City of New Bedford, Massachusetts



PHASE 2 FACILITIES PLAN

VOLUME III

Design Criteria Development and Process Evaluations

APPENDICES

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Camp Dresser & McKee Inc.

VOLUME III

Design Criteria Development and Process Evaluations

APPENDICES

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Appendix A

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VOLUME III APPENDIX A NPDES PERMIT

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AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Clean water Act, as amended, (33 U.S.C. §§1251 <u>et seq</u>.; the "CwA"), and the Massachusetts Clean waters Act, as amended, (M.G.L. Chap. 21, §§26-53),

New Bedford, MA

is authorized to discharge from the facility located at the

Municipal Wastewater Treatment Facility and Combined Sewer Overflows

to receiving waters named Clark's Cove, Acushnet River and Buzzard's Bay

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on 30 days from the date of signature.

This permit and the authorization to discharge expire at midnight, 5 years from effective date.

This permit supersedes the permit issued on December 30, 1974.

This permit consists of 19 pages in Part I including effluent limitations, monitoring requirements, etc., and 19 pages in Part II including General Conditions and Definitions.

day of / Signed this Director

Water Management Division Environmental Procession Agency Region I Boston, MA

Director, Division of water

Director, Division of water Pollution Control Department of Environmental Quality Engineering Commonwealth of Massachusetts Boston, MA

A. <u>Effect cont Limitations and Monitoring Requirements</u> tor POIW Outfalls Listed in Attachment A

1. a. Effluent Limitations and Monitoring Requirements -

During the period beginning the effective date and lasting through expiration, the permittee is authorized to discharge effluent to Buzzards Bay from POTW outfalls 001 and 002 listed in Attachment A. Such discharges shall be limited and monitored by the permittee as specified below and shall be reported by the permittee pursuant to section C on page 11 of Part I: Sampling location(s) shall be chosen to be representative of actual discharge from outfalls 001 and 002.

Effluent Characteristic	Discharge Limitations (specify units)			Monitoring Requirement	
	Average	Average	Maximum	Measurement	Sample
Flow-m ³ /Day (MGD)	Monthly	Weekly '	Daily ²	Frequency Continuous	<u>Type</u> See Footnote 1
i¥)])	30 mg/1	45 mg/1	50 mg/1	Daily	24 Hour Composite
TSS	30 mg/1	45 mg/1	50 mg/1	Daily	24 Hour Composite
Settleable Solids ²		0.1 ml/1	0.3 ml/1	Daily	Grab
₁₂₁₁ 2	(See A.l.b	on page 4	of Part I)	Daily	Grab
recal Colitorm ²	200/100 mL	400/100 ml	400/100 ml	3xDaily	Grab
Chlorine, Total Residual	(See A.3 or on page !	n page 4 an 5 ot Part I	d A.5 on)	3xDaily	Grab
Oil and Grease NUAEL ⁴ NULC ⁶	20% or greater	t or greate 5	15 mg/1 r ³ .	Weekly Monthly Monthly	Grab 24 Hour Composite 24 Hour Composite
1.050 ⁷ ; LOEC ⁸ ; MATC ⁹				Monthly	24 Hour Composite
Volatile Organic Compounds	*** Use EPA Test Meth	nod 624 ***		Monthly	Grab (Influent)
PCHs (Polychlorinated Biphenyls)			0.5 ug/1	Monthly	24 Hour Composite (4 grabs)

The discharges shall not cause a violation of the water quality standards of the receiving waters. FOOINOTES ON PAGE 3 OF PART I.

Footnotes

1. Report maximum and minimum daily rates and total flow for each operating date.

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- 2. Required for state certification.
- 3. The "40% or greater limit" is defined as a sample which is composed of 40% (or greater) effluent the remainder being dilution water (see A.l.a on page 2 of Part I and Attachment C on page 18 of Part I).
- 4. No observed acute effects level (NOAEL) is the highest concentration of toxicant or effluent, to which organisms are exposed in a short-term test, in which at least 90% of the test organisms survive.
- 5. The "20% or greater limit" is defined as a sample which is composed of 20% (or greater) effuent the remainder being dilution water (see A.l.a on page 2 of Part I and Attachment C on page 18 of Part I).
- 6. No observed effect concentration (NOEC) is the highest concentration of toxicant or effluent to which organisms are exposed in a life-cycle or partial life-cycle test, which causes an adverse effect (on growth, survival, and reproduction).
- 7. "LC5:" is defined as the concentration of wastewater that causes mortality to 50% of the test organisms (see A.l.a.on page 2 of Part I and Attachment C on page 18 of Part I).
- 8. Lowest observed effect concentration (LOEC) is the lowest concentration of toxicant or effluent to which organisms are exposed in a life-cycle or partial life-cycle test, which causes an adverse effect (on survival, growth, and reproduction).
- 9. Maximum allowable toxicant concentration (MATC) is the toxicant or effluent concentrations that may be present in a receiving water without causing significant harm to productivity or other uses. MATC is determined by long-term tests of either partial lite-cycle with sensitive life stages or a tull life-cycle of the test organism. The HATC is the geometric mean of the no observed effect concentration and the lowest observed effect concentration.

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- D. The pH of the effluent shall not be less than 6.5 nor greater than 8.5 at any time, unless these values are exceeded due to natural causes or as a result of the approved treatment processes.
- c. The discharge shall not cause ojectionable color, odor or turbidity to the receiving waters.
- d. The effluent shall contain neither a visible oil sheen, foam, not floating solids at any time.
- The permittee's treatment facility shall maintain a minimum of 85 percent removal of both total suspended solids and biochemical oxygen demand. The percent removal shall be based on monthly average values.(During Dry weather Only)
- 2. The permittee must provide adequate notice to the Director of the following:
 - Any new introduction of pollutants into the POTW from an indirect discharger in a primary industry category discharging process water; and
 - b. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.
 - c. For purposes of this paragraph, adequate notice shall include information on:
 - the juality and guantity of effluent introduced into the POTW; and
 - (2) any anticipated impact of the change on the quantity or quality of etfluent to be discharged from the POTw.

3. Toxic control

- The permittee shall not discharge any pollutant or combination
 of pollutants in toxic amounts.
- b. The total chlorine residual (and/or other toxic components) of the effluent shall not result in any demonstrable harm to aquatic life or violate any state or federal water quality standard which has been or may be promulgated. Upon promulgation of any such standard, this permit may be revised or amended in accordance with such standards.
- c. The permittee shall minimize the use of chlorine while still maintaining adequate bacterial control.

4. Sluage

The permittee shall not discharge sewage sludge into waters of the United States from any outfall.

T.A. 5. Toxicity Tests and Chemical Analysis

a. Effluent Monitoring

Beginning the effective date of the permit, the permittee shall perform the following tests every month on each sample from outfalls <u>001</u> and <u>002</u>. The permittee shall use the sampling and test procedures outlined in Attachment C on page 18 and shall report the results to the EPA and MADWPC pursuant to section C on page 11 of Part I:

(1) Chronic Toxicity Tests to Establish the NOEC, LOEC and MATC

Chronic toxicity tests on representative 24 hour composite samples of the discharge using each of the following organisms:

- (i) the sheepshead minnow, Cyprinodon variegatus (7-day tests to measure growth and survival); and
- (ii) the red marine alga, <u>Champia parvula</u> (2 to 4 day tests to evaluate the effects on sexual reproduction).

The endpoints to be established in the chronic tests are the No Observed Effect Concentration (NOEC), the Lowest Observed Effect Concentration (LOEC), and the Maximum Acceptable Toxicant Concentration (MATC).

(2) Acute Static Toxicity Tests to Establish the NOAEL and LC50.

96 hour acute static toxicity tests on representative 24 hour composite samples of the discharge shall be conducted using one to five-day-old juvenile mysid shrimp, <u>Mysidopsis</u> bahia, to establish No Observed Acute Effect Levels (NOAEL) and LC50s of the effluents.

(3) Chemical Analysis

A portion of each effluent sample used for the toxicity tests listed above shall be chemically analyzed to measure the concentrations of chlorine and the pollutants listed in Appendix D of 40 CFR Part 122. Grab samples shall be taken and analyzed for volatile organic compounds.

The actual detection limit must be specified for all values reported to be below the detection limit.

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b. Evaluation of Toxicity Test Results

If toxicity test results show two or more violations of the NOEC or the NOAEL limitations (see A.l.a. on page 2 of Part I) within a six month period, the permittee shall submit a plan and a schedule for conducting a toxicity evaluation to the EPA within 45 days. The toxicity evaluation shall determine how the permittee can achieve the etfluent toxicity limitations. After approval or modification of the plan by the EPA and the MADWPC, the permittee shall conduct the toxicity evaluation and shall submit all required reports to EPA within the specified time frames. The permittee also must continue to conduct toxicity tests as required in A.5 on page 5 of Part I. Upon completion of the evaluation, this permit may be modified to incorporate appropriate permit conditions.

c. Bioaccumulation Assessment

Within six months of the effective date of the permit, the permittee shall submit to the EPA a plan to assess the bioaccumulation potential from each of the existing POTW discharges 001 and 002 following the guidelines and procedures listed in Attachment D. Following EPA and MADWPC review and approval, the plan shall be implemented within one year of the effective date of the permit and shall be continued for the life of the permit. This permit may be modified to incorporate appropriate permit conditions based upon the bioaccumulation assessment.

d. Numerical Effluent Limitations for Toxicants

EPA and the MADWPC may use the results of the toxicity tests, chemical analyses, and bioaccumulation assessment conducted pursuant to this permit, as well as national water quality criteria developed pursuant to section 304(a)(1) of the Clean water Act, state water quality criteria, and any other appropriate information or data, to develop numerical effluent limitations for any pollutants, including but not limited to those pollutants listed in Appendix D of 40 CFR Part 122. The EPA may modify this permit to incorporate such numerical effluent limitations.

- 6. Development of Limitations for Industrial Users:
 - a. Pollutants introduced into POTWs by a nondomestic source (user) shall not Pass Through the POTW or Interfere with the operation or performance of the works.
 - b. The permittee, in cases where pollutants contributed by User(s) result in Interference or Pass-Through, and such violation is likely to recur, shall develop and enforce spe-

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ciric erfluent limits for Industrial User(s), and all other users, as appropriate, which together with appropriate changes in the POTW Treatment Plant's Facilities or operation, are necessary to ensure renewed and continued compliance with the POTW's NPDES permit or sludge use or disposal practices. Specific effluent limits shall not be developed and enforced without individual notice to persons or groups who have requested such notice and an opportunity to respond.

