STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

IN THE MATTER OF : APPLICATION NO. 199701559

NEW HAVEN WATER POLLUTION CONTROL AUTHORITY : JANUARY 22, 1999

PROPOSED FINAL DECISION

SUMMARY

The New Haven Water Pollution Control Authority ("the applicant") owns and operates a wastewater treatment plant in the city of New Haven and seeks authorization to dispose of sewage sludge by incineration. The applicant lawfully operated a sewage sludge incinerator throughout most of the 1980s, ceased using it for several years, and in 1992, pursuant to a permit to modify and construct, modified the incinerator by slightly increasing its capacity and by installing a new, upgraded emissions control system. Having satisfied the requirements of a temporary permit to operate issued in 1996, the applicant now seeks, pursuant to section 22a-174-3 of the Regulations of Connecticut State Agencies, a final permit to operate the modified incinerator.

In response to a petition for hearing, I conducted public hearings over the course of ten days in March and April 1998. The parties to this proceeding are the applicant, the staff of the Department of Environmental Protection Bureau of Air Management ("the staff"), and Peter and Mitzi Bowman who intervened under General Statutes §22a-19. The staff supports issuance of the final permit in accordance with certain terms as set out in a "draft permit." The intervenors oppose the application and allege that the incinerator may emit radiation and other air pollutants harmful to public health, that the incinerator may be poorly operated, and that there are alternatives to incineration.

The operation of the incinerator would meet all applicable legal standards for permit issuance and would have no adverse impacts on public health provided the applicant adheres to the terms of the draft permit. I therefore recommend that the requested final permit to operate issue, based upon the terms of the draft permit with the additions and modifications set forth below.

FINDINGS OF FACT

THE APPLICANT

1. The New Haven Water Pollution Control Authority ("the applicant" or "WPCA") has applied to the Department of Environmental Protection for a final permit to operate a multiple-hearth sewage sludge incinerator ("the incinerator") pursuant to General Statutes §§ 22a-174 et seq. and the regulations thereunder.

2. The applicant, a not-for-profit public authority, owns and operates a wastewater treatment plant ("the treatment plant") at 345 East Shore Parkway ("the site") in New Haven. The applicant collects and treats 38-40 million gallons per day ("gpd") of municipal wastewater from New Haven, Hamden, East Haven, Woodbridge and portions of North Branford, and discharges the treated effluent into Long Island Sound pursuant to a National Pollution Discharge Elimination System ("NPDES") permit[1] (Test. Smedberg, pp. 108-09; Fura, pp. 422-23; Ex. APP-I-029) The treatment plant also accepts and treats 1-1.5 million gallons per year of septage[2] pumped from septic tanks in New Haven, Hamden, East Haven, and Branford and delivered to the facility by trucks. (Test. Fura, pp. 422-23)

3. The treatment plant generates about 20-25 tons per day of sewage sludge, the semi-solid by-product of the wastewater treatment process.[3] (Ex. APP-I-029; test. Smedberg, pp. 10, 112; test. Fura, p. 411) Proper sewage sludge disposal is critical to the successful operation of this--and any--wastewater treatment plant, and the incinerator was an integral part of the plant's operation throughout the 1980s. (Exs. APP-I-029; test. Smedberg, pp. 110-13; test. Fura, p. 428)

BACKGROUND

4. The applicant used the incinerator between 1982 and 1989 to dispose of the sewage sludge pursuant to a permit to operate issued by the Commissioner of Environmental Protection ("the commissioner"). (Ex. APP-I-001). After deficient equipment and operating problems led the applicant to shut down the incinerator in 1989, the applicant disposed of the treated and dewatered sewage sludge at New Haven's municipal landfill. This option increased operational costs by $1-1.5 million per year. Odor complaints and limited landfill capacity caused WPCA to turn to landfills outside the New Haven region and out of

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[1] The NPDES program regulates certain surface discharges to navigable waters of the state. Section 402 of the Clean Water Act, 33 USC 1251, *et seq*. The state administers the NPDES program under General Statutes §22a-430, pursuant to approval (dated September 26, 1973) of the administrator of the U.S. Environmental Protection Agency. The NPDES permit requires, among other things, extensive monitoring and testing of the influent, the sludge, and the discharged effluent. (Test. Fura, pp. 418-25)

[2] For the purposes of the application and this decision, the words "wastewater," "effluent," sewage," and other similar terms include septage. (See test. Fura, pp. 422-25; 491-92)

[3] Sewage sludge is defined in the staff's draft permit as "any solid, semi-solid or liquid residue removed during the treatment of municipal or private wastewater and domestic sewage or the treatment of domestic sewage. Sewage sludge includes, but is not limited to, solids removed during primary, secondary or advanced wastewater treatment, scum, septage, portable toilet pumpings and sewage sludge products." (Ex. DEP-14)

state. Because odor problems and landfill availability continued to hamper landfill disposal, WPCA also resorted to trucking the sludge to other facilities for dewatering and incineration. (Ex. APP-I-029; test. Fura, pp. 433-436; test. Smedberg, pp. 115-16, 127-29)

5. Between 1989 and 1992, the WPCA evaluated other sludge-disposal options, including alkaline stabilization, composting, and a return to incineration, and it decided to upgrade and reactivate the incinerator. (Ex. APP-I-029; test. Fura, pp. 430 ff)

6. In January 1992, WPCA submitted to the commissioner an application for a permit to modify the incinerator and bring it back on-line. The proposed modifications consisted of upgraded equipment and a new emissions control system. (Exs. APP-I-011, APP-I-027, APP-I-029, APP-I-037, APP-II-03) On September 14, 1992, the commissioner issued to the applicant a Permit to Modify and Construct the incinerator. (Ex. DEP-1)

7. On August 9, 1996, the commissioner issued a one-year temporary air permit to operate the modified incinerator and conduct stack tests (Ex. DEP-2), and WPCA began operations three weeks later. (Ex. APP-I-065) The temporary permit to operate required WPCA, among other things, to conduct stack testing to determine compliance with state and federal emission limits and with the more stringent emission limits established in the permit itself. (Ex. DEP-2)

8. On or about May 12, 1997, the applicant filed its application for a final permit to operate the modified incinerator[4] (Exs. DEP-7, APP-I-054), although it had not yet completed its stack testing under the temporary operational permit. On August 7, 1997 the commissioner issued Consent Order No. 1522, which, among other things, permitted the applicant to continue its temporary operation until February 9, 1998, subject to specific conditions.[5] (Ex. DEP-4) On February 6, 1998 the commissioner modified the consent order, allowing the applicant to continue its temporary operation until the department made a final determination on the applicant's final permit to operate. (Ex. DEP-5) The applicant, therefore, has been operating the incinerator throughout the pendency of this proceeding.

9. On or about October 21, 1997, the DEP Bureau of Air Management completed its evaluation of the application and made a tentative determination to approve the final permit to operate.[6] (Exs. DEP-19, APP-I-066, -076) Thereafter, the staff prepared a draft permit, setting forth the specific terms of operation. (Ex. DEP-14, attached hereto as Appendix A)

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[4] In accordance with RCSA §22a-174-3(j)(1)(B), the applicant published notice of the filing of its application in The New Haven Register, a newspaper of general circulation in the New Haven area. (Exs. DEP-8, DEP-22)

[5] The Consent Order, among other things, also required the WPCA to submit to the Commissioner for approval a detailed Operations and Management (O&M) Manual by February 7, 1998. The WPCA satisfied this requirement on or about October 6, 1997. (Exs. DEP-6, APP-II-12; test. Patris, p. 940) Adherence to the O&M Manual is a requirement of the draft permit. (Ex. DEP-14)

[6] The applicant published notice of the tentative determination in The New Haven Register in accordance with RCSA §22a-174-3(j)(2). (Ex. DEP-13)

10. On or about December 4, 1997, an organization known as "Don't Waste Connecticut" submitted to the DEP a petition for a public hearing on the application (Ex. DEP-15) and the commissioner granted the petition on January 20, 1998. (Test. Patris, p. 19; Ex. DEP-20) On March 18, 1998, the organization's chairpersons, Peter Bowman and Mitzi Bowman, individually intervened in this proceeding under General Statutes §22a-19. (See Docket item #18 and comments of hearing officer, p. 4)

Among the intervenors concerns are:

A. Whether "ecological engineering" is a feasible and prudent alternative to incineration of sewage sludge.
B. Whether emissions from the incinerator contain harmful contaminants.
C. Whether poor oversight of the facility would allow potentially harmful materials to be burned in the sludge, thus increasing the release of harmful emissions.
D. Whether the applicant is required to prepare an "environmental impact statement."[7]
E. Whether the area in which the incinerator is located is already impacted by existing air polluters in violation of the Clean Air Act.
F. Whether the incinerator will have adverse health impacts on "an already vulnerable population" in the New Haven area.
G. Whether sewage sludge contains unsafe radioactive materials which would ultimately be emitted through the incinerator's stack

