected to be 0.3% or less, which would be equivalent to the other two control options.

District research has found that temperature can be used as a primary, singular, and direct wine ethanol emission reduction/control technique. Based on an initial study's data (Blazer, R. M., Wine Evaporation from Barrels, Practical Winery and Vineyard Jan/Feb 20-22 (1991)), District staff ran a linear regression that showed a proportional relationship between temperature and ethanol loss from wine aging in barrels. Further research concluded that ethanol loss is independent of humidity. The Blazer data may be limited but it is an appropriately example that aptly demonstrates for the purposes of this rule the scientific relationship of decrease temperature and proportional decrease ethanol evaporation. This relationship is graphically shown below in Figure 1.

Diagram1. Linear regression of temperature and ethanol loss per barrel.



Because there are no other wine aging emission controls regularly put into practice other than temperature control, as currently achieved in practice for larger brandy aging and wine aging operations, and because temperature control is not only used to substantially reduce evaporative loss but to increase product quality; temperature control is to be considered a Reasonably Available Control Technology (RACT) practice. Because this practice will not generate additional reductions from current practices, not further emission reductions for RACT will be credited to this rule.

The use of a controlled nominal daily temperature, averaged over a calendar year, is considered RACT for two reasons. First, the San Joaquin Valley has great diurnal and seasonal temperature variations. Diurnal variations from night to day average 30 degrees, with extreme diurnal variations of up to 64 degrees Fahrenheit. The seasonal winter to summer monthly variations average 60 degrees, with extreme variations of up to 98 degrees Fahrenheit, based on a summer high of 115 degrees to winter low of 18 degrees. Second, the existing larger brandy aging and wine aging operations already employ refrigeration to maintain summer temperatures below a certain point, generally around 60 degrees Fahrenheit. The exact aging temperature can vary by 10 degree Fahrenheit at certain times of the year, depending on the outside temperature, related operations occurring in the warehouse, and the refrigeration equipment limitations.

Another seasonal operational factor involved in an aging warehouse's daily temperature fluctuations is fermentation. Fermentations produce large amounts of carbon dioxide gas. During the fall months of wine fermentation, doors nearest a fermentation section of the aging warehouse may be opened to exit the excess carbon dioxide gas thus contributing to daily variations in a controlled warehouse's daily temperature. Consequently, because of the above detailed diurnal and seasonal temperature fluctuations the warehouse nominal daily temperature must be averaged over the course of a calendar year.

All wine aging and brandy aging operations at Major Sources must implement RACT as detailed earlier. Larger operations must also implement capture and control of VOC emissions by using a PTE vented to a control device. This system is much more costly than the RACT requirements and is therefore considered a BARCT. As detailed in Appendix C, the high cost effectiveness of this BARCT requirement limits its application to the largest brandy aging operations which would otherwise have the highest emissions of VOC.

Currently, four of five largest brandy aging operations in the District are using a warehouse that is a PTE venting to a Regenerative Thermal Oxidizer (RTO). Out of several control devices at stakeholder disposal, the brandy aging industry has universally selected the use of a Regenerative Thermal Oxidizer (RTO) due to its low annual maintenance costs for this control application. Because of the current installation and operation of the RTOs, it has been demonstrated that RTOs are practical and effective controls for high levels of VOC emissions. The RTO that are currently in operation were installed as an alternative compliance option in lieu of

controlling the emissions from wine fermentation and storage for Rule 4694 (Wine Fermentation and Storage).

As explained in Appendix B, the expected reductions are summarized in Table 2 below. These emission reductions only include the reductions which will be realized from the one, uncontrolled brandy aging warehouse and do not include those reductions that are creditable to the Rule 4694. The compliance date for achieving this reduction is January 1, 2012.

Table 2: Emission Reductions for Rule 4695

Operation	Tons per Year	Tons per Day
Brandy Aging	42.6	0.12
Wine Aging	0[1]	0
Total	42.6	0.12

[1] Current wine aging facilities meet RACT control requirements.

In determining a reasonable level at which to require BARCT, staff used a $25,000 per ton cost effectiveness cut point. This level is similar to that which has been historically used in other VOC control rule determinations. This value will not generally cause a significant socioeconomic impact and yet will still affect a reasonable level of emission control.