- c. Where specific prohibitions or limits on pollutants or pollutant parameters are developed by the permittee in accordance with paragraph (b) above such limits shall be deemed Pretreatment Standards for the purposes of section 307(d) of the Act (once approved by EPA).
- d. If, within 30 days after notice of an Interference or Pass Through violation has been sent by EPA to the POTW, and to persons or groups who have requested such notice, the POTW fails to commence appropriate enforcement action to correct the violation, EPA may take appropriate enforcement action.
- 7. Industrial Pretreatment Program
 - a. Program Implementation
 - The permittee shall have implemented the Industrial Pretreatment Program in accordance with the legal authorities, policies, procedures, and tinancial provisions described in the permittee's Pretreatment Program submission, as approved by EPA on 11/26/85 and the General Pretreatment Regulations, 40 CFR 403. The permittee shall maintain adequate resource levels to accomplish the objectives of the pretreatment program.
 - The permittee must obtain written approval from EPA prior to making any significant changes to the Industrial Pretreatment Program as approved by EPA (e.g., sewer use ordinance, local limits, method of controlling industrial discharges, and program staffing and resources).
 - b. Annual Report

By the fifteenth of January annually, the permittee shall submit a report to EPA and the MADWPC which includes the following:

1. An updated master list of all categorical and significant non-categorical industrial users (as defined in the permittee's approved Pretreatment Program), indicating compliance or non-compliance with the following (as applicable):

- Baseline monitoring report requirements;
- (?) Compliance status reports;
- (3) Self-monitoring reports;
- (4) Categorical standards; and
 - (5) Local limitations
- 2. For the activities listed in a, b, and c below, provide a summary of compliance monitoring and enforcement actions during the reported period, including the number and percentage of actions, as compared to the number of industries on the master list. The summary for the activities listed in c, d, e, and below shall list the total number of actions in each category, shall describe the actions taken, and shall identify the industrial users subject to such actions.
 - (a) Facilities inspected;
 - (b) Facilities sampled;
 - (c) Compliance schedules issued;
 - (d) Notices of violations issued;
 - (e) Administrative orders issued;
 - (f) Criminal or civil suits filed; and
 - (g) Penalties obtained (and amounts)
- 3. A list of industries in significant non-compliance as published in local newspapers in accordance with the requirements set forth in 40 CFR 403.8(f)(2)(vii).
- 4. A narrative description of program effectiveness and present and proposed changes in program, <u>e.g.</u>, funding, staffing, ordinances, regulations, rules, or statutory authority.
- 5. A summary of all data not previously submitted to the EPA on the permittee's POTW influent, effluent, and sludge and any bioassay data.

8. Discharge Limitations for CSO Outfalls

- a. During wet weather, the permittee is permitted to discharge stormwater/wastewater from CSO outfalls, discharge serial numbers 003 to 041 (listed in Attachment B). Such discharges shall receive treatment at a level providing Best Conventional Pollutant Control Technology ("BCT") to control and abate conventional pollutants and Best Available Technology economically achievable ("BAT") to control and abate nonconventional and toxic pollutants. CSO discharges also must meet water quality standards. EPA has made a BPJ determination that BAT and BCT for the CSO discharges are no more stringent than the levels of treatment required to meet water quality standards. Therefore, CSO discharges must be treated to ensure that water quality standards will not be violated.
- b. Dry weather discharges are not authorized.

c. Discharge of holding tank wastes and septage is not authorized.

9. CSO Outfall Identification and Monitoring Requirements

a. Outfall Identification

Within 12 months of the effective date of the permit, the permittee shall place and maintain identification signs for all City owned CSO outfall structures. These signs shall be a minimum of 12 x 18 inches in size, shall be metal with embossed white lettering against a green background, and shall contain the following information:

> New Bedford WET WEATHER SEWAGE DISCHARGE OUTFALL (discharge serial number)

The permittee shall give notice of compliance with this requirement pursuant to section C on page 11 of Part I.

b. Monitoring Requirements

Beginning the effective date of the permit, the permittee shall notify the EPA of all discharges from CSO outfalls, / discharge serial numbers 003 through 041. The following information must be submitted for each outfall discharge in writing pursuant to Section C on page 11 of Part I:

1. When discharging from outfalls 003 through 041.

- (a) The estimated period of discharge;
- (b) the estimated volume of discharge; and
- (c) the National Weather Service precipitation data for Providence, Rhode Island, or other location approved by EPA and the state.
- 2. Beginning the effective date of this permit a monitoring program adequate to demonstrate compliance with paragraph 8 on page 8 shall be developed and submitted to EPA and the MADWPC for review and approval. The monitoring program shall be designed to:
 - (a) Adequately assess compliance or non-compliance with water quality standards for the receiving water during wet and dry weather and minimum dilution conditions (for receiving waters)
 - (b) Provide an assessment of individual overflow impacts on the receiving waters.
 - (c) Provide for reporting of results to EPA and the state periodically, but no less frequent than quarterly.
- 3. Within six months of the effective date of this permit, the permittee shall implement the approved monitoring program.

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OPERATION AND MAINTENANCE OF THE SEWER SYSTEM

Operation and maintenance of the sewer system shall be in compliance with the General Requirements of Part II and the following terms and conditions:

Maintenance Staff

The permittee shall provide an adequate staff to carry out the operation, maintenance, repair, and testing functions required to ensure compliance with the terms and conditions of this permit.

2. Infiltration/Inflow

The permittee, shall minimize infiltration/inflow to the sewer system. A summary report of all actions taken to minimize infiltration/inflow during the previous twelve months shall be submitted to EPA and the MADWPC by the fifteenth day of January each year.

Combined Sewer Overflows and Bypasses

The permittee shall operate and improve its POTW and the total sewer system to minimize the discharge of pollutants from combined sewer overflows or bypasses.

4. CSO Facilities and Systems Inspection and Maintenance Program

- a. The permittee shall conduct a tidegate and overflow structure/ regulator inspection and maintenance program as follows:
 - (1) Inspect combined sewer overflow structures/regulators and tidegate every three months.
 - (2) Repair and perform preventative and corrective maintenance, as necessary, to the combined sewer overflow structures/ regulators and tidegates.
- b. A report on tidegate and combined sever overflow/regulator inspections, maintenance, and repair during the previous 12 months shall be submitted to the EPA by the 15th day of January each year. The report shall indicate which structures were checked and when, the condition of each one, which were repaired and when, which ones must yet be repaired, the reasons any repair was delayed, and the anticipated repair schedule.

5. Alternate Power Source

In order to maintain compliance with the terms and conditions of this permit, the permittee shall provide by the effective date of the permit an alternative power source sufficient to operate the wastewater control facilities. ADVITORING AND REPORTING

1. Monitoring

Monitoring shall be conducted pursuant to General Requirement j (Monitoring and Records) on pages 4 and 5 of Part II of the permit, unless otherwise required by Part I of the permit. The permittee shall identity the exact location of the effluent sampling point used for each discharge.

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Reporting

- a. All reports shall be in writing and shall be postmarked no later than the 15th day of the month following the completed reporting period, unless otherwise required by General Requirement 1 (Reporting Requirements) on pages 5 and 6 of Part II of the permit. The first reports must be postmarked by the 15th day of the month following the effective date of the permit. Monitoring results shall be reported on separate Discharge Monitoring Report forms and on any other forms designated by EPA.
- b. Duplicate signed copies of all reports required herein shall be submitted to the EPA at the following address:

Permit Compliance Section Compliance Branch Water Management Division Environmental Protection Agency JFK Federal Building Boston, MA 02203

Submittals to other offices in EPA shall not be construed to be a fullfillment of the terms and conditions of this permit.

Signed copies of all and reports required by this permit shall be submitted to the State at:

Massachusetts Department of Environmental Quality Engineering Massachusetts Division of Water Pollution Control Southeastern Regional Office Lakeville Hospital Middleboro, Massachussets 02346

Massachusetts Department of Environmental Quality Engineering Massachusetts Division of Water Pollution Control Regulatory Branch 1 Winter Street Boston, Massachusetts 02108

3. Notice of Noncompliance

The permittee shall give notice of noncompliance with the terms and conditions of this permit pursuant to General Requirement 1 on pages 5 and 6 of Part II of the permit. Notice of noncompliance does not relieve the permittee of its obligation to ensure that such noncompliance does not occur.

D. STATE PERMIT CONDITIONS

This Discharge Permit is issued jointly by the U.S. Environmental Protection Agency and the Division of Water Pollution Control under. Federal and State law, respectively. As such, all the terms and conditions of this permit are hereby incorporated into and constitute a discharge permit issued by the Director of the Massachusetts Division of Water Pollution Control pursuant to M.G.L. Chap. 21, §43.

Each Agency shall have the independent right to enforce the terms and conditions of this Permit. Any modification, suspension or revocation of this Permit shall be effective only with respect to the Agency taking such action, and shall not affect the validity or status of this Permit as issued by the other Agency, unless and until each Agency has concurred in writing with such modification, suspension or revocation. In the event any portion of this Permit is declared, invalid, illegal or otherwise issued in violation of State law such permit shall remain in full force and effect under Federal law as an NPDES Permit issued by the U.S. Environmental Protection Agency. In the event this Permit is declared invalid, illegal or otherwise issued in violation of Federal law, this Permit shall cemain in full force and effect under State law as a Permit issued by the Commonwealth of Massachusetts. Part !-

Wastewater Treatment'Plant Outfalls

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charge	Location		Average Flow (MGD)	Receiving Water
1	Treatment Plant Outfall	41°35'17" Lat. 70°53'37" Long.	30	Buzzards Bay
2	Treatment Plant Auxiliary Outfall	41°31'58" Lat. 70°52'36" Long.	*	Buzzards Bay
	*Discharge flow in excess of design capacity main			(
· ·	outfall (001)			

Attachment B Combined Sewer Overflov

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ischarge erial No.	Location Description	Size and/or Type Oveflow	Receiving Water	Remarks
003	E. of Inter, Cove Rd. & Padanuram Ave.	54" R.C. Pipe	Clark's Cove	Constructed by U.S. Army Corps of Engineers-part of N.B. Hurrican Barrier
004	Hurrican Barrier Clark's Cove Pumping Sta	8'x7' R.C. Culvert	, Clark's Cove	14 19 17
005	Dudley St. & W. Rodney French Blvd.	18" Pipe	Clark's Cove	
006	Lucas St. & W. Rodney French Blvd.	24" Pipe	Clark's Cove	Reconstructed April 1971
UU7 .	Capitol St. & W. Rodney French Blvd.	24" Pipe	Clark's Cove	Reconstructed April 1971
008	Calumet St. & W. Rodney French Blvd.	18" Pipe	Clark's Cove	
009	Aquidneck St. & West Rodney French Blvd.	18 Pipe	Clark's Cove	
010	Bellevue St. & West Rodney French Bvd.	12" Pipe	Clark's Cove	Reconstructed April 1971
011(10.1)	Hudson St. (extended) & W. Rodney French Blvd.	12" C.I. Pipe	Clark's Cove	0
012	Ricketson St. & E. Rodney French Blvd.	30" C.I. Pipe	Buzzards Bay (Outer Harbor)	
013	Aquidneck St. & E. Rodney French Blvd.	15" Pipe	Buzzards Bay (Outer Harbor)	
014	Apponagansett St. & E. Rodney French Blvd.	24 Pipe	Buzzards Bay (Outer Harbor,)	