(Docket item #18)

11. I conducted hearings on March 18, 1998 in New Haven and for nine additional days thereafter in Hartford. [8]

THE INCINERATOR

12. The incinerator, located in a building adjacent to the treatment plant, is a Zimpro Multiple-Hearth sewage sludge incinerator designed to process 1.66 dry tons per hour ("tph") of processed sewage sludge.[9] (Exs. APP-I-001, APP-I-011, APP-I-015; test. McConaghy, pp. 294-95) The applicant has operated and, if the permit is approved, would continue to operate the incinerator twenty-four hours a day, Monday through Friday. (Ex. DEP-6)

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[7] Because the state provided no funding for the modifications to the incinerator, both the staff and the applicant assert that no state environmental impact evaluation is required under General Statutes §22a-1b. (Test. Patris, p. 931, test. Smedberg, p. 205; Ex. DEP-22)

[8] Pursuant to RCSA §22a-174-3(j)(4), notice of the hearing was published in The New Haven Register on February 21, 1998. (Exs. APP-I-075, DEP-12, DEP-22)

[9] The multiple hearth incinerator is the most commonly used sludge incineration system. EPA/Office of Water, Environmental Regulations & Technology: Use and Disposal of Municipal Wastewater Sludge, p. 49 (March 1989). [Excerpts from this document were officially noticed under General Statutes §4-178.]

13. After wastewater enters the treatment plant, it passes through various treatment processes where sludge is collected in clarifiers and settling facilities and stored in a 280,000 gallon tank. The sludge, at That point still predominantly liquid, is then dewatered and subsequently fed onto the incinerator's conveyor belts in what is called "cake form" and transported to the incinerator. As the sludge passes top-down through the incinerator's seven hearths, all moisture is removed and the solids burned. Inorganic ash collects in the bottom hearth and is disposed of at a legally authorized disposal site. The exhaust gases generated by the combustion pass through an emissions control system and exit the incinerator through the stack. (Test. Smedberg, pp. 108-11; test. McConaghy, pp. 294-95; test. Fura, p. 412; Exs. APP-I-076; DEP-6)

THE EMISSIONS CONTROL SYSTEM

14. The incinerator's upgraded emissions control system includes an adjustable-throat venturi scrubber, designed to remove large particulates and some of the acid gases present in the flue gas; an impingement tray scrubber, which condenses volatilized metal pollutants and acid gases, and directs liquid residue into the effluent treatment system; a wet tubular electrostatic precipitator designed to remove fine particulates from the flue gas; an induced draft fan, designed to pull air through the emissions control train and to maintain draft within the incinerator; and a regenerative thermal oxidizer designed to combust carbon monoxide, volatile organic compounds, and nitrogen oxides. (Test. Almquist, pp. 223-33; test. McConaghy, pp. 296-302; Exs. DEP-6, DEP-20, APP-II-03)

15. Because the incinerator, without air pollution controls, has the potential to emit more than five tons per year of five criteria pollutants (particulate matter, nitrogen oxides, sulfur dioxide, carbon monoxide, and volatile organic compounds), [10] RCSA §22a-174-3(c)(1)(G) requires the applicant to perform a Best Available Control Technology ("BACT") analysis for each of these pollutants and incorporate BACT into the incinerator's emission controls. (Exs. DEP-20, APP-II-03)

The potential emissions for any individual non-criteria pollutant, with the exception of zinc and hydrogen chloride, would be below five tons per year; BACT analysis is therefore required for these two pollutants as well. (Ex. APP-II-03)

16. Using methodology approved by the U.S. Environmental Protection Agency ("EPA"), the applicant performed a BACT analysis and determined--and the staff agreed--that the proposed emissions control system constitutes BACT. (Test. Patris, pp. 22-23; test. Almquist, pp. 221-23; Exs. APP-I-027, APP-II-03, DEP-20)

17. According to staff, the technology used in the emission control system is currently the best in any incinerator in the state and the staff has recommended that EPA consider this particular control system to represent the Maximum Achievable Control Technology for sewage sludge incinerators. (Test. Bouffard, pp. 1184-86)

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[10] These criteria pollutants are common air pollutants regulated by EPA standards which are based on health and environmental impacts. The incinerator also has the potential, absent pollution controls, to emit approximately 0.725 tpy of lead (another criteria pollutant), far below the level triggering need for a BACT analysis. (Ex. APP-II-03)

18. The modified emissions control system is far more effective at reducing emissions than original system, which consisted primarily of a wet venturi scrubber and an impingement tray scrubber. Although the upgraded equipment allows the WPCA to process slightly more sludge than before, emissions of air pollutants are significantly lower than those prior to the modifications. (Exs. APP-I-027, APP-I-029, APP-I-040, APP-II-03, APP-II-08, APP-IV-05, APP-IV-06; test. Almquist, pp. 69-70; test. Smedberg, pp. 9-11, 71, 128)

ESTABLISHING THE PERMIT LIMITS

19. To establish the emission limits in the draft permit, the staff relied upon state and federal regulatory requirements, data from the applicant's stack tests during temporary operation, the manufacturer's equipment specifications for the control system, test data from similar sources, and an EPA manual entitled "Compilation of Air Pollutant Emission Factors (AP-42)." (Test. Patris, pp. 20, 829 ff.; test. Almquist, pp. 252-53; Exs. DEP-11, DEP-20)

20. Federal and state air regulations take into account the potential effects of stack emissions on public health. The regulatory standards are based upon epidemiological research and they are intended to be protective of the health of even the most sensitive members of the public, *e.g.*, children, the elderly, asthmatics. (Test Patris, pp. 940-41, 977 ff.; test. Bouffard, pp. 77, 1172-73, 1179-90; test. Almquist, pp. 240, 246-47, 1671 ff.)

21. The applicant's stack tests, undertaken in accordance with the temporary permit to operate, demonstrated that the emissions control system was working properly and that the incinerator's emissions were within all of the limits established by law and those contained in the temporary permit. (Test. Almquist, pp. 237-50, 1671-81; test. Patris, p. 932; test. Bouffard, pp. 1172-90, 1243; Exs. DEP-2, DEP-3, DEP-11, DEP-20, APP-II-07, APP-II-08, APP-IV-05, APP-IV-06, APP-IV-07, APP-IV-08)

22. Because the incinerator does not and will not emit one hundred tons per year of any individual air pollutant or fifty tons per year of volatile organic compounds or nitrogen oxides in an area classified as serious non-attainment for ozone,[11] the staff determined that the incinerator is neither a "major stationary source" for ozone nor a "major modification," as those terms are defined in RCSA §22a-174-1. (Exs. DEP-1, DEP-2, DEP-11, DEP-14, APP-I-035, APP-II-01; test. Patris, pp. 236-37, 962; Bouffard, p. 1183)

When evaluating an application for a source of air emissions, the staff conducts (or requires an applicant to conduct) various air dispersion analyses to establish ambient air impacts. (*See* RCSA §22a-174-3(c)(3).) If the incinerator were a major stationary source, the staff would have undertaken a comprehensive modeling procedure known as "refined modeling," which takes into account, *inter alia*, wind direction, temperature, and surrounding terrain; refined modeling also takes into consideration emissions from other major sources in the vicinity. (Test. Bouffard, pp. 1190, 1224) Because the staff considers the incinerator to be a minor modification to a minor source, it did not conduct refined modeling. (Exs. DEP-11, APP-III-03, p. 26; test. Bouffard, pp. 879-80, 1241)

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[11] A non-attainment area is a geographical area in which the levels of a criteria pollutant are higher than the levels allowed by the National Ambient Air Quality Standards (NAAQS), 40 CFR 50. New Haven, like most of Connecticut, is classified as "serious non-attainment for ozone." (RCSA §22a-174-1(81), (82); see Ex. DEP-11; test. P. Bowman p. 32; test. Bouffard, pp. 1227-28)

Instead, the staff undertook a less-stringent "Stationary Source Stack Height Analysis" (SSSHA), a modeling protocol approved by the commissioner as appropriate for minor sources. Based on its analysis, the staff determined that a minimum stack height of 190 was needed in order to ensure that there would be no adverse ambient air quality impact. (Test. Patris, pp. 972-77, 998, 1250-51; Ex. DEP-20) The applicant has constructed (and the draft permit requires) a stack whose height is at least 190 feet above grade. (Test. Scheuritzel, p. 761; Ex. DEP-14)

23. The draft permit establishes emission limits for criteria pollutants, which limits are at least as stringent as those imposed by applicable law:

Pollutant	Permit Limit	Legal Standard(s)
SO_x	16 ppmv	500 ppmv (§22a-174-19(f))
NO_x	60.8 ppmv	700 ppmv (§22a-174-22(c))
VOC	100 ppm @ 12% CO_2	100 ppm @ 12% CO_2 (§22a-174-3(c)(1)(G)
CO	100 ppmv	105 ppmv (§22a-174-3(c)(1)(G))
TSP	0.43 lb/ton dry sludge [0.71 lb/hr]	1.30 lb/ton dry sludge (40 CFR 60.152 (A)(1))
	0.015 gr/dscf @12% CO_2	0.08 gr/dscf @ 12% CO_2 (§22a-174-18(c)(3)(I))

(Ex. DEP-14, Table 1 and Part C; see also Exs. DEP-11, DEP-20)

24. Nitrogen oxides are typically emitted from any combustion process. The draft permit would allow the emission of 32.93 tons per year, 28.8 tpy less than that allowed under the previous operating permit. (Ex. APP-I-027)

25. During stack testing under the temporary permit to operate, the incinerator emitted, on average, 0.0035 lb/hr of mercury. (Ex. DEP-3; test. Patris, p.932) The draft permit, like the temporary permit to operate, limits the emission of mercury to 0.02 lb/hr, well below the maximum allowable emission rate of 7.055 lb/24-hr period established in 40 CFR 61.52. (Ex. DEP-14, Table 1; test. Patris, p. 932; test. Almquist, pp. 1700-17)[12]

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[12] Dr. Mark Mitchell, a public health and environmental health consultant and president of the Connecticut Coalition for Environmental Justice, Inc., expressed concern--but offered no evidence--that mercury emissions would "bioaccumulate in waterways and contaminate fish," ultimately causing neurological and kidney damage to humans. (SPK-2, p. 4) Mitchell conceded, however, that the mercury emission limits in the draft permit are below the federal limits (test. Mitchell, p. 1353) and acknowledged that his belief that the incinerator is "unsafe"was not based upon this particular application but upon his understanding of incineration in general. (Id., 1351)

26. Based on data from other sewage sludge incinerators, the staff determined that the incinerator would emit, on average, 0.0000033 pounds per hour of beryllium. (Ex. APP-I-027) The draft permit limits the emission of beryllium to 0.022 lb/24-hr period (10g/24-hr) in accordance with 40 CFR 61.32. (Ex. DEP-14, Part C)

27. The draft permit prohibits the WPCA from emitting non-criteria pollutants in excess of the Maximum Allowable Stack Concentrations ("MASC") established under RCSA §22a-174-29. (Ex. DEP-14, Part C.7.c) MASCs are determined by equations which consider the emission point's distance from the property line, stack height, the air volume from the stack, and the health-based hazardous limiting values (HLV) set out in RCSA §22a-174-29, Tables 29-1, 29-2, and 29-3.[13] (Exs. DEP-20; APP-I-027; APP-II-03, APP-II-04; test. Almquist, pp. 1685, 1718; test. Bouffard, pp. 1180-81)

Testing under the temporary permit to operate demonstrated that emissions do not and will not exceed any of the applicable MASCs. (Test. Patris, p. 945; test. Bouffard, p. 1182; test. Almquist. pp. 1681, 1714 ff.; Exs. DEP-11, DEP-20)

The permit not only incorporates by reference the regulatory MASCs, but also contains its own limits on emissions of non-criteria pollutants. These permit limits, referred to as Allowable Stack Concentrations ("ASC"), are at least as stringent as MASC. (Ex. DEP-14, Table 1; test. Almquist, pp. 246, 1717; test. Patris, p. 835) For example, the permit would limit emissions of lead (which is regulated as both a criteria and non-criteria pollutant) to 0.0057 lbs/hr, less than 1% of the MASC. (Ex. APP-II-027) (During stack testing, the incinerator emitted less than 0.000001 lbs/hr. [Exs. DEP-3, APP-IV-05])

28. The incinerator is equipped with a Continuous Emissions Monitoring system (CEM), which continuously measures and records various operational parameters, including but not limited to:

(A) the mass or volume of sludge entering the incinerator,
(B) the wet scrubber system gas flow pressure,
(C) the exhaust gas oxygen content,
(D) the temperature in each hearth,
(E) auxiliary fuel flow to the incinerator,
(F) temperature in the RTO, and
(G) voltage & current in the wet electrostatic precipitator (ESP).

(Exs. APP-I-027, APP-I-062, APP-II-05, APP-II-08, APP-II-09; test. Almquist, p. 233; test. McConaghy, p. 386) Operation of the CEM system and appropriate record keeping are requirements of the draft permit. (Ex. DEP-14, Part D). The CEM is used to determine that all emissions control equipment is functioning correctly and to demonstrate the applicant's compliance with the permit limits. (Test. Almquist, pp. 283, 296-302; test. McConaghy, pp. 296-302; test. Patris, pp. 885, 984-85)

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13 The MASC equations in §22a-174-29(c) are based on worst-case possibilities, including the assumptions that there is little or no dilution and that the nearest property line is the same height as the stack. The HLVs in the equations are also calculated using the most conservative numbers available. (Test. Bouffard, pp. 1179-90; Ex. APP-I-027)

29. The draft permit would require the applicant to conduct stack tests every five years, in accordance with the requirements of federal law or in a manner otherwise approved by the commissioner. The comprehensive stack tests, which would be monitored by DEP personnel, are used to demonstrate compliance with regulatory emission limits and those required by the permit. (Ex. DEP-14, Part D; test. Patris, pp. 984-85)

30. During the course of the hearing, the staff recommended that two conditions be added to the draft permit:

(A) According to one public speaker, dioxin is known to be emitted by sewage sludge incinerators. (Test. Mitchell, p. 1347; Ex. SPK-2) Monitoring of dioxin and polychlorinated biphenyls (PCB) was required in the temporary permit to operate, but because stack test results showed insignificant levels of dioxin and PCB emissions (Ex. APP-II-08; test. Bouffard, pp. 1184-87), the staff did not include such monitoring in its draft permit. However, the staff now recommends that such monitoring be included in the final permit to operate. (Ex. DEP-23; test. Patris, p. 933; see staff's post-hearing brief) The applicant does not object to the inclusion of this permit term. (See comments of Attorney Rubinstein, p. 946; Applicant's post-hearing brief, p. 14; Applicant's reply brief, p. 9.)

(B) Because the WPCA may in the future accept sewage sludge from outside its present service area, the staff recommends a permit term requiring the WPCA to record the date, time, amount and, most important, the origin of any sludge delivered by truck. Such condition would allow the commissioner to monitor the applicant's compliance with the fuel restrictions in the permit![14] (Ex. DEP-23, test. Patris, p. 934; see staff's Post-hearing Brief)

The applicant objects to recording the origin of the sludge, and claims that such requirement would be "unreasonable, arbitrary, and a clear abuse of discretion." The applicant also argues that the requirement duplicates that in its NPDES permits and that the origin of the sludge has no bearing on the nature of the emissions regulated by this permit. (Applicant's post-hearing brief, p. 19, Applicant's memorandum of law, p. 12) However, the applicant does not object to the condition's inclusion in its O&M plan.[15] (See comments of Attorney Rubinstein, Tr. pp. 946, 992.)

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[14] RCSA §22a-174-3(g)(1) authorizes the commissioner to "impose reasonable conditions within any permit to operate, including requirements beyond normal due diligence in operation and maintenance."

According to RCSA §22a-174-4(c)(1),

> The Commissioner may require the submission of any records or reports of monitoring data and other information as he deems necessary to fulfill the purpose and policies contained in these [air] regulations. Such record keeping and reporting may be required of any point source or any indirect source of air pollution. Records and reports required by the Commissioner concerning air pollutants, *fuels*, and operational information shall be recorded, compiled, and submitted on forms furnished or prescribed by the Commissioner . . . [Emphasis added]

[15] The applicant's willingness to incorporate this condition only in its O&M Plan is somewhat bewildering, because compliance with the O&M Plan is a condition established in the draft permit. (Ex. DEP-14, Part B) Failure to adhere to this new condition would be a permit violation even if the new condition were only in the Plan.

ODORS

31. In 1995, the applicant received seventy-nine complaints about odors emanating from the treatment plant. In 1996, there were fewer than forty complaints, with incinerator beginning its test operations in August. In 1997, with incinerator operating all year, there were no more than ten odor complaints. (Test. Smedberg, p. 12; Ex. APP-IV-34) As of the close of these public hearings, there had been only one odor complaint in 1998. (Test. Fura, pp. 532-38)

THE EMERGENCY BYPASS DAMPER

32. The incinerator, like all multiple-hearth incinerators, is designed with a safety feature known as an Emergency Bypass Damper ("EBD"),[16] which is located on a vent line leading to the top of the incinerator building. The EBD is designed to open if, due to mechanical failure or electrical outage, the induced draft fan stops for more than two minutes during normal operation. If the EBD opens while sludge is being burned, untreated exhaust gases are released through a small stack on top of the incinerator building. (Ex. DEP-6; test. McConaghy, pp. 303-08, 385, 401, 566, 571; test. Fura, pp. 546-47) The intervenors are concerned that such incidents will occur frequently, with uncontrolled emissions harming the environment and public health.