The brandy evaporative loss rate of 3 proof gallons per barrel per year is based on the average loss rate for all permitted facilities in the District (except one facility that is not industry representative). The subsequently calculated brandy aging emission factor is 0.1986 pounds ethanol per gallon annually.

District research developed an evaporative loss rate scale showing that the annual wine aging evaporative loss rate for various operations in the District may range from 0.16% to 10% by volume. It was found that within that range, the 3% value is the appropriate value to use for the District's evaporative loss rate, which takes into account weighted inventories and evaporative loss rates. The wine evaporative loss rate of 3% by volume per barrel per year and the wine aging emission factor of 0.02783 pounds ethanol per gallon are based on the results of District research outlined in the following:

- According to Tobacco and Tax Trade Bureau (TTB) data for the years 2004, 2005, and 2006; and Wine Institute wine production values for those same years, wine loss during production is only 0.16%. This includes losses due to spillage, leakage, soakage, evaporation, include aging, and other losses normally occurring from racking and filtering. However, the overwhelming majority of the wine production is not aged. Therefore, for those wines that go through this production process and are then aged, the loss rates can be no less than 0.16% by volume per year. This sets the low end of the evaporative loss scale to 0.16%.

- District research has also shown that non-climate controlled wine aging warehouses in hot climates may lose up to 10% by volume, thereby setting the high end of the evaporative loss rate scale at 10%. From District surveys there are 22 wine aging facilities in District operation. Of those facilities, 21 facilities are less then one-tenth the size of the largest facility. These smaller facilities average approximately 800 – 1,000 barrels in aging inventory. District staff understands that these smaller facilities do not utilize climate controls for their aging barrels and that these barrels are aged in existing operational buildings (fermentation, storage tank, filtering, and/or bottling rooms/buildings). From the District survey these smaller facilities make up 37% of the annual wine aging inventory gallons.

- District research has also shown wine aging warehouses that are in mild climates or warehouses are operated with climate controls: approximately 60 degrees Fahrenheit and 75 percent humidity, according to stakeholder information. These facilities are expected to have loss rates no greater than 3% by volume, based on the factor developed by the publicly-vetted Santa Barbara Air Pollution Control District rule and permit development process. Santa Barbara has a mild climate with average temperature of 61 degrees Fahrenheit and 50% humidity.

- The likelihood that losses of no greater than 3% is also supported by data from the TTB whereby losses due to spillage, leakage, soakage, evaporation, including wine aging, and other losses normally occurring from racking and filtering, of up to 3% loss by volume, are not taxed. It is assumed that this allowance is recognition that the 3% loss is what would normally occur from a reasonably well-managed wine production operation. Since the other 97% is taxed, operators would have an incentive to minimize emissions or they would end up being taxed on lost product.

- Published research has also shown that measured wine evaporative loss rates which were measured under environmentally controlled conditions in wine aging warehouses and caves - demonstrate a wine aging evaporative loss range from 0.3% to 1.4% by volume. This measured wine evaporative loss rate range was based on the spread of relative humidity from 60 to 75% and temperature 59 to 95 degrees Fahrenheit. This relative humidity and temperature spread was selected from the data set to reproduce the wine evaporative loss rates submitted by stakeholders of 0.29% to 1.4%.

The rule includes an allowance for operators to use site-specific loss rates in determining the applicability of the rule requirements to their aging operations. Stakeholders have requested that the site-specific loss factors also be used in calculating the emissions inventory for this source category. While the District is always open to improving the accuracy of the emissions inventory, such a determination is beyond scope of his project and will be pursued as a separate issue.

District Staff welcomed input from stakeholders who submitted similar but a facility specific wine evaporative loss rate (1.4%), cost of control total capital and annual investment data, and a resulting cost effectiveness analysis. Staff Report Appendices B, C, and D incorporated stakeholder results. These analyses resulted in a second wine cost effectiveness value of $76,695 per ton. The District subsequently adjusted up the above wine aging threshold limit to 30 tons (60,000 pounds) per year with a subsequent cost effectiveness of value of $26,700 per ton. Because there are no wine aging warehouses of that size in the Valley, and because the District's permitting process would prevent the establishment of one that large, the scenario of a wine aging operation large enough that would require the installation of a BARCT PTE and VOC control was dropped from the rule.