Attachment B (cont) Combined Sewer Overflc

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Discharge Serial No.	Location Description	Size and/or Type Oveflow	Receiving Water	Remarks
015	Butler Street & E. Rodney French Blvd.	24 Pipe	Buzzards Bay (Outer Harbor)	Reconstructed August 197
016	Frederick St. & E. Rodney French Blvd.	30 R.C. Pipe	Buzzards Bay (Outer Harbor)	Reconstructed
017	David Street & E. Rodney French Blvd.	48" Pipe	Buzzards Bay (Outer Harbor)	
018	Cove St. & E. Rodney French Blvd.	2 25" x 7' conduits	Drainage Ditch to Buzzards Bay (Outer Harbor)	
019	Route 6 - E. of Front St at Acushnet River	Pipe	Acushnet River	
020	Merrimac St. (extended) (500' S. of Wamsutta St.) E. of Herman Melville Blvd. at Acushnet River	6' x 6' R.C. Culvert	Acushnet River	
021	Washburn St. at Acushnet River	30" R.C. Pipe	Acushnet River	
022	Sawyer St. at Acushnet River	72" Brick Pipe	Acushnet River	
023	Coffin Ave. at Acushnet River	48" Culvert	'Acushnet River	C
024	Hathaway St. at Acushnet River	48" Brick Pipe	Acushnet River	
0 25	Howard Ave. at Acushnet River	24" VC Pipe	Acushnet River	
026	Truro St. (extended) /E. of River Rd. at Acushnet River	4' x 5' R.C. 'Culvert	Acushnet River	

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Attachment B (cont) Combined Sewer Overflow

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scharge tial No.	Location Description	Size and/or Type Oveflow	Receiving Water	Remarks .
127	Mill Rd. at Acushnet River	72"x54" .	Acushnet River	
)28 (18.1)	Gifford St.	36"'Pipe	Buzzatds Bay (Inner Harbor)	
J 29 (32)	Blackmer St.	30" Pipe	Buzzards Bay (Inner Harbor)	
J JU (18.2)	South St.	5' x 7' Box Culvert	Buzzards Bay (Inner Harbor)	Ć
U31	Conway. St.	2-13' x 7' Boxes	Buzzards Bay (Inner Harbor)	
032(18.3)	Walnut St.	90" Pipe	Buzzards Bay (Inner Harbor)	
033 (18.4)	School St.	42" Pipe	Buzzards Bay (Inner Harbor)	
) 34 (18.5)	William St.	72" Pipe	Buzzards Bay (Inner Harbor)	· .
035 (18.6)	Maxfield St.	66" Pipe	Buzzards Bay (Inner Harbor)	0
036 (18:7)	Harvey Tichon Ave.	60" Pipe	Buzzards Bay (Inner Harbor)	
037 (18.8)	Pope St.	24" Pipe	Buzzards Bay (Inner Harbor)	
038 (20.1)	Wamsutta St.	24" Pipe	Acushnet River	

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Combined Sewer Overflows -

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scharge rial No.	Location Description	Size and/or Type Oveflow	Receiving Water	Remarks
39 (29)	Coggeshall St.	18" Pipe	Acushnet River	
40(30)	Coggeshall St.	24" Pipe	Acushnet River	
41(28)	Belleville Rd.	51" x 60" Pipe	Acushnet River	, , , , , , , , , , , , , , , , , , ,
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The CSO identifi	with a number contained with a number contained with discussion of the discussion of	thin parentheses are nce of the previous	CSO's that have been NPDES permit.	
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Attachment C Toxicity Festing Test Procedures and Sampling Requirements

- 1. The samples shall be:
 - a. Collected during a period of chlorination.
 - b. For POTw: One representative weekday 24 hour composite sample of the discharge from the POTW (one composite sample to be collected at each outfall sampling station).
- 2. The tests shall begin within 24 hours following the collection of effluent samples.
- 3. The control water used for the dilution should be of excellent quality and support 90% survival of the test organisms.
- 4. Each bioassay test must conform to the respective methodology as outlined in:
 - a. Shimmel, S.C., Hughes, M.M., Hebar, M.A., Berry, W.J., <u>Final Report on Growth and Survival Studies with Effluents</u> <u>Using the Sheepshead Minnow (Cyprinodon variegatus).</u> U.S. Environmental Protection Agency, Environmental Research Laboratory, Narragansett, RI. (ERL-Narragansett Conribution #669)
 - b. Final Report on Sexual Reproduction Studies with Complex Effluents Using the Marine Red Alga Champia Parvula.
 U.S. Environmental Protection Agency, Environmental Research Laboratory, Narragansett, RI.
 - c. Peltier, W.H., and Weber, C.I., PhD, <u>Methods for Measuring</u> the Acute Toxicity of Etfluents to Freshwater and Marine <u>Organisms (Third Edition), EPA-600/4-85-013.</u> Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH, March 1985.

EPA-600/4-83-000. Cincinnati, OH.

Attachment D Bioaccumulation Assessment Plan Guidelines and Pocedures

The permittee shall monitor three exposure sites within the zone of initial dilution (ZID) of the Buzzard Bay discharge outfalls 001 and 002 plus a control using live, caged molluscs.

The following general methods outline shall be adhered to:

Test species (2)	-	Blue mussel (<u>Mytilus</u> <u>edulis</u>) Eastern oysteer (<u>Crassostrea</u> <u>virginica</u>)
Exposures (2)	-	May - June August
Duration	-	30 days
Number	-	Minimum of 25 individuals for each species
End Point	-	Survivability at end of 30 days Bioaccumulation
Suggested Control	-	Marion Harbor, MA or alternate location approved by EPA and the state.
Method:	-	U.S. Environmental Protection Agency. 1983. Methods for Use of Caged Mussels for In Situ Biomonitoring of Marine Sewage Dis-

charges.

New Bedford Response to Comments

Comment No. 1:

The City states that EPA failed to take into account any reduction of toxic pollutants resulting from implementation of the City's industrial pretreatment program.

Response:

Contrary to this comment, EPA did take into account the City of New Bedford's Industrial Pretreatment Program in EPA's Decision Document on page 43. EPA's conclusion, which resulted from a thorough review of the City's Industrial Pretreatment Program, is that, upon implementation of the pretreatment program limits, the EPA water quality criteria (WQC) for copper, cyanide, mercury, silver, nickel and PCBs are expected to be exceeded at the proposed discharge site. Although the pretreatment limits could be adjusted so that most metals of concern would meet EPA's WQC at the proposed discharge, the across-the-board limits based upon economically feasible pretreatment methods would not achieve copper reductions necessary to meet the criterion for this pollutant. PCBs would also continue to exceed the WQC, since the pretreatment program does not address all the possible sources of this pollutant.

Comment No. 2:

The City states that EPA failed to take into account any reduction in toxic pollutants resulting from a non-industrial toxicant control program which the City would implement. Specifically, the City claims that the analysis fails to take into account a sewer cleaning/ replacement program for the control of PCB's which has been set forth as a stipulated requirement of the Commonwealth of Massachusetts.

Response:

Contrary to this comment, the City of New Bedford's Non-Industrial Source Control Program was evaluated by EPA and is addressed on pages 43 and 44 of EPA's Decision Document. The applicant did not identify non-industrial toxicants of concern nor the probable sources of these contaminants. The applicant's program did not address the reduction of the background PCB levels measured in the New Bedford sewers. It also did not address the feasibility of the clean-up of the background PCB sewer contamination or the background levels of copper in the water distribution system. EPA, upon reviewing various studies, determined that the background contamination throughout the City's sewers ranges between 1 to 5 ug/l and that these concentrations would lead to violation of EPA's water quality criterion for PCBs after initial dilution with ambient water. Similarly, the data on copper concentrations presented in

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the application demonstrate that the water quality criterion for copper would be exceeded after initial dilution with ambient water. (See page 36 of EPA's Decision Document). EPA concluded that the non-industrial source control program did not adequately address the existing and the projected levels of PCBs and copper in the New Bedford sewer system and the treatment plant effluent. Therefore, compliance with EPA's water quality criteria for PCBs and copper could not be assured.

The sewer cleaning/replacement requirement, referred to in Comment No. 2, was not presented by the City as a component of the 301(h) Application. Rather it was a condition set by the Massachusetts Division of Water Pollution Control in certifying a grant of the 301(h) waiver for the City. This requirement, as presented by the State, was not a detailed program and did not provide information necessary for the evaluation of feasibility of implementation and adequacy of contaminant reductions. In addition, sewer cleaning and replacement may not ensure PCB reductions adequate to meet EPA's water quality criterion for PCBs because there may be other sources for PCBs in the influent and effluent in addition to residual sewer contamination. Furthermore, the State's sewer cleaning/replacement requirement does not address excessive copper levels which may result from industrial and non-industrial sources.

Comment No. 3:

The City states that EPA failed to take into account the enhanced removal efficiencies of toxic pollutants resulting from the City's proposal to enhance the performance of its existing primary treatment plant by chemical addition.

Response:

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Contrary to this comment, EPA's evaluation of the City's 301(h) Application did take into consideration the chemical addition process proposed by the City. The City used a bench scale, laboratory test to demonstrate that the primary treatment removal efficiency for conventional pollutants could be improved with chemical addition. EPA accepted the City's contention that this improvement in removal efficiency could be maintained upon the full scale implementation of the chemical addition process in the future facility. EPA used the City's proposed loadings for the conventional pollutants, such as SS and BOD, in the 301(h) Application evaluation. The City, however, presented no data documenting toxic removal efficiencies due to primary treatment and no evidence to support the claim of toxic removal enhancement due to the chemical addition process.

Comment No. 4:

The City states that no quantitative information is presented in EPA's Decision Document to support the conclusion that accumulation rates in the ZID are expected to far exceed the 25 g/m². Using the data points presented in the application and EPA's technical consultant, and presuming a Gaussian distribution to sediment

accumulation, maximum accumulation rates within the ZID have been computed at approximately 23.5 g/m^2 . The City also states that it appears that the proposed outfall location would be no more of an area of solids deposition than any other area of Buzzards Bay, and that predicted sediment accumulation rates discussed above should be used for the analysis. Further, the potential for adverse environmental impacts is closely linked to the quality of the sediments.