33. Between September 1996 and June 1997 (during operation under the temporary permit), there were eight unanticipated openings of the EBD while sludge was being burned in the incinerator. On each occasion, the EBD remained open for about 15-20 minutes. The applicant reported these openings to DEP and ultimately corrected the mechanical and operational problems that caused the EBD to open. (Test. McConaghy, pp. 306-08, test. Smedberg, p. 204; Exs. APP-I-038, -042, -045, -051, -052, -054, -065)

On September 25, 1996, a DEP inspector who was driving near the treatment plant observed smoke emanating from the incinerator during one of the unanticipated EBD openings. (Test. Smedberg, p. 204; test. McConaghy, pp. 313-14; Ex. APP-I-038) On or about October 21, 1996, the chief of the DEP Bureau of Air Management issued a Notice of Violation (NOV) to the WPCA regarding this incident. (Ex. APP-I-041) The applicant has corrected the violations to the satisfaction of the commissioner. (Test. Fura, pp. 1002, 1663-64; test. Patris, p. 1000)

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[16] According to the applicant's Operations and Management Manual (Ex. DEP-6),

> *Emergency*, as it pertains to the use of the Emergency By-Pass Damper (EBD), is defined as an unexpected and necessary venting of incinerator exhaust gases directly to the atmosphere because of the loss of an important plant component such as the use of the Induced Draft fan (ID fan), electrical power or scrubber water. Failure to vent the gases through the EBD will result in an unsafe venting of the exhaust gases directly into the incinerator building work spaces, placing at risk the health of the operating personnel. There could be a dangerous buildup of carbon monoxide inside the work space in addition to unsafe temperature and fire potentials. Additionally, damage to the incinerator or its associated equipment can result without this emergency venting capability, as in the case of a loss of scrubber water.

34. The applicant recently made some additional modifications to the facility which would allow the operator to keep the EBD closed in the event of a power outage lasting no more than three minutes. (Test. Fura, p. 547; test. McConaghy, p. 566)

35. Since June 1997 no EBD openings have occurred while sludge was burning (Ex. APP-II-06), and it is unlikely, given the applicant's corrective measures, that such openings will occur. (Test. McConaghy, p. 309) Nevertheless, in its post-hearing brief, the staff recommended an additional permit condition requiring the applicant to record the date, time, duration, and cause of any EBD opening, as well as whether the incinerator was burning sludge at the time of the opening. (See staff's post-hearing brief, pp. 7-8.)

RADIATION

36. The main sources of radiation in the wastewater processed at the WPCA treatment plant are the two New Haven hospitals (the Hospital of Saint Raphael and Yale-New Haven Hospital) and the laboratories at Yale University. The hospitals use radioactive materials (radioisotopes) for diagnostic and therapeutic procedures; patients' human excreta (feces, urine) discharged to the sanitary sewer systems may contain small amounts of technetium-99m, iodine-123, iodine-131, xenon-133, thalium-201, and indium-111. Wastewater from the hospitals might also include iodine-125 and cobalt-57, used for in-vitro radioimmunoassay tests.[17] (Test. Barlow, pp. 596-97, 731-33, 1744; test. Bohan, pp. 1006-08, 1013-14; 1093; test. Scheuritzel, pp. 771-74; [18] Exs. APP-III-02, APP-III-03)

Radioactive materials can also end up in the sewer when, during the course of their work, people wash non-disposable equipment, wash their hands, or accidentally spill radioactive materials into sinks, floor drains, or other drains leading to sewer system. (Test. Barlow, pp. 590, 628)

37. Yale University uses tracer quantities of radioisotopes as part of its biomedical research experiments. (Test. Barlow, pp. 583 ff.) Yale typically uses sulfur-35, tritium, phosphorus-32, carbon-14 and, to

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[17] Discharge of radioactive materials into sanitary sewage systems is regulated by 10 CFR Part 20 and, in similar language, by RCSA §19-24-14. (The state regulation incorporates the quantity and concentration limits set out in the federal regulation.) Discharge of excreta from persons undergoing medical diagnosis or therapy with radioactive materials is explicitly exempt from both the federal and state limitations. (10 CFR Part 20.2003(d), RCSA §19-24-14(c)(4); see Exs. APP-III-03, APP-IV-14; test. Bohan, pp. 1014-15) Nevertheless, Michael Bohan, the Yale-New Haven radiation safety officer, determined that, even including human excreta, the concentrations released from the hospitals into the sewers are below the state and federal limits. (Test. Bohan, pp. 1021-22; Ex. APP-III-03)

[18] Aggie Barlow has been in the radiation protection field for about twenty-two years, serving as the radiation safety officer at Yale University for more than seven years. Ms. Barlow holds degrees in biology and radiation science; she is a health physicist certified by the American Board of Health Physics, the national certifying board for radiation safety professionals. (Test. Barlow, pp. 585-87) A significant portion of her work concerns human responses to radiation. (Test. Barlow, p. 635) Michael Bohan is a certified health physicist, has been the radiation safety field for almost twenty years, and has been the radiation safety officer at Yale-New Haven Hospital since 1985. (Test. Bohan, p. 1005; Ex. APP-IV-03) Fred Scheuritzel has been a radiation control physicist with DEP since 1992, with prior radiation safety experience with the University of Connecticut and the U.S. Navy. (Ex. DEP-18; test. Scheuritzel, p. 753). These three individuals are the only experts to testify about radiation issues.

lesser extent, chromium-51, phosphorus-33, rubidium-86. (Id., 632) Yale also uses cesium, strontium, and plutonium in some of its research, but these are used only in a sealed form and are not sewer-disposed. (Id., 647-48)

38. In addition to Yale and the two hospitals, about thirteen other small, private industries in New Haven are registered with the DEP to handle radioactive materials. (Test. Scheuritzel, pp. 771, 791) Four of these may, in accordance with applicable law, discharge radioactive materials to the sewer (id., 793-94), although the record is silent on what exactly they discharge. Their discharges, compared to those from Yale and the hospitals, comprise only a very small, insignificant percentage of the radioactive materials reaching the sewer system. (Id., 771-72, 803)

39. The radioactive materials used for medical research and treatment have short half-lives. For example, Yale uses phosphorus-32 which has a half-life of about 2 weeks. The hospitals use technetium-99m, by far the most abundant radioisotope discharged in human excreta, which has a half-life of about six hours. The hospitals also use thallium-201, which has a half-life of about three days; indium-111, about 3 days; iodine-123, about 12 hours; iodine-131, eight days. Cobalt-57 and chromium-51 have longer half-lives but they are used and discharged in much smaller quantities. (Test. Barlow, pp. 595-96, 750; test. Bohan, pp. 1008, 1015-16, 1088; Ex. APP-III-03)

All of the radioactive materials used for medical research and treatment are readily soluble and dispersible in water. (See 10 CFR Part 20.2003, RCSA §19-24-14(c)(1).) Less than 1/100th of the radioactive materials discharged into the sewer might concentrate in the sludge. (Test. Barlow, pp. 589, 596-97, 604, 1744, 1790-93; Scheuritzel, pp.775-76; Bohan, pp. 1023, 1093; Exs. APP-III-02, APP-III-03) When the sludge is burned, some of the remaining radioactive materials would end up in the ash, but most would flow through and be recovered by the emissions control system. (Test. Bohan, p. 1094)

40. According to a 1992 report prepared by Pacific Northwest Laboratory for the Nuclear Regulatory Commission, "Evaluation of Exposure Pathways to Man From Disposal of Radioactive Materials into the Sanitary Sewer Systems," there are five radioactive materials produced in the U.S. which, if discharged into the sewer in large quantities and then incinerated in sewer sludge, would be "of concern." These are americium-241, iridium-192, cobalt-60, cesium-137 and strontium-90. (Ex. APP-IV-14, p. ix; see test. Barlow, pp. 599-600, 613) Neither Yale nor the hospitals discharge any of these five isotopes, either directly or contained in human excreta. (Test. Barlow, pp. 600-01)

41. The EPA has developed a computer model to calculate potential exposure to airborne radioactive materials emitted by facilities licensed by the NRC. This model, known as COMPLY, is used by thousands of facilities in the country to determine their compliance with the federal regulations at 40 CFR Part 61, Subpart I (which applies only to certain federal facilities) and 10 CFR Part 20.[19] The model