III. BACKGROUND

A. Brandy and Brandy Aging

The name brandy comes from the Dutch word *brandewijn,* meaning "burnt wine." The name is apt as most brandies are made by applying heat, originally from open flames, to wine. This wine is boiled at a temperature between the boiling point of alcohol (ethyl alcohol) and the boiling point of water. This heating a liquid to separate components with different boiling points is called heat distillation. The low-boiling point liquids distilled from wine include almost all of the alcohol, a small amount of water, and many of the wine's organic compounds. It is these chemicals that give brandy its taste and aroma. The resulting vapors are collected and cooled. To drive out more of the water, always saving the alcohol, the distillation process can be repeated several times more depending on the alcohol content desired.

In California, these brandies are generally made of wine produced from many varieties of grapes but principally use Thompson Seedless and Chardonnay. Brandy is produced with an ethyl alcohol of less than 190° proof and bottled at a minimum of 80° proof. In the United States, "proof" denotes the ethyl alcohol content of a liquid at 15.6°C (60°F), stated in units of twice the percent ethyl alcohol by volume. For governmental reporting purposes, ethanol is reported in volume units of proof gallons, which is one liquid gallon of proof spirits which are 50% ethanol, by volume, at 60 degrees Fahrenheit.

B. Wine and Wine Aging

Wine is an alcoholic beverage produced by the fermentation of sugars in fruit juices, primarily grape juice. This fermentation process is an anaerobic breakdown of organic compounds by microscopic yeast organisms which provide complicated enzymes that, in the presence of sugar, form alcohol, carbon dioxide, glycerin, and other products.

The amount of time required to complete a fermentation is a function of temperature, where at 55 to 60^0F, wines are fermented in 7 to 10 days, and at 75 to 80^0F, wines will take 3 to 6 days to ferment. In commercial wineries fermentation of the grape juice or

must (grape juice plus skins) commonly occurs in fixed-roof steel fermentation tanks inoculated with yeast. After fermentation, wine is transferred a number of times between storage tanks to perform various finishing operations such as racking or decantation for separation of sediment, and filtration.

In California, table wines can be made from either a single grape variety or made from a combination of many grape varieties. These table wines have an alcohol content that ranges from 7 to 14 percent by volume (14° to 28° proof). Some of these table wines are subsequently aged in oak barrels or casks, to improve the quality. The changes that occur during the aging process are the result of interactions between the aging wine and the oak barrel, driven by the conditions of the surrounding atmosphere which may have both diurnal and seasonal variation. Both the ethanol and water evaporate from the surface of the barrel during the aging process with the rate of evaporation depending upon both the porosity of the barrel and the atmospheric conditions of the storage room among other factors.

C. Fugitive Emission Source: The Barrel

Modern barrels (Diagram 1) are made of oak staves (Diagram 2) shaped into bulging cylinders that are bound by steel hoops and capped with flat circular heads at both ends The belly, or bilge, allows them to be rolled and turned, and when stored horizontally, facilitates racking or the transfer of the liquid to another barrel.

Diagram 2. Wood barrel components.

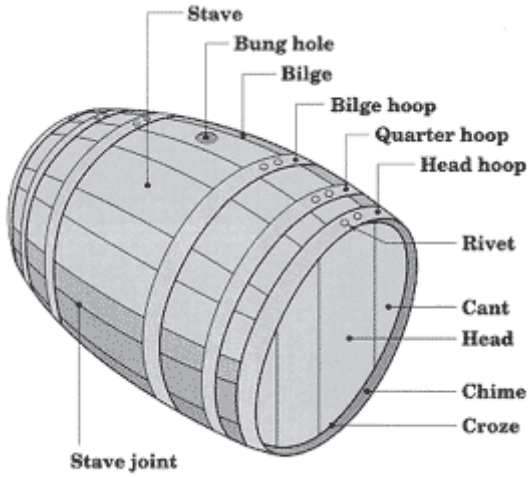
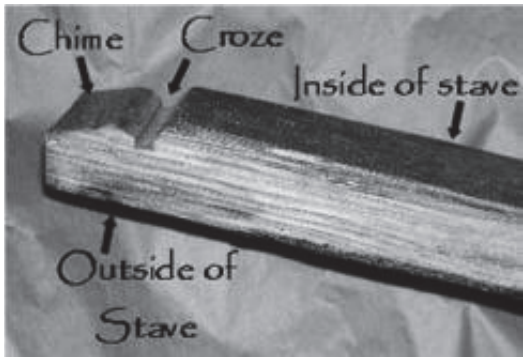


Diagram 3. Stave components.