Response:

EPA evaluated the impact of the proposed discharge on the marine communities by (1) examining impacts associated with the existing discharge; (2) examining the location of the proposed discharge for sedimentary characteristics; and (3) estimating the accumulation of organic sewage solids which settle in the vicinity of the proposed discharge. According to the 301(h) regulations at 40 CFR 125.61(c) (1),(2) and (4), no adverse impacts on the balanced indigenous populations can be observed within and beyond the zone of initial dilution (ZID) of the proposed discharge. Because the water depth at the City's proposed discharge site is relatively shallow, the ZID is small, approximately 0.018 km² (Decision Document, page 17). The City's 301(h) Application shows on page II-10 that the accumulation of organic solids of 23 g/m^2 would occur over an area of 1 km². EPA's Decision Document also notes this on pages 34 and 35. The 1 km² area is approximately 56 times the size of the proposed 2ID. Because of limited information on the velocity distribution of the primary effluent solids, the estimates of solids accumulation cannot be calculated for an area as small as the proposed ZID. However, the modeling results presented on page II-10 of the application and the modeling methodology presented on page III-25 of EPA's 301(h) Technical Support Document demonstrate that accumulation of solids increases significantly with the proximity to the source and that the solids accumulation within the ZID of the proposed discharge would exceed 25 g/m². The 25 g/m² value is the threshold accumulation at which biological effects may be observed in estuaries (Technical Support Document, page III-25, EPA 430/9-82-011).

EPA made the determination of the adverse effects of the proposed discharge on the balanced indigenous populations by also noting the evidence of highly altered benthic communities, bioaccumulation of toxics, fish and lobster pathology, and contaminated sediment quality at the existing discharge site. In addition, on page 19 of the Decision Document EPA noted the high total volatile solids and mud-silt content of the proposed discharge site sediments as compared with sediments from other sites studied in Buzzards Bay. These sediment characteristics indicate that the proposed discharge site is a depositional area in which sewage particles with their associated pollutants will tend to accumulate more than at other sites in Buzzards Bay.

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Comment No. 5:

The maximum day limit of 50 mg/l for BOD and Suspended Solids (SS) should be adjusted to 75 mg/l to reflect the natural variability attendant a well operated secondary plant and to account for impacts associated with combined sewerage entering the system.

Response:

The 50 mg/l maximum day limit for BOD and SS is a state certification requirement. The State was not presented with any data that would justify changing this limit. This limit has been used within the State for many years and can be achieved by properly operated and designed wastewater treatment plants.

Comment No. 6:

The requirement to achieve 85% removal of BOD and Suspended Solids (SS) should be eliminated since the existing facility receives combined sewage and dilute wastes.

Response:

The secondary treatment regulations (40 CFR 133.103(a)) allow the 85% removal requirement for both BOD and SS to be modified during wet weather for treatment works receiving flows from combined sewers. Since the New Bedford sewerage system is combined, the 85% removal requirement has been eliminated for periods of wet weather. The secondary treatment regulations also allow the 85% removal requirement to be modified for treatment plants receiving dilute wastes for separate sewer systems (see 40 CFR 133.103(d)). The New Bedford sewerage system is a combined system and therefore does not qualify for any special consideration given to separate systems. It should be noted that pursuant to a settlement agreement between EPA and the City of New York (filed with second circuit U.S. Court of Appeals, No. 85-4142, on January 7, 1986), the EPA has agreed to consider a possible regulation change to allow the 85% removal requirement to also be modified or eliminated during periods of dry weather for these facilities. If and when the above requirements are changed by regulation EPA may modify the permit as appropriate.

Comment No. 7:

The City objects to establishing effluent limits on NOAEL, NOEC and monitoring requirements for the above as well as LC50, LOEC, and MATC. The above requirements are water quality based effluent limitations based upon Massachusetts regulations. However, the State has not developed policies regarding the evaluation of discharges into the marine environment and has not developed the marine equivalent of the 7 day 10 year low flow commonly used to establish water quality based limits in riverine environments. Consequently, the City cannot find a basis for the limits set forth.

Pesponse:

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The Massachusetts State Water Quality Standards contain numerical pollutant specific standards and narrative standards. Both type of standards are legal requirements that must be met. The NOEL and NOEC effluent limits as well as the LC50, LOEC and MATC monitoring requirements were developed pursuant 314 CMR 4.03:(7):Other Constituents and 314 CMR 4.02: Application of Standards. The state water quality standards at 314 CMR 4.03:(2) allow bioassay testing as a means to establish discharge limits pursuant to 4.03:(7):Other Constituents. The state water quality standards also allow the Director of the Division of Water Pollution Control to establish procedures for sampling and analysis (see 314 CMR 4.02(4)). In addition, pursuant to 314 CMR 4.02:(3) Hydrologic Condition, the State will determine the most severe hydrological condition at which water quality standards must be met. The concept of initial dilution as a means to establish hydrologic conditions when evaluating discharges to the marine environment has been well established within the scientific community as well as regulatory agencies. The 5:1 initial dilution factor was developed by the City in support of its 301(h) waiver application and has been accepted by both EPA and the State as satisfying the most severe hydrologic condition requirement. The lack of a state policy does not limit the legal requirements as stated above or as outlined in the Fact Sheet.

Comment No. 8:

EPA's national policy for the development of water quality-based permit limitations for toxic pollutants indicates that a more appropriate approach to biological testing in the permit is to conduct a toxicity evaluation as a monitoring requirement followed by the reopening of the permit and the establishment of limitations if necessary.

Response:

The City's suggested approach would be appropriate where the potential for nonattainment of water quality standards exists but there is a strong indication that complying with BCT/BAT will sufficiently mitigate the water quality problems. It is not appropriate in this situation for the following reasons: (1) water quality problems already exist and those problems are directly related to the discharges from the wastewater treatment plant; (2) EPA is not convinced that secondary treatment by itself will mitigate the water quality problems, and the City will also need to implement the approved industrial pretreatment program as well as evaluate impacts associated from CSO discharges; (3) the state water quality standards establish the requirement that forbids the discharge of toxic pollutants in toxic amounts (310 CMR 4.03:(4)(7)). If the toxicity limits were not established as permit limits, there would be no standards to compare against the biological testing results.

The toxicity limits and biological testing requirements establish a reasonable means to determine compliance or noncompliance with state water quality requirements. The permit requirement and monitoring requirement could be modified based upon the results from the testing.

Comment No. 9:

The toxicity tests and chemical analysis requirements of the permit outlined in Part I A.5 should be rewritten to allow the City to develop within 90 days of issuance of the permit a comprehensive study of toxicity of the discharge. Concern was also expressed relative to the effects that chlorinated effluents and nonconventional pollutants such as ammonia might have on the toxicity tests required by the permit and the need to assure that the test species are appropriate to the New Bedford environment.

Response:

The method required in the permit for measuring acute toxicity of effluents to marine organisms represents EPA's best professional judgment. The references cited in the permit represent many years of research and were reviewed by a diverse group of individuals in both the public and private sectors. If the City wants to develop a different methodology it may do so and seek a permit modification. There is no justification, however, for delaying the requirement to measure toxicity based upon EPA's established test procedures in the meantime. In addition, the city did not refute the possibility that the present discharge may be toxic. The toxicity limit applies to all forms of toxicity to include that associated with chlorine and ammonia. The test can and should be conducted to ensure that toxicity from chlorine, ammonia and any other pollutant is properly identified.

Comment No. 10:

The City objects to inclusion of a limit on total PCBs since the State has not established a policy for establishing the effluent limits for that pollutant.

Response:

The limits on PCBs in the discharge are established under the Authority of Section 301(b)(1)(C) of the Act, and are based on Massachusetts' Water Quality Standards, specifically the narrative criteria which forbid the discharge of toxic pollutants in toxic amounts (310 CMR 4.03(4)(7)). In interpreting the narrative standard, EPA's water quality criteria established pursuant to Section 304(a)(1) of the Act are to be relied upon as guidance. EPA has published criteria for PCBs (EPA Ambient Water Quality Criteria for Polychlorinated Biphenyls EPA 44015-80-068, October 1980). The permit limit for PCBs was based on these criteria.

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Comment No. 11:

The City objects to the VOC's monitoring requirement since the basis was not set forth in the Fact Sheet.

Response:

The discharge is known to contain VOC's as demonstrated in the City's application for a 301(h) variance from the secondary treatment requirement. The EPA is concerned with the potential air pollution impacts that might be associated with VOC's contained in sewerage. Consequently, a VOC monitoring program was required. The draft permit incorrectly indicated that the monitoring was required for effluent samples. EPA intended to require monitoring of the wastewater influent and this is reflected in the final permit. However, the permit could be modified at some future date based upon the results of the VOC monitoring program.

Comment No. 12:

The City objects to the establishment of a combined sewer overflow (CSO) effluent limit until such time as EPA and the State can concur on a CSO Treatment Policy. It also requests that the CSO monitoring program be delayed until such time as EPA and the State can agree as to the standards which must be met by CSO discharges.

Response:

As discussed in the Fact Sheet, the permit's limits on discharges from combined sewer overflows are required by Section 301(b)(2)(A) and (E) of the Clean Water Act (requiring best available treatment (BAT) and best conventional treatment (BCT) for toxic and conventional pollutants) and Section 301(b)(1)(C) (requiring any more stringent limits needed to meet applicable water quality standards). Based on current information, it seems clear that discharge limits based on BAT and BCT would be no more stringent than the limits needed to meet water quality standards. Therefore the focus in the permit and for future planning purposes is on the Massachusetts water quality standards set forth in 310 CMR Part 4.

The state water quality criteria apply to CSO discharges in the same manner that they apply to other discharges. For some pollutants, such as dissolved oxygen and total coliform bacteria, there are specific criteria that apply in marine waters. For toxic pollutants, the standard narrative prohibition against discharges of toxic pollutants in toxic amounts applies (310 CMR 4.03(4)(7)). According to the state standards, EPA's water quality criteria established pursuant to Section 304(a)(1) of the Clean Water Act are to be used as guidance in determining whether the narrative criterion is satisfied. Although the State has been developing a CSO treatment policy, EPA is obligated to apply and enforce the provisions of the state regulations in circumstances where the regulations are more stringent than the policy or more stringent than federal law. Therefore, the fact that the State and EPA have not reached final agreement on the CSO policy has no bearing on EPA's obligation to include all applicable water quality requirements in the permit.

Furthermore, other municipalities within Massachusetts have been required to develop similar monitoring programs for CSO. New Bedford has demonstrated an ability to develop sophisticated monitoring programs as evidenced by its 301(h) waiver applications. Once the monitoring information is submitted, EPA and the State will determine in conjunction with the City what CSO treatment is necessary and what alternatives are capable of meeting permit requirements.

Comment No. 13:

The City objects to the requirement to estimate periods of discharge and discharge volumes from combined sewer overflows. Until such time as the City completes CSO studies on control alternatives such estimates will be based upon computer simulation, and not on actual field measurements.

Response:

The City was required to complete a CSO study as a condition of the previous permit. Until such time as the CSO study is completed, EPA will consider computer simulated estimates. However, the permittee will be required to justify the validity of using this method or any other method in lieu of actual field measurements.