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[19] According to 10 CFR 20.1101, NRC licensees shall limit the air emissions of radioactive materials so that "the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 10 mrem . . . per year from these emissions." The NRC regulation places no specific limit on emissions of radioiodine, unlike the EPA regulation which limits the exposure to 10 mrem, of which no more than 3 mrem may be from radioiodine. (40 CFR 61.102; *see* 61 Fed. Reg. 68972 (1996))

Although the applicant is not an NRC licensee or a federal entity, and thus is not subject to either of these regulations, the staff and the applicant each ran the COMPLY model in response to public concern and used the

considers site specific factors such as stack height and diameter, flow rate in the stack, meteorological conditions, effluent temperature, wind speed and direction, and distance to the property line and food sources. (Test. Scheuritzel, pp. 754-56, 768; test. Barlow, pp. 605-11; 40 CFR 61.103; 61 Fed. Reg. 68971 et seq. (1996); U.S. Nuclear Regulatory Commission, Regulatory Guide 4.20 [officially noticed], pp. 3-4)

42. Fred Scheuritzel, a DEP radiation control physicist, ran the COMPLY model using the hospitals' average annual sewer disposal figures; his modeling specifically addressed the disposal of iodine-131 and technetium-99m, the predominant nuclides used at the hospitals. He conservatively assumed that *all* of radioactive material discharged by the hospital into the sewer would reach the treatment plant, concentrate in the sludge, and ultimately be emitted, undiminished, from the incinerator stack. His assumption intentionally ignores the natural decay of the radioactive materials (most of which have short half-lives), their high solubility in water,[20] and the use of pollution controls. (Test. Scheuritzel, pp. 769-81; Ex. DEP-21)

Some of the data Scheuritzel used in the model were actual figures--e.g., building height, stack height and diameter, and distances from the stack to the property line. Others, such as wind speed and direction, were "default" figures, which do not reflect actual conditions but are built into the computer model itself. (Test. Scheuritzel, pp. 764-65, 776-78; test. Barlow, pp. 1741-43, 1779)

43. Scheuritzel determined that, even with all of his conservative assumptions, a person's theoretical maximum exposure at the property line would be would be about 1.5 millirem (mrem) per year of radionuclides, almost all of which would be iodine-131.[21] (Test. Scheuritzel, pp.758, 782-73, 810-13; Ex. DEP-21)

44. Aggie Barlow, the Yale radiation safety officer, also ran the COMPLY model for the incinerator based on calculated annual sewer releases of all radionuclides (including those contained in human excreta) from Yale and the two hospitals from October 1996 through September 1997. She used several conservative assumptions such as: (1) all radioactive material entering the sewer from the three sources would concentrate in the sludge--none would naturally decay or remain in the liquid effluent;[22] (2) all radioactive materials would flow through the stack rather than remain in the ash; (3) the facility would operate at the lowest feasible temperature within its expected range; (4) no air pollution controls. Unlike Scheuritzel, she used none of the model's "default" figures; some of her information on amounts

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federal regulatory standards as a benchmark when assessing the potential emissions from this incinerator. (Test. Scheuritzel, pp. 754, 820-21; test. Barlow, p. 1780)

21 More realistically, the radioactive materials used in treatment would naturally decay before they are even excreted by the patients, and then continue to decay as they enter the sewer and flow to and through the treatment plant. Furthermore, most of the remaining radioactive materials would never reach the incinerator because they remain in the liquid effluent. (See test. Scheuritzel, pp. 773-81)

[21] The applicant's expert witness, Aggie Barlow, in response to a question from the intervenors, explained that Scheuritzel's modeling results, when carried out to five decimal places, were actually 1.5 mrem iodine-131 and 0.00052 mrem technetium-99m. (Test. Barlow, p. 1787)

[22] As noted above, less than 1% concentrates in the sludge. (FF # 39)

released from the hospitals was more recent than Scheuritzel's as well. (Test. Scheuritzel, p. 809; test. Barlow, pp. 1783-85) Modeling results demonstrated that, even with Barlow's conservative assumptions,[23] a member of the public living at the property line and obtaining all food from sources within the direct path of the emissions would, at worst, be exposed to 0.4 mrem per year. (Test. Barlow, pp. 605-611, 1737-38, 1765-69, 1788-90; see U.S. Nuclear Regulatory Commission Guide 4.20, December 1996 [officially noticed pursuant to Conn. Gen. Stat. §4-178].)

According to Barlow, with an exposure of 0.4 mrem/yr, the likelihood of a person getting cancer "might be one in 1.25 billion." (Test. Barlow, pp. 715, 745-46.)

45. The average person in the U.S. is exposed to naturally-occurring background radiation of about 300 mrem per year.[24] (Test. Barlow, p. 609; test. Bohan, p. 1009) Radioactive emissions from the incinerator would be indistinguishable from natural background levels. (Test. Barlow, pp. 605-11, 715-16, 1737-44, 1787-95; test. Bohan, pp. 1022-24, 1049-51)

46. The intervenors claim that there is no dose of radiation, no matter how low the dose or brief the exposure, that is harmless. They rely on numerous book excerpts, journal articles, and other written documents to support their position (e.g., Exs. INT-1-1, INT-1-2(A), INT-1-4, INT-1-5, INT-3-5, INT-7-3), but they called no expert witnesses to testify on their behalf.[25] The applicant, in turn, submitted numerous articles to rebut those offered by the intervenors (e.g., Exs. APP-III-02, -IV-09, -IV-10, -IV-12, -IV-23, -IV-25, -IV-27) and called upon two experts in the field of radiation safety to testify about emissions from this incinerator and to contest the theories espoused in the intervenors' documents.

47. Ernest J. Sternglass, Ph.D., professor emeritus of radiological physics at the University of Pittsburgh, is the primary expert upon whom the intervenors rely. Dr. Sternglass has been involved in the field of radiation and its effects on humans for about thirty years, and has written extensively on the health effects of fallout from nuclear bomb testing and nuclear power plants. Dr. Sternglass is among a small and controversial group of professionals who consistently write and speak out on the dangers of low doses of radiation; he is a leading proponent of the theory that exposure to low levels of ionized radiation is as harmful as, or even more harmful than, exposure to high doses over a short period of time (the "linear no-dose threshold theory," or "LNT"). (Exs. INT-1-5, INT-9, INT-11, INT-12, INT-13; test. Bohan, pp. 1034, 1047; test. Barlow, p. 683)

Dr. Sternglass, like the other experts whose works the intervenors cite, did not testify at this hearing. Furthermore, none of his writings specifically addresses the WPCA incinerator or, for that matter, sewage sludge incinerators in general. (See, e.g., Exs. INT-1-5, INT-3-5, INT-11, INT-13.)

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[23] Barlow describes her assumptions as "beyond even the worst case scenario." (Test. p. 606)

[24] Background radiation includes radiation from cosmic sources (the sun and stars), residual radioactivity dating back to the creation of the earth, and man-made radioactivity. (Test. Bohan, pp. 1009-11)

[25] Instead, the intervenors cross-examined the applicant's and the staff's expert witnesses at length, but were unable to garner any support for their position in this fashion.

48. For almost thirty years, Sternglass's theories and methodologies have been challenged and criticized by the majority of the scientific community. (See, e.g., Ex. APP-IV-29 [Nuclear Energy Institute's compilation of numerous criticisms of Sternglass's hypothesis linking fallout from nuclear weapons with adverse health effects]; Ex. APP-IV-23 [article in International Journal of Health Services referring to over fifty challenges to Sternglass's methodologies and conclusions, including those by the Minnesota Energy Agency, US EPA, National Cancer Institute, National Academy of Sciences, and independent scientists]; Ex. APP-IV-09 [position paper by the Health Physics Society, a professional organization of physicists who specialize in radiation safety, challenging Sternglass's hypothesis connecting infant mortality with wastes from nuclear power reactors; test. Barlow, p. 616 [Sternglass has a poor reputation in the radiation health community, and he is considered to be neither careful nor reliable]; see also Exs. APP-IV-24, -IV-25, -IV-26, -IV-27; test Barlow, 614-15; test. Bohan, pp. 1037-47, 1110-11.)