The inside of the barrel is then subjected to fire, known as ‘toasting’ that caramelizes some of the woody substances (generally sugars) which develop into a multitude of sweet woody aromas, which will add flavor to whatever liquid is stored inside the barrel.

For wines, this ‘toast’ level can be adjusted according to the customers' requests: light, medium or heavy toast. For Bourbon, the ‘toasting’ is heavy (or charred) that leaves a heavy charcoal layer on the inside that greatly mellows the liquid contents.

Once finished, a test of impermeability is made by pouring a small amount of hot water under pressure into the barrel. This procedure makes it possible to immediately detect any leaks, or mere traces of moisture caused by unusually porous areas or a manufacturing defect.

California brandy makers buy used American Bourbon barrels to age their brandy. These barrels generally hold 53 gallons are made of American oak. Barrels used for wine are fashioned in two principal configurations: the 59-gallon French Bordeaux and the 60-gallon French Burgundy. The latter is nearly three inches shorter and over one inch broader at the bilge. Wine barrels are purchased new or used and are made of oak from America, France, or Eastern Europe. Larger barrels of 79 to 185 gallons are called puncheons and offer a lower wood surface-to-wine ratio imparting less oak and vanilla characteristics to the wine. Large upright tanks generally fixed in place and constructed of wood are called casks and can be used to ferment or age the wine.

D. Fugitive Emission Driving Force: Diffusion

Wood is a solid, porous, and permeable material. Porosity is the volume fraction of void space in a solid. The porosity is reported to be 1.2 to 4.6% of dry volume of wood cell wall. Permeability is a measure of the ease by which fluids are transported through a porous solid under the influence of some driving force, such as chemical potential. There are several types of chemical potential driving forces, but in this instance, it is diffusion. The diffusive movement of moisture and vapor through the wood is by several types of passageways and variations in wood structure. These pathways consist of cavities in vessel cells, fibers, ray cells, pit chambers, intercellular spaces, and transitory cell wall passageways.

Diffusion will redistribute moisture and vapor between the interior and exterior barrel surfaces, until the moisture or vapor level is uniform throughout the wood and the surrounding air, and a zero chemical potential gradient is reached at equilibrium. However, it should be noted, that this chemical potential gradient does not have a straightforward relationship in wood due to commonly observable variables, such as temperature, moisture content, and humidity.

Diffusion’s constant driving force to reach equilibrium, forces a wine’s 7 to 14%, or a brandy’s 40% alcohol from the porous barrel into the housing room where, at least for brandy, there is a constant state of disequilibrium. This diffusion of alcohol and water over time causes a decrease in volume of the barrel’s liquid contents. This loss is historically known as “the angels share” but is known today as fugitive emissions.

IV. Fugitive Emission Control Techniques

A. Emissions Capture System

The brandy storage warehouse functions as an enclosure from which the ethanol emissions can be captured. The capture efficiency is primarily a function of the configuration of this structure. Since such a structure can be sealed and ventilated to a control device such that it qualifies as a Total Enclosure pursuant to U.S. EPA Method 204, the theoretical capture efficiency could be considered to be 100%. However, since brandy aging and wine aging operations are a continuous 24 hour/day operation throughout the year, it would be difficult and expensive to continuously maintain the warehouse in a Total Enclosure status due to the on-going requirements to transport the product into and out of the warehouse and the requirements for maintenance during which the warehouse must be opened or the control device must be shut down. During such periods, uncontrolled emissions are delivered to the atmosphere in the absence of expensive air lock systems and/or redundant control devices.

Although neither of the terms “Fan Inlet Pressure Control Point” and “Maximum Allowable Negative Gauge Pressure” appear in EPA Method 204, the industry has previously indicated that there are technical difficulties with continuous monitoring and directly controlling a differential pressure of 0.013 mm Hg and has requested use of a surrogate for monitoring and for controlling of the induced draft fan. The selected surrogate is the pressure control instrument for the induced draft fan, typically located on the inlet ductwork near the fan inlet plenum. Due to pressure losses in the ductwork, the vacuum at this point is considerably higher than that in the warehouse (on the order of 2 “WC) which is more easily measured and controlled. The facility is required to establish, control, and periodically demonstrate a control set pressure at this point which ensures that the PTE requirement of 0.013 mm Hg is met.