Comment No. 14:

The City is willing to cooperate with EPA and the State but these agencies must be sensitive to the financial capability of the City to meet the requirements contained in the permit.

Response:

Both EPA and the state realize that the cost to design, construct, and operate a secondary treatment facility can be expensive. However, the permit must be written to reflect the specific requirements of the law. The actual construction schedules and interim limits that must be developed to reflect present conditions and bring the City into compliance with the permit will be addressed through enforcement actions. The permit reflects existing legal requirements. If those requirements are not or cannot be satisfied the resolution can only be achieved through judicial action according to EPA's National Municipal Policy (January 1984).

Comment No. 15

The permit should address the odor problems associated with the existing treatment facility.

Response:

A properly designed and operated treatment facility should not cause significant odor problems. The existing treatment facility has not been well maintained and needs to be upgraded. The permit requires the facility to be properly operated and maintained.

Comment No. 16:

The secondary treatment plant should not be located next to the existing primary treatment facility.

Response:

The permit does not specify the location of the treatment facility. The permit specifies the effluent paramaters that the treatment plant must meet. The environmental impacts associated with siting, sizing, constructing and operating of a secondary treatment facility, will be addressed during the facilities planning process and the public will have the opportunity to express concerns during that process.

Comment No. 17:

The comment period on the Draft Permit should be extended.

Response:

One individual requested an extension of the comment period and indicated that he only became aware of the public hearing on the day it was being held.

His oral testimony did not identify any specific objection to various aspects of the permit. The individual was primarily concerned that the City receive equitable and fair treatment from EPA and the State. The Draft Permit is similar to other permits recently being proposed by both agencies. The permit reflects the requirements of both federal and state law. The request for a time extension was denied since no apparent benefit could be foreseen and only a singular request for such an extension was received.



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APPENDIX B

SAMPLING PROGRAM MEMORANDUM

VOLUME III APPENDIX B SAMPLING PROGRAM MEMORANDUM

1.0 SAMPLING PROGRAM

1.1 INTRODUCTION

Under the Phase I Facilities Plan, a two-phased sampling program was conducted to obtain data on the chemical constituents in the wastewater. The results gathered during this previous program will be presented again in this appendix, since the data will be used extensively to establish loadings of non-conventional pollutants.

Subsequent to the Phase 1 program conducted by CDM, GHR Analytical Laboratories (GHR) were under contract with the City of New Bedford to perform essential laboratory services, including sampling and analysis of the wastewater for non-conventional pollutants. The results of this work is presented in this appendix, since the data will also be used to establish influent loadings of non-conventional pollutants.

Under Task 3 of the Phase 2 Facilities Plan scope of work, all Phase 1 sampling data and all existing data were analyzed to determine whether or not additional data is needed for estimating loads and to evaluate sludge quantity, effluent quality, and air emissions. Based upon the review of analytical results from the CDM Phase 1 sampling program and about 5 months of available data from GHR, it was determined that no additional influent sampling was needed. However, a supplemental sampling program was deemed necessary to obtain additional data on the chemical constituents in the existing primary sludge and on VOC emissions being emitted from the wastewater under turbulent conditions.

To establish acceptable objectives and guidelines, a quality assurance/ quality control document entitled QA/QC Project Plan for City of New Bedford, Massachusetts WWTP Phase 2 Facilities Planning for Sludge and Air

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Sampling Program was prepared and submitted to the State Department of Environmental Quality Engineering. The document outlined program objectives, sampling methodology, location, laboratory procedures, detection limits, and duplicate and blank sample requirements, as well as scheduling and frequency of sample gathering. The Phase 2 plan is attached in its entirety to the back of this appendix and should be read before proceeding with the rest of this summary memorandum. The QA/QC document for the Phase 1 Facilities Plan Sampling Program is also attached to the end of this appendix.

1.2 PROGRAM EXECUTION

Using the appended Quality Assurance Plan, the Phase 2 air sampling program was conducted under the direction of CDM with the assistance of Alliance Technologies Corporation (ATC) for air sample collection and analysis. The Atc lab was responsible for the analysis of total non-methane organic compounds and selected volatile`organic compounds. The Phase 2 sludge sampling program was conducted by CDM. All sludge analyses were conducted by either the CDM labs, at Energy and Environmental Engineering Inc. (EEEI) or at ENSECO/ERCO Inc.

Phase 2 Sludge Samples

Sludge samples of gravity thickened sludge were collected by CDM over a 2-week period. Twenty-four hour composite samples were made of four samples taken every 6 hours for each of the 6 sampling days. Sampling was conducted on February 15-17, 1989 and February 22-24, 1989. Sludge samples of dewatered sludge cake were also collected by CDM over another 2-week period. One grab sample was collected on each each of the six sampling days. Sampling was conducted on May 8-10, 1989 and May 16-18, 1989. Table B-1 summarizes the total number of samples taken, and the date, time, and identification number for each.
SLUDGE SAMPLING PROGRAM LOG

Gravity Thickened Sludge

Sampling Day No.	Date Sampled	Time Sampled	Identification Number
1	2/15/89	8:00 AM	NB-CF-TS-1
1	2/15/89	2:00 PM	NB-CF-TS-2
. 1	2/15/89	8:00 PM	NB-CF-TS-3
1	2/16/89	2:00 AM	NB-CF-TS-4
2	2/16/89	8:00 AM	NB-CF-TS-5
2	2/16/89	2:00 PM	NB-CF-TS-6
2	2/16/89	8:00 PM	NB-CF-TS-7
2	2/17/89	2:00 AM	NB-CF-TS-8
3	2/17/89	8:00 AM	NB-CF-TS-39
3	2/17/89	2:00 PM	NB-CF-TS-10
3	2/17/89	8:00 PM	NB-CF-TS-11
3	2/18/89	2:00 AM	NB-CF-TS-12
4	2/22/89	4:30 PM	NB-CF-TS-13
4	2/23/89	12:30 AM	NB-CF-TS-14
4	2/23/89	6:30 AM	NB-CF-TS-15
4	2/23/89	12:30 PM	NB-CF-TS-16
5	2/23/89	8:00 PM	NB-CF-TS-17
5	2/24/89	2:00 AM	NB-CF-TS-18
5	2/24/89	8:00 AM	NB-CF-TS-19
5	2/24/89	2:00 PM	NB-CF-TS-20
5	2/23/89	8:00 PM	NB-CF-TS-17D*
5	2/24/89	2:00 AM	NB-CF-TS-18D*
5	2/24/89	8:00 AM	NB-CF-TS-19D*
5	2/24/89	2:00 PM	NB-CF-TS-20D*
6	2/24/89	8:00 PM	NB-CF-TS-21
6	2/25/89	2:00 AM	NB-CF-TS-22
6	2/25/89	8:00 AM	NB-CF-TS-23
6	2/25/89	2:00 AM	NB-CF-TS-24
		Sludge Cake	
7	5/8/89	11:00 AM	NB-DS-CD-001
8	5/9/89	10:30 AM	NB-DS-CD-002
9	5/10/89	4:45 AM	NB-DS-CD-003
10	5/16/89	10:00 AM	NB-DS-CD-004
11	5/17/89	10:10 AM	NB-DS-CD-005
12	5/18/89	10:00 AM	NB-DS-CD-006

*D-Designates duplicate sample

Phase 2 Air Samples

Air samples were collected over two 12-hour periods (8 a.m. - 8 p.m.) on November 22, 1988 and December 7, 1988. Table B-2 summarizes the total number of samples taken, and the date, time, and identification number for each.

1.3 SAMPLING LOCATIONS

Sludge samples of gravity-thickened sludge were obtained at the existing city plant from a spigot located on the discharge side of the gravity thickener sludge pumps.

Sludge samples of dewatered sludge cake were obtained at the existing city plant from the discharge of the sludge centrifuges.

Air sampling was conducted at the existing primary treatment plant from the headworks' influent channel immediately downstream of the mechanical screens, below the grating.

1.4 VARIATION IN DETECTION LIMITS

The detection limits for the sludge sampling of gravity-thickened primary sludge was difficult to reach with any certain accuracy due to low solids content. To obtain results with lower detection limits and better accuracy, sludge sampling of the dewatered sludge cake was performed. This proved successful in most cases.

2.0 DATA SUMMARY AND OBSERVATIONS

2.1 DATA SUMMARY

Tables B-3 through B-6 summarize the average dry weather loadings of non-conventional pollutants, developed as a result of the CDM sampling program conducted under the Phase 1 Facilities Plan, the GHR sampling program, and sludge sampling. The dry weather average loadings of a

AIR SAMPLING PROGRAM LOG

Sampling Day No.	Date Sampled	Time	Identification Number
1	11/22/88	07:50-09:58 AM	NB-AIR-TPI-1A, B, C
2	11/22/88	11:40-12:40 PM	NB-AIR-TPI-2A, B, C
3	11/22/88	03:27-04:25 PM	NB-AIR-TPI-3A, B, C
4	11/22/88	07:10-08:10 PM	NB-AIR-TPI-4A, B, C
5	12/07/88	07:05-08:06 AM	NB-AIR-TPI-5A, B, C
6	12/07/88	11:08-12:12 PM	NB-AIR-TPI-6A, B, C
7	12/07/88	03:16-04:16 PM	NB-AIR-TPI-7A, B, C
8	12/07/88	07:13-08:13 PM	NB-AIR-TPI-8A, B, C

	Average	Standard
Constituent	(lb/dav)	(lb/dav)
	(10/ 44)/	(10, 44))
Antimony	1.17	0.56
Arsenic	0.53	0.39
Beryllium	1.86	NA
Boron	62.02	11.58
Codmium	0 42	0 11
Channium	0.42	16 00
Corpor	21.10	16.09
copper	52.05	14.00
Cyanide, Total	1.98	3.26
Lead	6.95	16.10
Mercury	0.10	0.03
Malash Jamma	/ 55	DT A
Molybdenum	4.00	
Nickel	10.83	9.84
Selenium	0.95	0.51
Silver	1.99	1.16
Thallium	0.93	NA
Zinc	47.39	22.76

EXISTING DRY WEATHER AVERAGE INFLUENT METAL LOADINGS

Note: Loadings are based on influent values only. These are reported in the appendix, and are the result of sample collections at the headworks to the existing New Bedford wastewater treatment plant.