49. The intervenors also rely strongly upon the works of Dr. John Gofman, professor emeritus of molecular cell biology at University of California and another major proponent of the LNT theory. (Exs. INT-1-1, INT-7-3, APP-IV-23) Like Dr. Sternglass, Dr. Gofman did not testify at this proceeding, nor do his writings concern incineration of sewage sludge. According to Bohan, Gofman's reputation in the health physicists community is "very similar to Dr. Sternglass's." (Test. Bohan, p. 1048) "Within the health physic[ists] community it's not given very much weight at all." (Id.; see Ex. APP-IV-23)

50. According to the uncontroverted testimony of Aggie Barlow, the LNT theory does not take into account the body's repair mechanisms and other biological factors. Scientists and radiation safety experts generally do not accept the LNT theory as the appropriate way to calculate the risks of low dose exposure. (Test. Barlow, pp. 611-12, 663; Ex. APP-IV-28) Conversely, many studies clearly demonstrate that there is a clear threshold for safe exposure to radiation, a threshold which many believe to be between 10 and 100 rem (i.e., between 10,000 and 100,000 mrem) per year. (Test. Barlow, pp. 612, 716-17)

51. In January 1996, the Health Physics Society ("HPS")[26] published a position statement entitled "Radiation Risk in Perspective," which states, "There is substantial and convincing scientific evidence for health risks at high doses. Below 10 rem (which includes occupational and environmental exposures), risks of health effects are either too small to be observed or are non-existent." (APP-IV-28, p. 1) "Epidemiological studies have not demonstrated adverse health effects in individuals exposed to small doses (less than 10 rem) delivered in a period of many years." (Id., 2) The HPS statement concluded that risk estimates should be limited "to individuals receiving a dose of 5 rem in one year or a lifetime dose of 10 rem in addition to natural background." (Id.)

THE RADIATION DETECTOR

52. During operation under the temporary permit to operate, the applicant installed a HARSHAW BICRON Model LFM-2 Radioactive Material Detection System ("radiation detector") along side of the

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[26] The HPS, of which both Barlow and Bohan are members, is a "professional organization of over 6,400 scientists, educators, engineers, and operational health physicists who are dedicated to developing, disseminating and applying scientific knowledge of, and the practical means for, radiation safety. The primary objective of the Society is to protect people and the environment from potentially harmful exposure to ionizing radiation." (Ex. APP-IV-31; see APP-IV-28, p. 3)

conveyor belt which carries the dried sludge to the incinerator. (Exs. APP-III-01, APP-III-04; test. McConaghy, pp. 318 ff.) The radiation detector is designed to monitor the sludge for detectable levels of low, medium and high energy gamma rays and X rays. (Ex. APP-III-01, p.1; test. McConaghy, p. 388)

Alpha and beta radiation are more likely than gamma or X rays to cause ionization of human and animal tissue and damage to cells. (Test. Barlow, pp. 592-94) Although the radiation detector is not designed to detect alpha or beta radiation (test. McConaghy, p. 320), the radioisotopes primarily used in nuclear medicine emit gamma rays. (Test. Barlow, p. 613; test. Bohan, pp. 1090-91)

53. The applicant installed the radiation detector as a gesture of being "a good industrial neighbor," in response to concerns raised by citizens at various informational meetings in the mid-1990s. (Test. McConaghy, p. 389; test. Fura, p. 441) The applicant's construction permit and temporary operation permit did not require the installation and use of the detector; the draft permit likewise contains no such requirement. (Test. Fura, p. 441; see also APP-I-023) The staff, in fact, believes there is no justification for sampling the sludge for radioactivity. (Ex. APP-I-023)

The radiation detector's alarm is designed to sound when detectable levels of gamma or X rays (above ambient levels) pass by the radiation detector on the conveyor belt. (Test. McConaghy, p. 387) Should this occur, the applicant would shut down the feed unit, remove the sludge from the conveyor belt, and notify DEP. (Ex. APP-I-029) Since the detector was installed, its alarm has not sounded. (Test. McConaghy, pp. 387, 402; test. Fura, pp. 515-16)

The radiation detector's instruction and maintenance manual recommends that the radiation detector be tested "on a regular basis (daily or weekly) using a small radioactive source." (Ex. APP-III-01, p. 7). It does not appear that such test has ever been done. (See test. McConaghy, pp. 336, 341; Fura, p. 515)[27]

COMPLIANCE HISTORY

54. The commissioner considered the WPCA's compliance history when he evaluated and ultimately approved the WPCA's application for a permit to construct and modify the incinerator in 1992. Minor violations of the applicant's NPDES permit occurred frequently between 1988 and 1991; most resulted from technical problems with the treatment process, and they were rectified without any formal enforcement action by the DEP. One of the applicant's 1988 violations resulted in the issuance of a consent order, whose requirements the applicant has since satisfied. On three occasions in 1989 the commissioner issued Notices of Violation to the applicant for violations of its discharge permit; the applicant's prompt remedial actions obviated the need for follow-up enforcement actions. On or about May 26, 1989, the commissioner issued an NOV to the WPCA alleging a violation of RCSA §22a-174-18(a)(1); this matter was resolved when the WPCA took the pertinent equipment out of service. (Exs. APP-I-009, APP-I-060)

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[27] Assuming that installation of the detector was, indeed, a good faith gesture, that gesture is meaningless without proper operation and maintenance in accordance with the manufacturer's instruction manual.

55. As discussed above, on eight occasions between September 1996 and June 1997, the incinerator's emergency bypass damper opened while sludge was burning and released untreated flue gases into the atmosphere. In response to one of these unanticipated EBD openings, the commissioner issued a Notice of Violation (NOV #13465) to the applicant, alleging violation of RCSA §22a-174-18(1)(I) and requiring corrective actions. After months of evaluation, the applicant permanently rectified the problem with mechanical and operational changes. Since June 1997 there have been no releases due to unanticipated EBD openings and the department has determined that no further actions are needed. (Test. Fura, pp. 1002, 1663-64; test. Patris, p. 1000; Exs. APP-I-038, -041; -042; -045; -048; -051, -052, -058; -059, -060, -065, -068; see FF #33)

56. The WPCA is in compliance with the most recent order, Consent Order No. 1522. (See FF #8, n. 6; test. Patris, p. 940)

57. The commissioner requires permit applicants to complete a form ("compliance history form") on which the applicants provide information regarding any violations of state and federal environmental laws occurring in the five years prior to application. (See General Statutes §22a-6m.) In February or March 1998, the applicant submitted a compliance history form as part of its application for registration under the department's Title V "General Permit to Limit Potential to Emit." (Ex. DEP-24; test. Patris, pp. 1267-68, test. Fura, p. 1291) According to the form, as clarified by record testimony: (1) In September 1992, the applicant entered into a consent order with the DEP regarding excess nitrogen in its water discharge; (2) in 1993, the US EPA issued an order to the WPCA regarding chlorine exceedances in its discharge; modifications to the treatment plant resolved the problems; (3) in June 1995, the Connecticut Fund for the Environment brought a civil law suit against the WPCA alleging violations of discharge effluent limits in its NPDES permit; the parties settled the case before trial; (4) in 1987, the state brought a civil law suit against the WPCA regarding removal of suspended solids from its water discharge; this matter was resolved with a stipulated judgment; and (5) in June 1993, the commissioner issued an NOV to the WPCA regarding violations of the NPDES permit limits on settleable solids. (Ex. DEP-24 ; test. Fura, pp. 1292-93)

58. New Haven Residuals, L.P. ("NHR") is a limited partnership which operates the incinerator pursuant to a contract with the WPCA. (Ex. APP-IV-32; test. McConaghy, pp. 292-93, 310; test. McCormack, p. 1299) Paul Toretta and R.J. Guerra are the limited and general partners of NHR and other affiliated business entities. (Test. McCormack, pp. 1299-1305)

59. The intervenors and other members of the public have expressed concern that the allegedly poor compliance history of the operator (and its affiliates) at other facilities will be reflected in poor operation and oversight of this incinerator. (Docket Item #18) They have, however, offered no evidence to support their concern.