B. Control Technologies and Devices (Exhaust-type)

1. Thermal Oxidation (Incineration)

Thermal oxidizers (TO) use the process of combustion to destroy VOCs. A basic TO system consists of a combustion chamber, burner, stack, and combustion controls. All hydrocarbons are oxidized to carbon dioxide and water vapor by the proper mix of temperature, residence time and turbulence within the reactor chamber. Combustion of the contaminated gas stream occurs at high temperatures, normally 650^{o}C to 870^{o}C (1,200^{o}F to 1,600^{o}F) when treating low concentration streams. Recent source tests at existing facilities utilizing TO control have demonstrated a 98% destruction efficiency at a combustor temperature of 1400^{o} Fahrenheit.

TO systems can be divided into recuperative or regenerative systems, based on methods used to increase operating efficiencies by capturing heat from the combustion process. Recuperative TO systems increase fuel efficiency by use of a gas pre-heating section and a heat recovery section. Heat recovery can be as high as 70%. A

regenerative system provides extremely high thermal-energy recovery; up to 95% of heat energy can be recovered. Regenerative TO systems use a ceramic heat-exchange bed to preheat process air to within 5% of the oxidation temperature.

VOC conversion efficiencies range from 95% to 99.9% for TO systems. However, the combustion of supplemental fuel for the oxidation produces NOx, an ozone precursor like VOC, thus offsetting some of the VOC emission reduction. The District considers thermal oxidation as technologically feasible for the application to brandy aging and wine aging.

Stakeholders have implemented thermal oxidation controls for their brandy storage warehouses and are currently adjusting the functional operations of this system to minimize any detrimental quality and evaporative effects. This control technology is currently operating on six permit units in the San Joaquin Valley.

2. Catalytic Thermal Oxidation

A catalytic thermal oxidizer (CTO) is essentially a thermal oxidation unit with a catalyst module. These units are similar in design to recuperative units, except that VOCs are oxidized at lower temperatures using precious metal or metal-oxide-based catalysts. Operating at about half the temperature of thermal oxidizers, catalytic units have smaller physical footprints and may offer lower operating costs in certain circumstances. Since catalysts are employed, these systems are subject to catalyst poisoning or deactivation due to operating upset and may require periodic catalyst replacement, which represents a substantial operating cost.

Other industries have demonstrated typical VOC removal efficiencies of up to 98%. The District considers catalytic thermal oxidation as technologically feasible for application to brandy aging and wine aging and that a control efficiency of 98% is reasonably achievable.

3. Adsorption Vapor Recovery

Adsorption vapor recovery is accomplished by passing the VOC-laden gas through beds containing adsorbents that have a high surface area to weight ratio. Typical adsorbents are activated carbon, zeolite, or organic polymers. As the gas stream passes through the bed, organic compounds adsorb weakly onto the adsorbent's surface. Adsorption of the hydrocarbon molecules proceeds until the available surface area is filled or saturated with VOC molecules. The VOC molecules are retained until the regeneration step, or disposal of the spent adsorbent.

Desorbing or removing captured VOCs regenerates the adsorbent. Decreasing the pressure, reducing the hydrocarbon concentration around the adsorbent or increasing the temperature of the bed can perform regeneration. A combination of these steps can also be used for regeneration. There are three basic types of adsorption systems

available to recover or remove hydrocarbon vapors from an air stream. Two of these systems regenerate the adsorbent in-situ for reuse. The third system requires removal of the adsorbent to another site for regeneration.

The two systems that provide in-situ regeneration are: Pressure Swing Regenerated Systems and Thermally Regenerated Systems (or a combination of the two methods). Since the net result of the combined adsorption and regeneration process only results in transfer of the ethanol from the vent stream to another liquid or gaseous stream, further treatment of the effluent of the regeneration process is required to either destroy or recover the ethanol (typically thermal oxidation of the stripping gas stream or water treatment in the case of steam stripping).

The District considers adsorption vapor recovery (with appropriate handling of regeneration waste streams) as technologically feasible for application to brandy aging and wine aging. Based on a draft technical assessment document (TAD) prepared by the ARB, a control efficiency of 95% is considered reasonable for adsorption systems when controlling ethanol emissions (from wine fermentation), a more demanding application due to the presence of large amounts of CO2.