EXISTING DRY WEATHER AVERAGE INFLUENT VOLATILE ORGANIC COMPOUND LOADINGS

Constituent	Average Load (lb/day)	Standard Deviation (lb/day)
Methylene Chloride	1.21	1.14
1,2 DiChloroethene	1.15	0.65
Chloroform	2.28	0.81
1,2 DiChloroethane	1.15	0.91
1,1,1-Trichloroethane	2.40	2.72
Trichloroethylene	2.85	1.43
Tetrachloroethene	1.87	2.36
1,1,2,2-Tetrachloroethane	1.27	1.16
Toluene	9.09	9.37
Ethylbenzene	2.09	2.41
Total Xylenes	10.19	12.35
2-Butanone	7.07	19.86
Acetone	32.12	27.65
Benzene	0.97	0.91
4 Methyl 2 Pentanone	1.58	1.90

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EXISTING DRY WEATHER AVERAGE INFLUENT ACID/BASE/NEUTRAL LOADINGS

Constituent	Average Load <u>(lb/day)</u>	Standard Deviation <u>(lb/day)</u>
Phenol	2.92	3.31
Benzyl Alcohol	1.72	0.77
2-Methylphenol	1.49	0.62
4-Methylphenol	7.68	5.36
Benzoic Acid	10.94	5.14
4 Chloro 3 Methylphenol	1.47	0.63
Isophorone	1.52	0.63
1,2,4 Trichlorobenzene	1.54	0.60
2-Methylnapthalene	1.53 `	0.71
N-Nitrosodiphenylamine	1.96	1.61
Di-N-Butyl Phthalate	1.60	0.87
Butyl Benzyl Phthalate	1.50	0.65
Bis(2-Ethylhexyl) Phthalate	14.42	37.21
Di-N-Octyl Phthalate	1.54	0.60
Napthalene	2.08	1.24
Diethyl Phthalate	1.66	0.54

EXISTING DRY WEATHER AVERAGE INFLUENT PESTICIDE/PCB LOADINGS

Constituent	Average Load (lb/day)	Standard Deviation <u>(lb/day)</u>
gamma-BHC	0.02	0.02
4,4'-DDD	0.01	NA
4,4'-DDT	0.01	NA
PCB-1242	0.06	0.05
PCB-1254	0.08	0.05

NOTE: Loadings are based on influent values only. These are reported in the appendix and are the result of samples collected at the headworks to the existing New Bedford Wastewater Treatment Plant. particular pollutant in the influent were calculated based on the concentration measured in each sample and on the flow readings that were recorded on that dry weather day of sampling. In a number of cases, the concentrations were reported below the detection limit of the test methods. In these instances, the following procedure was followed:

- o If a pollutant was detected at least once in the samplings above the sample's detection limit, then half the detection limit would be used as the concentration for those samples that reported results below detection limits.
- o If no pollutant was detected at least once in the samplings above the sample's detection limit, then no loadings were presented.

Table B-7 summarizes the results of analyses conducted on the primary sludge cake under the Phase 2 Facilities Plan sampling program. Results of analysis conducted on air emissions under the Phase 2 Facilities Plan sampling program are summarized on Table B-8.

2.2 INFLUENT METALS AND TOTAL CYANIDE

Analyses were conducted under the Phase 1 Facilities Plan for the 13 priority pollutant metals plus boron, total cyanide, and molybdenum. Tables B-9 through B-24 show the average daily loadings calculated for each constituent, as presented earlier in Appendix K of the Phase 1 Facilities Plan Report. (Note: Tables from B-9 on are presented following this introductory text.) Antimony, beryllium, cadmium, molybdenum, selenium, and thallium were not found at the detection limits reported. GHR also conducted analyses for the 13 priority pollutant metals plus total cyanides. Analyses for influent boron and molybdenum were not conducted. Average daily loadings were calculated based on GHR's results and are presented in Table B-25 through B-38. The GHR sampling program found antimony, cadmium, and selenium in the influent as a result of lower detection limits. Beryllium, molybdenum, and thallium were found in the primary sludge. Thus, to establish influent metals loadings, the original CDM loadings for these compounds were revised by using a concentration set at one-half the detection limit. Tables B-39 through B-44 present the

PRIMARY SLUDGE ANALYSIS PHASE 2 FACILITIES PLAN

Metals	Range (mg/kg)	Average (mg/kg)	Allowable Conc. in ppm Dry Wt. Type II
Antimony	<2.5	<2.5	
Arsenic	<1.0 - 1.1	<1.0	
Barium	160 - 190	182	
Beryllium	<1.0	<1.0	
Boron	<50	<50	300
Cadmium	<1.0 - 2.7	2.2	25
Chromium	150 – 640	265	1000
Copper	1100** - 1600**	1283**	1000
Cyanide	0.9 - 2.6	1.7	
Led	120 - 180	162	1000
Mercury	<0.05 - 0.34	0.16	10
Molybdenum	14** - 26**	19**	10
Nickel	160 – 470**	235**	200
Selenium	2.0 - 5.1	3.3	
Silver	13 - 20	16	
Thallium	<1.0	<1.0	
Zinc	700 – 900	730	2500
PCBs	5.1 - 12.5 **	8.9	10
Chloroform	<0.010310	0.063	
1,4-Dichlorobenzene	<0.010 - 1.200	0.225	
1,2-dichloroethene	<0.010 - 0.310	0.060	
Ethylbenzene	0.050 - 1.800	0.602	
Tetrachloroethane	<0.010 - 2.400	0.486	
Toluene	0.230 - 3.500	1.158	
Trichloroethene	<0.010520	0.112	
Carbon Disulfide	<0.010 - 0.35	0.019	
Acetone	<0.200 - 120.000	31.333	
4-Methyl-2-Pentanone	<0.010 - 8.400	2.038	
Total Xylenes	<0.200 - 6.600	1.798	
Bis-(2-Ethylhexyl)phthalate	<68 - 100	78	
4,4′-DDD	<0.25 - 3.0	0.94	
4,4′-DDT	<0.25 - <1.0	0.55	
PCB-1242	2.1-5.9	9.9	
PCB-1254	3.0-6.6	4.7	
Nitrogen, Total	3,160 - 20,600	10,985	
Ammonia as N	1,910 - 4,000	2,628	
Nitrate as N		<15	
Phosphorous	1,390 = 2,720	1,998	
Potassium	620 - 720	682	
pH	5.45 - 5.92	5.69	

< - Indicates element was analyzed for but not detected, and that its concentration is less than the indicated quantitative limit.

** - Indicates concentration exceeds Type II criteria.

AIR SAMPLING ANALYSIS PHASE 2 FACILITIES PLAN

	FID Analysis TNMO	VOST Analysis Total VOCs	Ratio FID To Total
Sample No.	(ug/l)	(ug/l)	VOC
NB-AIR-TPI-1C	8.98*	**	
NB-AIR-TPI-2C	8.98*	1.11	8.10
NB-AIR-TPI-3C	8,98*	1.61	5.59
NB-AIR-TPI-4C	8.98*	5.57	1.61
NB-AIR-TPI-5C	8.98*	0.75	11.97
NB-AIR-TPI-6C	8.98*	11.29	0.30
NB-AIR-TPI-7C	8.98*	2.49	3.60
NB-AIR-TPI-8C	25.50	26.95	0.95

- * Indicates that TNMOs were not detected and that the detection limit of ppm TNMO as propane (or 8.98 ug/l as propane) was used to calculate the concentration.
- ** Indicates that problems were encountered during sampling and no results were reported.

revised loadings for antimony, beryllium, cadmium, molybdenum, selenium, and thallium. The dry weather average metals influent loadings (presented earlier in Table B-3) were developed based upon all available data.

2.3 INFLUENT VOLATILE ORGANIC COMPOUNDS

Analyses conducted under the Phase 1 Facilities Plan influent sampling program for Priority Pollutant List (PPL) and Hazardous Substance List (HSL) volatile organic compounds (VOCs) found 13 compounds above detectable limits. Tables B-45 through B-57 show the average daily loadings calculated for each compound as presented earlier in Appendix K of the Phase 1 Facilities Plan Report. GHR also conducted analyses for the PP and HSL VOCs. Influent loadings of VOCs based on GHR's data are presented in Tables B-58 through B-72. The GHR sampling program found 15 compounds. The two additional compounds found were benzene and 4 methyl 2 pentanone. For purposes of calculating dry weather average influent VOC loadings, the CDM data for these two compounds was adjusted by setting the concentration at one-half the detection limit. Tables B-73 and B-74 present the revised CDM loadings calculated for benzene and 4 methyl 2 pentanone. The dry weather average VOC influent loadings, presented earlier in Table B-4, were developed based upon all available data.

2.4 INFLUENT SEMI-VOLATILE ORGANIC COMPOUNDS

Analyses conducted under the Phase 1 Facilities Plan influent sampling program for priority PP and HSL semi-volatile organic compounds found six acid fraction and nine base/neutral fraction compounds above detectable influent limits. Tables B-75 through B-89 show the average daily loadings calculated for each compound as presented earlier in Appendix K of the Phase 1 Facilities Plan Report. GHR also conducted analyses for PPL and HSL ABNS. Influent loadings of ABNs based on GHR's data are presented in Tables B-90 through B-105. The GHR sampling program found 17 compounds. The two additional compounds found were napthalene and diethyl phthalate. For purposes of calculating dry weather average influent ABN loadings, the CDM data for these two compounds was adjusted by setting the concentration at one-half the detection limit. Review of CDM's raw data revealed errors

in calculating loadings for 4-chloro-3-methylphenol and bis (2-ethylhexyl) phthalate. Tables B-106 and B-109 present the revised CDM loadings calculated for 4-chloro-3-methylphenol, bis (2-ethylhexyl) phthalate, napthalene and diethyl, phthalate. Dimethyl phthalate was not found in GHR's sampling. Review of CDM's raw data for dimethyl phthalate revealed that this compound was not found above detectable limits and should not have been included among the compounds found. Thus, dimethyl phthalate was deleted. The dry weather average ABN influent loadings, presented earlier in Table B-5, were developed based upon all available data.

2.5 INFLUENT PESTICIDES AND PCBs

Of the 19 pesticide and 7 PCB compounds found on the PPL and HSL, only one pesticide compound was detected. The compound Gamma-BHC (Lindane) exhibited concentrations of .15 and .05 ppm on 2 of the 11 days it was analyzed for. If it was present in the remaining nine samples, its concentration was lower than the detection limit. `Table B-110 shows the average daily plant loadings calculated for lindane as presented earlier in Appendix K of the Phase 1 Facilities Plan Report. GHR also conducted analyses for PPL and HSL pesticides and PCBs. The GHR sampling program, however, only found PCB-1242 and PCB-1254. Lindane was not detected in the influent, but since it was found in the CDM sampling program, loadings were calculated using one-half GHR's influent detectable limits. The pesticides, 4,4'-DDD and 4,4'-DDT, were not detected in either the CDM or GHR sampling program; however, since they were found in the Phase 2 sludge sampling program, loadings for these two pesticides were also calculated using one-half the influent detectable limits. Tables B-111 through B-115 present the GHR influent loadings for these pesticides and PCBs. Tables B-116 through B-119 present revised CDM loadings calculated for 4,4'-DDD, 4,4'-DDT, PCB-1242, and PCB-1254. The dry weather average pesticide and PCB influent loadings presented earlier in Table B-6 were developed based upon all available data.