At the request of staff, who believed it "appropriate" given the citizens' concerns (Test. Patris, p. 1269; see test. McCormack, p. 1301), Paul Toretta prepared a compliance history form on his own behalf and another on behalf of NHR and its affiliates. (Ex. DEP-10; test. McCormack, pp. 1301-04) According to the forms, during the five year period preceding submission of this application, neither Toretta nor NHR or its affiliates was found by a court or administrative agency to be in violation of any civil or criminal environmental laws and neither was subject to a civil penalty or order resulting from violation of any environmental laws. (Ex. DEP-10)

Furthermore, the DEP's own records do not indicate any violations of environmental law by the applicant and/or its operator. (Exs. APP-I-036, -037)

60. Unlike Toretta, Guerra has no involvement in the day-to-day activities of NHR or its affiliates. (Test. McCormack, p. 1307) Guerra owns a private waste-hauling business (id., 1310) that, according to the intervenors, is involved in a law suit involving a sludge incinerator in Naugatuck.[28]

ALTERNATIVES

61. In the early 1990s, while the incinerator was not in operation, the applicant evaluated various sludge disposal options, including alkaline stabilization, composting, and a return to incineration. (Test. Fura, p. 430) In its evaluation, the applicant sought a proven technology adaptable to the geographic constraints, regulatory requirements, land area limits, sludge volumes, and wastewater issues associated with the New Haven area. (Id., 436-37)

62. One alternative to incineration is landfill disposal of the sewage sludge. (Test. Smedberg, p. 164; see APP-IV-14, §§3.5-3.8) The applicant's previous attempts at landfill disposal in the early 1990s were thwarted by odor problems and, more important, limited landfill availability (see FF 4). Not only would the applicant face these same obstacles, but landfill disposal would cost the applicant roughly $1-1.5 million per year more than incineration, a cost ultimately reflected in WPCA customers' sewer use fees. (Exs. APP-I-029, APP-I-034) Offsite disposal of the sludge would also involve frequent truck traffic with its potential for additional air pollution. (Ex. APP-I-029)

63. Alkaline stabilization is a process used to destroy pathogens by elevating the pH of the sludge for several hours . The sludge is eventually reused--for example, as landfill cover. (Test. Fura, pp. 431-32) Elevating the pH causes the emission of ammonia, which burns the eyes and has an offensive odor. A school near the New Haven landfill was affected by ammonia fumes when material stabilized in this fashion was deposited at the landfill. (Id., pp. 434-35)

64. Composting-related options are like the alkaline stabilization, but with additional processing which allows the sludge to be converted into products usable as compost or soil "amendments." (Test. Fura, pp. 432-35; test. Smedberg, pp. 128-29) The applicant was unable to determine a ready market for compost created from approximately 22 tons of sludge per day. (Test. Smedberg, p. 129; test. Fura, pp. 433-34.)

65. Ecological engineering (also referred to as "solar aquatics" or "the living machine") is a method of treating wastewater by using natural processes to break down the wastes; harmful constituents are removed and the remaining wastewater can be reused. There are several variations of this technology, such as growing aquatic plants in the wastewater within contained areas (such as greenhouses) or using marsh areas or tanks. (Exs. INT-5-1, APP-IV-13, APP-IV-17, APP-IV-18; test. Fura, p. 442)

Because ecological engineering treats wastewater, not sludge, it is an alternative to the entire wastewater treatment plant, not just to the incinerator. (Ex. APP-IV-20) Nevertheless, in the early 1990s, when

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[28] The intervenors have provided no further information on Guerra or the alleged law suit, nor have they explained why such law suit is relevant here.

assessing alternative means to dispose of sludge, the applicant considered this option, reviewed published literature on the subject, and contacted several facilities which use that process. (Test. Smedberg, p. 138; test. Fura, pp. 442-44, 491, 516-20, 1668 ff.; Ex. APP-IV-20)

66. Ecological engineering is best suited for wastewater treatment plants handling no more than 1 to 3 million gpd of wastewater (test. Smedberg, p. 139), whereas the WPCA handles approximately 40 million gpd. Ben & Jerry's ice cream manufacturing facility in Waterbury, VT, which the applicant visited in 1992, was designed to treat 1,000 gpd. (Ex. APP-IV-15; test. Fura, pp. 442-44, 516-20) A solar aquatics operation in Harwich, MA was designed to handle 3,600 gpd; one in Providence, 24,000 gpd; one in Marion, MA, 1,000 gpd; and one in Muncie, IN, 3,000 gpd. (Exs. APP-IV-15, APP-IV-18) All of these were designed to treat wastewater flows, not to dispose of sludge. (Ex. APP-IV-20)

67. The largest ecological engineering facility in the country, located in California, treats about a half-million gallons of wastewater per day. The intervenors acknowledge that there is no living machine that treats--or is capable of treating--flows of more than 80,000 gpd (i.e., 0.2% of the WPCA's average daily flow) in a "New Haven-type climate." (Test. P. Bowman, pp. 1504-05)

68. Only about 10% of the solids are removed in the ecological engineering process; the remainder would still require some form of disposal. (Ex. APP-IV-20; test. Fura, pp. 553-56; see also EPA Office of Water, Environmental Regulations & Technology, Use and Disposal of Municipal Wastewater Sludge [officially noticed], p. 47)

69. According to EPA's Environmental Regulations & Technology: Use and Disposal of Municipal Wastewater Sludge, *supra* at 47, "Incineration offers significant advantages over usual disposal options, it reduces the sludge to a compact residue consisting of about twenty percent of the original volume of the sludge solids and it eliminates some potential environmental problems by completely destroying pathogens and degrading many toxic organic chemicals." Although, according to the document, "[h]igh pressure scrubbers or other pollution devices are needed to prevent degradation of air quality" (id.), the applicant has proposed the appropriate controls to reduce emissions and protect air quality. (See FF 16-18.)

CONCLUSIONS

A. RCSA §22a-174-3(f) requires the owner or operator of a stationary source, or modification thereto, to obtain a permit to operate if, among other reasons, the source is an incinerator or if the source will have potential emissions of any individual air pollutant equal to or greater than five tons per year. The applicant must obtain a permit to operate for both of these reasons and therefore must demonstrate compliance with the "relevant and applicable"[29] provisions of RCSA §22a-174-3(g)(2). As set out more fully below, I conclude that the applicant has met all of these standards.

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[29] Not all of the standards apply to every application to operate a stationary source. For example, some may apply only when potential emissions exceed certain levels; others apply only to resources recovery facilities. Typically, the staff informs an applicant, long before any public hearing, whether its application is deficient because it fails to address any of the applicable provisions in §22a-174-3(g)(2).

B. A major stationary source is a premise[30] with potential emissions equal to or greater than one hundred tons per year of any individual air pollutant (prior to the proposed modification to the source) or the more stringent of the following: (a) 50 tpy of VOC or nitrogen oxides in any area designated as serious non-attainment for ozone, or (b) 25 tpy VOC or nitrogen oxides in any area designated as severe non-attainment. RCSA §22a-174-1(46) Because potential emissions of any air pollutant are less than 100 tpy, and because potential emissions of VOC and nitrogen oxides are less than 50 tpy in a serious non-attainment area, the incinerator is not a major stationary source. RCSA §22a-174-1(46)

Because of a small increase in capacity, the reconstructed incinerator, with its new emissions control system, is considered to be a "modification" of the original incinerator. RCSA §22a-174-1(52). However, because the incinerator is not a major stationary source, the changes are not considered "major modifications." RCSA §22a-174-1(45)

C. Data from stack tests during operation under the temporary permit to operate demonstrate that the applicant has operated the incinerator in compliance with the terms of that permit and that it would operate in compliance with the terms of the draft permit. Adherence to the terms of the draft permit, modified in accordance with the recommendations below, would also ensure that the incinerator operates in compliance with the applicable regulations, because such permit terms are consistent with, and often more restrictive than, the regulations. RCSA §22a-174-(g)(2)(A); RCSA §22a-174-3(g)(2)(E)

D. Section 22a-174-3(g)(2)(B) requires an applicant to demonstrate that it would operate a stationary source without preventing or interfering with the attainment or maintenance of applicable ambient air quality standards or the available Prevention of Significant Deterioration (PSD) increments listed in RCSA §22a-174-3(k), Table 3(k)-2.

A source's impact on ambient air quality are determined by using modeling procedures approved by the commissioner. RCSA §22a-174-3(c)(3). Because the incinerator is not a major stationary source, there is no requirement for the staff to conduct (or to require the applicant to conduct) air quality modeling which takes into account emissions from other sources. The staff correctly conducted a "Stationary Source Stack Height Analysis," a procedure approved by the commissioner, and determined that a minimum stack height of 190 would ensure that there would be no adverse ambient air quality impacts.

The requirements of the PSD program apply only to a new major stationary source or to a major modification, RCSA §22a-174-3(k)(1)(A), and therefore are not applicable here.

E. The applicant has equipped the incinerator with appropriate instrumentation, including continuous emission monitors, to monitor and record emission data and other operational information, in accordance with the requirements of the commissioner. Accordingly, it has satisfied the requirements of RCSA §§ 22a-174-3(g)(2)(C) and 22a-174-3(c)(1)(H).

F. The applicant has demonstrated that it constructed the incinerator in accordance with its permit to construct and thus it has satisfied the requirement of RCSA §22a-174-3(g)(2)(D).

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[30] "Premise" means the grouping of all stationary sources at any one location and owned or under the control of the same person or persons. RCSA §22a-174-1(72). The incinerator is the sole stationary source at this location.

G. The incinerator's emissions control system constitutes Best Available Control Technology for all pollutants with potential emissions of greater than five tons per year. RCSA §§ 22a-174-3(c)(1)(G), 22a-174-3(g)(2)(H).

H. Section 22a-174-3(g)(2)(J) requires the owner or operator of a major stationary source or major modification to submit to the Commissioner, for his approval, a comprehensive operations and maintenance plan. This requirement does not apply here because the incinerator is neither a major source nor a major modification. Nevertheless, to satisfy the requirements of Consent Order No. 1522, the applicant did in fact submit, and receive the commissioner's approval of, its O&M Manual. The draft permit requires the applicant to maintain such plan on site and to operate the incinerator and emissions control system in accordance therewith.