4. Wet Scrubbing (Absorption)

The basic process involved in wet scrubbing is the contact of a polluted gas stream with a liquid solution. During operation, gas flows upward through a column containing packing or other mass transfer media. The scrubbing liquid is delivered to the top of the column and flows down (by gravity) through the porous mass transfer media, generating a substantial interfacial surface area between the gas and liquid phases in a counter flow arrangement which provides optimal mass transfer. Gaseous contaminants are absorbed into the liquid and the decontaminated gas stream flows out of the scrubber.

Many scrubbing applications achieve emission reduction efficiencies of 99.9%. In a pilot study conducted by the ARB in 1987, wet scrubbing demonstrated greater than 90% reduction in ethanol emissions when operated for control of ethanol emissions (from wine fermentation tanks). The District considers wet scrubbing as technologically feasible for application to brandy aging and wine aging and that a control efficiency of 90% is reasonably achievable.

5. Condensation, Refrigeration, and Cryogenic Systems

Condensation, refrigeration, and cryogenic systems remove organic vapor by condensing the target gases on cold surfaces. These cold conditions can be created by passing cold water through an indirect heat exchanger, by spraying cold liquid into an open chamber with the gas stream, by using a refrigerant to create very cold coils, or by injecting cryogenic gases such as liquid nitrogen into the gas stream. The concentration of VOCs is reduced to the level equivalent to the vapor pressures of the compounds at the operating temperature. Removal efficiencies attainable with this

approach depend strongly on the outlet gas temperature. For cold-water-based condensation systems, the outlet gas temperature is usually in the 40 to 50°F range, and the VOC removal efficiencies can be in the 90% to 99% range depending on the vapor pressures of the specific compounds. For refrigerant and cryogenic systems, the removal efficiencies can be considerably above 99% due to the extremely low vapor pressures of essentially all VOC compounds at the very low operating temperatures of -70°F to less than -200°F. Water vapor content in the gas stream may place a lower limit on the outlet gas temperature due to potential ice formation.

The application of refrigerated condenser to the control of ethanol emissions (from a fermentation tank) was examined by ARB. The results of that study indicated that a 90% ethanol recovery could be achieved at an outlet gas temperature of -12 ^{0}F when controlling ethanol emissions. However, it was noted that ice formation could be a problem at this temperature and that special equipment designs would be required for reasonable operation. In addition, the ethanol is recovered in aqueous solution and must be further process for recovery of the ethanol. The District considers refrigerated condensation as technologically feasible for application to brandy aging and wine aging and that a control efficiency of 90% is reasonably achievable.

6. Biological Oxidation

VOCs can be removed by forcing them to absorb into an aqueous liquid or moist media inoculated with microorganisms that consume the dissolved and/or adsorbed organic compounds. The control systems usually consist of an irrigated packed bed that hosts the microorganisms (biofilters). A presaturator is often placed ahead of the biological system to increase the gas stream relative humidity to more than 95%. The gas stream temperatures are maintained at less than approximately 105°F to avoid harming the organisms and to prevent excessive moisture loss from the media.

Biological oxidation systems are most often used for very low concentration VOC-laden gas streams for odor control. The VOC inlet concentrations are often less than 500 ppmv and sometimes less than 100 ppmv and achieve control efficiencies exceeding 95%. However, biofilters have been demonstrated in industrial applications achieving 90% control efficiency when controlling higher ethanol inlet concentrations (up to 3 g/1000 m^3). The District considers biological oxidation to be technologically feasible for application to brandy aging and wine aging and that a control efficiency of 90% is reasonably achievable.

C. Emission Reductions

The 2007 Ozone Plan estimates a 2012 brandy aging and wine aging VOC emission baseline of 2.30 tons per day. This value has been adjusted to account for 4.5 tons per day of reductions from facilities that are part of alternative compliance options in Rule 4694 (Wine Fermentation and Storage Tanks). These emissions are SIP creditable to previous 1-Hour Ozone Plan commitments for the Brandy and Wine Aging (S-IND-14)

control measure. Approximately 98 percent of the brandy aging emissions in the San Joaquin Valley (four facilities) are already controlled in accordance with the requirements of this rule. Implementation of this rule is expected to require emission controls on one additional brandy aging facility, resulting in an annual emission reduction of 0.12 tons per day attributable to this rule for brandy aging. The wine aging emission reductions are currently achieved in practice and are considered RACT and are not creditable to this rule.