PRIMARY SLUDGE

The gravity thickened primary sludge was analyzed for PPLL metals plus barium, baron, cyanide, molybdenum; PPLL and HSL VOCs, AB/Ns, pesticides,

and PCBs; nutrients; and EP toxicity. Table B-120 presents the results of the metals testing. Molybdenum, which was not found during influent sampling, was found above detection limits. Table B-121 presents the results of VOC analyses. Tetrachloroethene, toluene, acetone, and total xylene were detected above quantitative limits. Results of AB/N analyses are shown in Table B-122. Six compounds were detected above quantitative limits. These include 4-Methyphenol, napthalene, 2-Methylnapthalene, di-n-butylphthalate, butyl benzyl phthalate, and bis (2-ethylhexyl) phthalate, which were all found in the influent. Table B-123 presents the results of the pesticides and PCB analyses, and shows that none were detected above quantitative limits. This may have been due to the high detection limits. Nutrient and pH analyses are shown in Table B-124 and are typical of primary sludge. The two EP toxicity tests conducted indicated that the primary sludge is not classified as a hazardous waste. The results of these analyses are presented in Table B-125.

The dewatered primary sludge cake was analyzed for PPL metals plus barium, baron, cyanide, molybdenum; PPL and HSL VOCs, AB/Ns, pesticides and PCBs; and nutrients. Table B-126 summarizes the results of the metals testing. Molybdenum, which was not found during influent sampling, was found above detection limits. Antimony, beryllium, and thallium which were found in earlier sludge samplings were not detected above quantitative limits. Table B-127 presents the results of VOC analyses. Chloroform, 1.4-dichlorobenzene, 1,2 dichloroethene, cis 1,2 dichloroethene, ethylbenzene, tetrachloroethene, toluene, trichloroethene, carbon disulfide, acetone, 4-methyl-2-pentanone, and total xylenes were detected above quantitative limits. Results of AB/N analyses are shown in Table B-128; only bis (2-ethylhexyl) phthalate was found once at a concentration above detectable limits. Results of pesticide and PCB analyses are shown in Table B-129. Gamma BHC (lindane) which was found only once in the influent sampling program was not found in the sludge above detectable limits. PCBs 1242 and 1254 which were found in the influent were also found in high concentrations in the sludge cake. Two additional pesticides which were found in the sludge, were not found in the influent. These include 4,4'-DDD and 4,4'-DDT. Nutrient testing results are shown in Table B-130 and are typical of primary sludges.

Based on the results of the sludge analyses conducted under Phase 2, the primary sludge exceeds Type II sludge quality criteria for copper, nickel, and PCBs, and is thus classified as a Type III sludge.

4. VOC EMISSIONS

Air emissions from the influent channel were analyzed for specific VOC compound and for total non-methane organics (TNMO). Table B-131 presents the results of grab samples analyzed for specific VOC compounds. Sample 1C was not analyzed for specific VOCs due to equipment difficulties. The sum of the VOCs measured for each sample was then divided by the sample volume to establish the sample's concentration. Table B-132 presents the results of the TNMO analyses. The ratio between TNMO and the sum of all the specific VOC compounds found was shown earlier Table B-8. Where the TNMO concentration was less than the detection limit, the detection limit of 5,000 ppb was used to calculate this ratio.

CDM METALS RESULTS

ANTIMONY

Sample		Flow	Det. Limit	Conc	Influent
Day	Dete	r TOM		conc.	lh/dav
NO.	Date	mgu	phir	ppm	_10/uay
1	26-May-87	20.2	0.010	< DL*	0.00
2	27-May-87	23.2	0.010	< DL	0.00
3	28-May-87	23.6	0.010	< DL	0.00
4	12-Jun-87	25.8	0.010	< DL	0.00
5	31-May-87	19.3	0.010	< DL	0.00
6	01-Jun-87	27.0	0.010	< DL	0.00
8	03-Jun-87	20.5	0.010	< DL	0.00
9	04-Jun-87	19.9	0.010	< DL	0.00
10	07-Jun-87	21.1	0.010	< DL	0.00
11	08-Jun-87	38.4	0.010	< DL	0.00
12	09-Jun-87	29.2	0.010	< DL	0.00
13	10-Jun-87	24.8	0.010	< DL	0.00
14	11-Jun-87	23.1	0.010	< DL	0.00
15	14-Jun-87	21.1	0.010	< DL	0.00
16	15-Jun-87	21.9	0.010	< DL	0.00
17	16-Jun-87	22.4	0.010	< DL	0.00
18	17-Jun-87	20.6	0.010	< DL	0.00
19	18-Jun-87	20.5	0.010	< DL	0.00
20	19-Jun-87	23.2	0.010	< DL	0.00
29	06-Jul-87	19.8	0.010	< DL	0.00
30	. 17-Jul-87	18.9	0.010	< DL	0.00
31	08-Jul-87	19.3	0.010	< DL	0.00
32	09-Jul-87	19.8	0.010	< DL	0.00
34	14-Jul-87	21.0	0.010	< DL	0.00
35	15-Jul-87	19.5	0.010	< DL	0.00
36	25-Jul-87	19.6	0.010	< DL	0.00
37	16-Jul-87	19.7	0.010	< DL	0.00

ARITHMETIC MEAN:

22.3

0.00

* DL = Detection Limit

CDM METALS RESULTS

ARSENIC

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.005	0.0070	1.18
2	27-May-87	23.2	0.005**	0.0025	0.48
3	28-May-87	23.6	0.005**	0.0025	0.49
4	12-Jun-87	25.8	0.005**	0.0025	0.54
5	31-May-87	19.3	0.005**	0.0025	0.40
6	01-Jun-87	27.0	0.005**	0.0025	0.56
8	03-Jun-87	20.5	0.005**	0.0025	0.43
9	04-Jun-87	19.9	0.005**	0.0025	0.41
10	07-Jun-87	21.1	0.005**	0.0025	0.44
11	08-Jun-87	38.4	0.005**	0.0025	0.80
12	09-Jun-87	29.2	0.005**	0.0025	0.61
13	10-Jun-87	24.8	0.005**	0.0025	0.52
14	11–Jun–87	23.1	0.005**	0.0025	0.48
15	14-Jun-87	21.1	0.005**	0.0025	0.44
16	15-Jun-87	21.9	0.005**	0.0025	0.46
17	16-Jun-87	22.4	0.005**	0.0025	0.47
18	17-Jun-87	20.6	0.005**	0.0025	0.43
19	18-Jun-87	20.5	0.005**	0.0025	0.43
20	19-Jun-87	23.2	0.005**	0.0025	0.48
29	06-Jul-87	19.8	0.005**	0.0025	0.41
30	17-Jul-87	18.9	0.005**	0.0025	0.39
31	08-Jul-87	19.3	0.005**	0.0025	0.40
32	09-Jul-87	19.8	0.005**	0.0025	0.41
34	14-Jul-87	21.0	0.005**	0.0025	0.44
35	15-Jul-87	19.5	0.005**	0.0025	0.41
36	25-Jul-87	19.6	0.005**	0.0025	0.41
37	16-Jul-87	19.7	0.005**	0.0025	0.41
ARITHMETI	C MEAN:	22.3			0.49

**The concentration fell below the detection limit. For purposes of calculation, the concentration value was set at one-half the detection limit.

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CDM METALS RESULTS

BERYLLIUM

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	_ppm_	lb/day
1	26-May-87	20.2	0.020	< DL*	0.00
2	27-May-87	23.2	0.020	< DL	0.00
3	28-May-87	23.6	0.020	< DL	0.00
4	12-Jun-87	25.8	0.020	< DL	0.00
5	31-May-87	19.3	0.020	< DL	0.00
6	01-Jun-87	27.0	0.020	< DL	0.00
8	03-Jun-87	20.5	0.020	< DL	0.00
9	04-Jun-87	19.9	0.020	< DL	0.00
10	07-Jun-87	21.1	0.020	< DL	0.00
11	08-Jun-87	38.4	0.020	< DL	0.00
12	09-Jun-87	29.2	0.020	< DL	0.00
13	10-Jun-87	24.8	0.020	< DL	0.00
14	11–Jun–87	23.1	0.020	< DL	0.00
15	14-Jun-87	21.1	0.020	< DL	0.00
16	15-Jun-87	21.9	0.020	< DL	0.00
17	16-Jun-87	22.4	0.020	< DL	0.00
18	17–Jun–87	20.6	0.020	< DL	0.00
19	18-Jun-87	20.5	0.020	< DL	0.00
20	19-Jun-87	23.2	0.020	< DL	0.00
29	06-Jul-87	19.8	0.020	< DL	0.00
30	17-Jul-87	18.9	0.020	< DL	0.00
31	08-Jul-87	19.3	0.020	< DL	0.00
32	09-Jul-87	19.8	0.020	< DL	0.00
34	14-Jul-87	21.0	0.020	< DL	0.00
35	15-Jul-87	19.5	0.020	< DL	0.00
36	25-Jul-87	19.6	0.020	< DL	0.00
37	16-Jul-87	19.7	0.020	< DL	0.00

ARITHMETIC MEAN:

22.3

0.00

*DL = Detection Limit

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CDM METALS RESULTS

BORON

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
			0 100	0.010	50.00
1	26-May-8/	20.2	0.100	0.310	52.23
2	27-May-87	23.2	0.100	0.310	59.98
3	28-May-87	23.6	0.100	0.310	61.02
4	12–Jun–87	25.8	0.100	0.390	83.92
5	31-May-87	19.3	0.100	0.280	45.07
6	01-Jun-87	27.0	0.100	0.250	56.30
8	03-Jun-87	20.5	0.100	0.310	53.00
9	04-Jun-87	19.9	0.100	0.210	34.85
10	07-Jun-87	21.1	0.100	0.200	35.19
11	08-Jun-87	38.4	0.100	0.320	102.48
12	09-Jun-87	29.2	0.100	0.340	82.80
13	10-Jun-87	24.8	0.100	0.300	62.05
14	11-Jun-87	23.1	0.100	0.390	75.14
15	14-Jun-87	21.1	0.100	0.350	61.59
16	15-Jun-87	21.9	0.100	0.330	60.27
17	16-Jun-87	22.4	0.100	0.350	65.39
18	17-Jun-87	20.6	0.100	0.350	60.13
19	18-Jun-87	20.5	0.100	0.340	58.13
20	19-Jun-87	23.2	0.100	0.360	69.66
29	06-Jul-87	19.8	0.100	0.380	62.75
30	17-Jul-87	18.9	0.100	0.390	61.47
31	08-Jul-87	19.3	0.100	0.390	62.78
32	09-Jul-87	19.8	0.100	0.400	66.05
34	14 - 101 - 87	21.0	0.100	0.410	71.81
35	15_1u_{1-87}	19.5	0.100	0.460	74.81
36	25_111_87	19.6	0.100	0.410	67.02
37	16 - 101 - 87	19.7	0.100	0.420	69.01
57	10-041-07		0.200		