I. Section 22a-174-3(g)(2)(K) requires an applicant to demonstrate its compliance with the applicable provisions of §§22a-174-3(k), (*l*), and (m). Because subsections (k) and (*l*) apply only to major stationary sources or major modifications, they are not applicable here.

Section 22a-174-3(m) provides that the commissioner shall not issue a permit to operate if operation of that source would exceed any applicable MASC for any hazardous air pollutant. The evidence clearly shows that no emissions from the incinerator have exceeded or would exceed applicable MASCs.

J. Section 22a-174-3(g)(2)(L) requires an applicant to demonstrate that it operates the source without causing a violation of any applicable ambient air quality standard, available PSD increment, or applicable emission limitation. As explained above, operation of the incinerator in accordance with the terms in the draft permit would have no adverse impacts on ambient air quality or violate any regulatory emission limit; no PSD increment applies in this case. (See Conclusion D.)

K. The applicant has complied with all notice requirements set out in RCSA §22a-174-3(j)(1) [notice of application], §22a-174-3(j)(2) [notice of tentative determination], and §22a-174-3(j)(4) [notice of hearing]. (See FF 8, n. 5, FF 9, n. 7, FF 11, n. 9.)

L. The federal Standards of Performance for Sewage Treatment Plants require the applicant to demonstrate, through stack testing, that particulate emissions are below 1.30 lb/ton dry sludge input. 40 CFR Part 60.152 (A)(1). The applicant's stack tests demonstrated that particulate emissions met the draft permit's limit of 0.71 pounds per hour (0.43 lb/ton dry sludge), which is well below the regulatory limit.

Particulate emissions are also governed by RCSA § 22a-174-18(c)(3)(I), which allows emission of no more than 0.08 grains per standard cubic feet ("gscf"), corrected to 12% carbon dioxide. The draft permit's limit of 0.015 gscf, which the applicant consistently met during stack testing, is well below the federal limit.

M. The federal EPA has established National Emissions Standards for Hazardous Air Pollutant ("NESHAP") for several pollutants, notably beryllium and mercury, which have the potential to appear in air emissions from sewage sludge incinerators. (40 CFR Part 61) The draft permit would limit emissions of beryllium to no more than 0.022 lb/24-hr, consistent with the limit established in 40 CFR 61.32. The incinerator's average emission rate of mercury, as determined by the stack tests (0.0035 lb/hr), and the

draft permit's maximum allowable emission rate (0.02 lb/hr) are far below the maximum allowable emission rate for mercury (7.055 lb/24 hrs) established in 40 CFR Part 61.52.

N. Although the intervenors concede that the draft permit's emission limits are at least as stringent as applicable regulations, they claim--as does public speaker Dr. Mitchell--that the state and federal regulations themselves are not sufficient to protect human health. However, neither the intervenors nor the public speakers opposing the application offered any evidence or argument supporting this contention. Both the state and the federal emissions standards are, in fact, designed to be protective of public health. The draft permit not only incorporates these standards by reference, but also contains its own, more stringent emissions limits. Provided the applicant adheres to the terms of the draft permit and the additional conditions recommended below, operation of the incinerator would not pose a hazard to public health. General Statutes §22a-186a.

O. The compliance record of the applicant , as well as that of the incinerator's operator, evidences no pattern or practice of non-compliance with any environmental laws or with permits or orders issued by the commissioner. The small number of sporadic incidents and violations--due mostly to equipment problems--does not warrant denial of this application. General Statutes §22a-6m. However, the applicant's compliance history does justify an additional permit term, as recommended by staff, requiring written records of the cause of and circumstances surrounding any unanticipated openings of the emergency bypass damper.

P. The intervenors continuously assert their fears and beliefs that the incinerator would emit harmful amounts of radioactive material through the stack. However, they have presented no evidence--and elicited none from the other parties' witnesses--to show that any detectable radioactive materials would be released, much less have any harmful effects. The experts upon whose opinions they rely did not testify at the hearing. Most of experts' publications do not even deal with sewage sludge incinerators; none deals with this particular incinerator.

For all of the opinions espoused in the intervenors' documents, there are numerous countervailing opinions, as well numerous, serious indictments of the methodologies used by the experts cited by the intervenors. To rebut the intervenors' documents, the applicant presented published articles of its own, which clearly show that the intervenors' views are not widely held. However, while such articles cast doubt on the credibility of Dr. Sternglass and others, I will not dismiss their theories out of hand merely because there is more evidence--far more--against their opinions than in support of their opinions. The real issue is that because these opinions are so controversial, and because the proponents clearly are in a small minority, it is imperative that anyone espousing such opinions be available for examination under oath. Here, the only experts to testify--Barlow, Bohan, Scheuritzel--provided credible, uncontroverted testimony that any radiation releases that might occur would be almost indistinguishable from natural background radiation and would have no impact on public health.

Q. The intervenors allege that operation of the incinerator constitutes "conduct which has, or which is reasonably likely to have, the effect of unreasonably polluting, impairing or destroying the public trust in the air, water or other natural resources of the state." General Statutes §22a-19(a); see *Manchester v. Stockton*, 184 Conn. 51, 60 (1981). Whether pollution is unreasonable in any given instance is an issue to be determined by the trier of fact based on the evidentiary record. (See *Gardiner v. Conservation Commission*, 222 Conn. 98, 108 (1992); *PRICE, Inc. v. Keeney*, judicial district Hartford-New Britain at Hartford, Docket No. CV-94-0542469-S, pp. 2-3 (February 25, 1998)

Although the record is replete with suggestions and fears that harmful emissions would emanate from the incinerator, it contains little, if any, evidence to persuade me that this would occur. The intervenors offered no expert witnesses and neither they nor members of the public who spoke in opposition to the facility provided any probative evidence showing that emissions from the incinerator would pollute the environment or be harmful to public health. On the other hand, the unrefuted evidence from both the applicant's and the staff's experts convincingly demonstrates that (1) the applicable emission limits established by state and federal regulations are designed to be protective of human health, (2) the permit terms are as stringent as--and in many cases more stringent than--the regulatory limits, (3) the applicant will meet all applicable emissions limits provided it adheres to all operating terms of its permit, and (4) because of the state-of-the art emission control system, incinerator emissions have been and would continue to be cleaner than emissions before the incinerator was modified. Accordingly, I conclude that there is no reasonable likelihood of unreasonable pollution.

R. None of the alternative means of sewage sludge treatment or disposal identified in this record is a feasible and prudent alternative to the incinerator. Incineration appears to be the most reliable and environmentally sound form of sludge disposal for this particular wastewater treatment plant.

S. Federal agencies, in "proposals for legislation and other major Federal actions significantly affecting the environment," are required to prepare a detailed environmental impact statement (EIS) assessing the proposal's anticipated environmental and health effects and all reasonable alternatives. 42 U.S.C. §4332(C)(ii) Despite intervenors' suggestion, this requirement does not apply to the WPCA, which is not a federal agency. A state environmental impact evaluation is required for proposed "actions which may significantly affect the environment," a phrase which means "individual activities or a sequence of planned activities proposed to be *undertaken by state departments, institutions or agencies, or funded in whole or part by the state*, which could have a major impact on the state's water, air, . . . or other environmental resources, or could serve short term to the disadvantage of long-term environmental goals." [Emphasis added.] Conn. Gen. Stat. §22a-1c. This, too, is inapplicable, as the WPCA is a municipal authority and the modifications to the incinerator have not been funded by state monies.

T. The intervenors and several members of the public claim that permitting the incinerator without considering its potential for racially disparate impacts would violate Title VI of the Civil Rights Act of 1964, 42 USC §2000d, et seq. ("Title VI"), and thus no permit may issue.[31]

Title VI states that "[no person in the United States shall, on the ground of race, color or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." 42 USC §2000d. Because the DEP's air program receives financial assistance from the federal EPA, the department is subject to the provisions of Title VI.

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[31] During the hearings, the intervenors sought to permission to call as a witness Attorney Graham Boyd to provide testimony about Title VI violations. They had not previously identified Boyd as a witness or Title VI as an issue for adjudication. I directed the intervenors to have Boyd file a written summary of his proposed testimony and send copies to all parties. Upon review of that summary (Docket Item #24), I determined that Boyd's intention was not to offer evidence or sworn testimony but simply to provide legal argument. I ruled that Boyd would not need to "testify" about purely legal matters, that his document would be considered part of the intervenors' argument, and that he could, if he wished, provide further argument in conjunction with the intervenors' post-hearing briefs. (Transcript, pp. 1154 ff.)