As previously stated in this Draft Staff Report, the District sought as much reduction of VOC emissions from brandy aging and wine aging as expeditiously as practicable, technologically feasible, and economically reasonable, as determined by the District's Governing Board. The VOC emissions reduction analysis is presented in Appendix B of the Final Draft Staff Report and also includes stakeholder submitted data.

V. COST EFFECTIVENESS ANALYSIS

Pursuant to CH&SC section 40920.6(a), a cost effectiveness analysis is required for rules that implement RACT. The purpose of the cost effectiveness analysis is to evaluate the economic reasonableness of the rule or rule amendments. The analysis also serves as a guideline for developing the control requirements of the rule. District staff has conducted a cost effectiveness analysis for Rule 4695. The cost effectiveness analysis is presented in Appendix C of the Final Draft Staff Report.

VI. SOCIOECONOMIC ANALYSIS

Pursuant to CH&SC 40728.5, "whenever a district intends to propose the adoption, amendment, or repeal of a rule or regulation that will significantly affect air quality or emissions limitations, that agency shall, to the extent data are available; perform an assessment of the socioeconomic impacts of the adoption, amendment, or repeal of the rule or regulation." The socioeconomic impact of Rule 4695 is presented in Appendix D of the Final Draft Staff Report.

VII. RULE CONSISTENCY ANALYSIS

Pursuant to the state Health and Safety Code, Section 40272.2, District staff has prepared a rule consistency analysis of Rule 4695. The Rule Consistency Analysis is presented in Appendix E of the Final Draft Staff Report.

VIII. ENVIRONMENTAL IMPACTS

Pursuant to the California Environmental Quality Act (CEQA), District staff investigated the possible environmental impacts of the proposed Rule 4695. Based on the lack of evidence to the contrary, District staff concluded that proposed rule will not have any significant adverse effects on the environment. Staff recommends filing a Negative Declaration under the provisions of the Public Resource Code 15061 (b) (3).

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IN THE SUPERIOR COURT OF THE VIRGIN ISLANDS
DIVISION OF ST. CROIX

RYAN ALLEYNE, ENID V. ALLEYNE, MICHAEL BICETTE, MARCO BLACKMAN, ANISTIA JOHN, GEORGE JOHN, SUSIE SANES and **ALICIA SANES,** on behalf of themselves and all others similarly situated, *Plaintiffs,* **v.** **DIAGEO USVI, INC.** and **CRUZAN VIRIL, LTD.,** *Defendants.*	**Case No.: SX 2013-CV- 143** **CLASS ACTION** **JURY TRIAL DEMANDED**

'13 JUL 29 A9:44

DEFENDANTS CRUZAN VIRIL, LTD. AND DIAGEO USVI'S JOINT RULE 12(b)(6) MOTION TO DISMISS

Defendants Cruzan VIRIL, Ltd. and Diageo USVI, Inc., hereby move to dismiss the complaint pursuant to Rule 12(b)(6) for failing to state a claim upon which relief can be granted. The basis for the motion is more fully set forth in the attached joint memorandum, which is incorporated herein by reference. For the reasons set forth therein, it is respectfully submitted that the motion should be granted. A proposed Order is also submitted.

Dated: July 29, 2013

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CERTIFICATE OF SERVICE

I hereby certify that on this 29th day of July, 2013, I filed the foregoing with the Clerk of the Court, and delivered as indicated to the following:

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IN THE SUPERIOR COURT OF THE VIRGIN ISLANDS
DIVISION OF ST. CROIX

RYAN ALLEYNE, ENID V. ALLEYNE, MICHAEL BICETTE, MARCO BLACKMAN, ANISTIA JOHN, GEORGE JOHN, SUSIE SANES and **ALICIA SANES,** on behalf of themselves and all others similarly situated,

Plaintiffs,

v.

DIAGEO USVI, INC. and **CRUZAN VIRIL, LTD.,**

Defendants.

Case No.: SX 2013-CV- 143

CLASS ACTION

JURY TRIAL DEMANDED

ORDER

This matter is before the Court on Defendants' July 29, 2013 motion to dismiss for failure to state a cause of action pursuant to Rule 12(b)(6).

The Court being fully informed in the premises, it is hereby

ORDERED and ADJUDGED

That the motion is **GRANTED.**

HON. DOUGLAS BRADY

ATTEST: VENETIA VELASQUEZ
Clerk of the Court

BY:_____
Deputy Clerk

Distribution:

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