ARITHMETIC MEAN:

California

22.3

63.51

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CDM METALS RESULTS

CADMIUM

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	<u>lb/day</u>
1	26-May-87	20.2	0.005	< DL*	0.00
2	27-May-87	23.2	0.005	< DL	0.00
3	28-May-87	23.6	0.005	< DL	0.00
4	12-Jun-87	25.8	0.005	< DL	0.00
5	31-May-87	19.3	0.005	< DL	0.00
6	01-Jun-87	27.0	0.005	< DL	0.00
8	03-Jun-87	20.5	0.005	< DL	0.00
9	04-Jun-87	19.9	0.005	< DL	0.00
10	07-Jun-87	21.1	0.005	< DL	0.00
11	08-Jun-87	38.4	0.005	< DL	0.00
12	09-Jun-87	29.2	0.005	< DL	0.00
13	10-Jun-87	24.8	0.005	< DL	0.00
14	11-Jun-87	23.1	0.005	< DL	0.00
15	14-Jun-87	21.1	0.005	< DL	0.00
16	15–Jun–87	21.9	0.005	< DL	0.00
17	16-Jun-87	22.4	0.005	< DL	0.00
18	17-Jun-87	20.6	0.005	< DL	0.00
19	18-Jun-87	20.5	0.005	< DL	0.00
20	19-Jun-87	23.2	0.005	< DL	0.00
29	06-Jul-87	19.8	0.005	< DL	0.00
30	17-Jul-87	18.9	0.005	< DL	0.00
31	08-Jul-87	19.3	0.005	< DL	0.00
32	09-Jul-87	19.8	0.005	< DL	0.00
34	14-Jul-87	21.0	0.005	< DL	0.00
35	15-Jul-87	19.5	0.005	< DL	0.00
36	25-Jul-87	19.6	0.005	< DL	0.00
37	16-Jul-87	19.7	0.005	< DL	0.00

ARITHMETIC MEAN:

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22.3

0.00

*DL = Detection Limit

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CDM METALS RESULTS

CHROMIUM

Sample Day No.	Date	Flow mgd	Det. Limit _ppm	Conc. ppm	Influent Quantity lb/day
1	26-May-87	20.2	0.005	0.130	21.90
2	27-May-87	23.2	0.005	0.063	12.19
3	28-May-87	23.6	0.005	0.065	12.79
4	12-Jun-87	25.8	0.005	0.120	25.82
5	31-May-87	19.3	0.005	0.180	28.97
6	01-Jun-87	27.0	0.005	0.110	24.77
8	03-Jun-87	20.5	0.005	0.150	25.65
9	04–Jun–87	19.9	0.005	0.140	23.24
10	07-Jun-87	21.1	0.005	0.084	14.78
11	08-Jun-87	38.4	0.005	0.075	26.90
12	09-Jun-87	29.2	0.005	0.180	18.26
13	10-Jun-87	24.8	0.005	0.069	37.23
14	11-Jun-87	23.1	0.005	0.075	14.45
15	14-Jun-87	21.1	0.005	0.110	19.36
16	15-Jun-87	21.9	0.005	0.079	14.43
17	16-Jun-87	22.4	0.005	0.087	16.25
18	17-Jun-87	20.6	0.005	0.069	11.85
19	18-Jun-87	20.5	0.005	0.074	12.65
20	19-Jun-87	23.2	0.005	0.080	15.48
29	06-Jul-87	19.8	0.005	0.130	21.47
30	17-Jul-87	18.9	0.005	0.054	8.51
31	08-Jul-87	19.3	0.005	0.130	20.93
32	09-Jul-87	19.8	0.005	0.110	18.16
34	14-Jul-87	21.0	0.005	0.087	15.24
35	15-Jul-87	19.5	0.005	0.620	100.83
36	25-Jul-87	19.6	0.005	0.063	10.30
37	16-Jul-87	19.7	0.005	0.075	12.32

ARITHMETIC MEAN:

22.3

21.66

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CDM METALS RESULTS

COPPER

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26 May 87	20.2	0.005	0.280	47.17
2	27 Max-87	23.2	0.005	0.310	59.98
2	27-May-07	23.6	0.005	0.290	57.08
2	12 Jun - 87	25.8	0.005	0.250	53.79
4	31 - Max - 87	19.3	0.005	0.064	10.30
5	01 - Iun - 87	27.0	0.005	0.200	45.04
9	03 - 1 - 87	20.5	0.005	0.220	37.61
0	04 - 10 - 87	19.9	0.005	0.300	49.79
10	04 - 3 un - 87	21.1	0.005	0.130	22.88
10	07 = 3 m = 07 08 = 1 m = 87	38.4	0.005	0.200	64.05
12	09 - 100 - 87	29.2	0.005	0.220	53.58
13	10 - 10 - 87	24.8	0.005	0.200	41.37
14	11 - Jun - 87	23.1	0.005	0.190	36.60
15	4 - Jun - 87	21.1	0.005	0.088	15.49
16	15_Jun_87	21.9	0.005	0.260	47.49
17	16-Jun-87	22.4	0.005	0.190	35.50
18	17_Jun-87	20.6	0.005	0.180	30.92
19	18-Jun-87	20.5	0.005	0.240	41.03
20	19-Jun-87	23.2	0.005	0.180	34.83
29	06-Jul-87	19.8	0.005	0.086	14.20
30	17-Jul-87	18.9	0.005	0.170	26.80
31	08-Jul-87	19.3	0.005	0.170	27.36
32	09-Jul-87	19.8	0.005	0.150	24.77
34	14-Jul-87	21.0	0.005	0.081	14.19
35	15-Jul-87	19.5	0.005	0.096	15.61
36	25-Jul-87	19.6	0.005	0.250	40.87
37	16-Jul-87	19.7	0.005	0.180	29.57

ARITHMETIC MEAN:

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22.3

36.22

CDM METALS RESULTS

CYANIDE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	_ppm_	_lb/day_
1	26-May-87	20.2	0.010	0.018	3.03
2	27-May-87	23.2	0.010	0.098	18.96
4	12-Jun-87	25.8	0.010**	0.005	1.08
5	31-May-87	19.3	0.010**	0.005	0.80
6	01-Jun-87	27.0	0.010**	0.005	1.13
8	03-Jun-87	20.5	0.010**	0.005	0.85
9	04-Jun-87	19.9	0.010**	0.005	0.83
10	07-Jun-87	21.1	0.010**	0.005	0.88
11	08-Jun-87	38.4	0.010	0.019	6.08
12	09-Jun-87	29.2	0.010	0.012	2.92
13	10-Jun-87	24.8	0.010**	0.005	1.03
14	11–Jun–87	23.1	0.010	0.018	3.47
15	14-Jun-87	21.1	0.010**	0.005	0.88
16	15-Jun-87	21.9	0.010**	0.005	0.91
17	16-Jun-87	22.4	0.010**	0.005	0.93
18	17-Jun-87	20.6	0.010**	0.005	0.86
19	18-Jun-87	20.5	0.010**	0.005	0.85
20	19-Jun-87	23.2	0.010**	0.005	0.97
29	06-Jul-87	19.8	0.010**	0.005	0.83
30	17-Jul-87	18.9	0.010**	0.005	0.79
31	08-Jul-87	19.3	0.010**	0.005	0.80
32	09-Jul-87	19.8	0.010**	0.005	0.83
34	14-Jul-87	21.0	0.010**	0.005	0.88
35	15-Jul-87	19.5	0.010**	0.005	0.81
36	25-Jul-87	19.6	0.010**	0.005	0.82
37	16-Jul-87	19.7	0.010**	0.005	0.82

ARITHMETIC MEAN:

22.3

2.04

**The concentration fell below the detection limit. For purposes of calculation, the concentration value was set at one-half the detection limit

CDM METALS RESULTS

LEAD

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.010	0.038	6.40
2	27-May-87	23.2	0.010	0.016	3.10
3	28-May-87	23.6	0.010	0.017	3.35
4	12-Jun-87	25.8	0.010	0.033	7.10
5	31-May-87	19.3	0.010	0.014	2.25
6	01-Jun-87	27.0	0.010	0.014	3.15
8	03-Jun-87	20.5	0.010**	0.005	0.85
9	04-Jun-87	19.9	0.010	0.050	8.30
10	07-Jun-87	21.1	0.010	0.600	105.58
11	08-Jun-87	38.4	0.010	0.019	6.08
12	09-Jun-87	29.2	0.010	0.022	5.36
13	10-Jun-87	24.8	0.010	0.017	3.52
14	11-Jun-87	23.1	0.010	0.020	3.85
15	14–Jun–87	21.1	0.010**	0.005	0.88
16	15-Jun-87	21.9	0.010	0.027	4.93
17	16-Jun-87	22.4	0.010	0.017	3.18
18	17-Jun-87	20.6	0.010	0.022	3.78
19	18-Jun-87	20.5	0.010	0.076	12.99
20	19-Jun-87	23.2	0.010	0.024	4.64
29	06-Jul-87	19.8	0.010	0.015	2.48
30	17-Jul-87	18.9	0.010**	0.005	0.79
31	08-Jul-87	19.3	0.010	0.015	2.41
32	09-Jul-87	19.8	0.010	0.027	4.46
34	14-Jul-87	21.0	0.010**	0.005	0.88
35	15-Jul-87	19.5	0.10**	0.005	0.81
36	25-Jul-87	19.6	0.010	0.029	4.74
37	16-Jul-87	19.7	0.010**	0.005	0.82

ARITHMETIC MEAN:

22.3

7.66

**The concentration fell below the detection limit. For purposes of calculation, the concentration value was set at one-half the detection limit.

CDM METALS RESULTS

MERCURY

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	_ppm	ppm	lb/day_
1	26-May-87	20.2	0.001**	0.0005	0.08
2	27-May-87	23.2	0.001**	0.0005	0.10
3	28-May-87	23.6	0.001**	0.0005	0.10
4	12-Jun-87	25.8	0.001**	0.0005	0.11
5	31-May-87	19.3	0.001**	0.0005	0.08
6	01-Jun-87	27.0	0.001	0.0010	0.23
8	03-Jun-87	0.001	0.001**	0.0005	0.09
9	04-Jun-87	19.9	0.001**	0.0005	0.08
10	07-Jun-87	21.1	0.001**	0.0005	0.09
11	08-Jun-87	38.4	0.001**	0.0005	0.16
12	09-Jun-87	29.2	0.001**	0.0005	0.12
13	10-Jun-87	24.8	0.001**	0.0005	0.10
14	11-Jun-87	23.1	0.001**	0.0005	0.10
15	14-Jun-87	21.1	0.001**	0.0005	0.09
16	15-Jun-87	21.9	0.001**	0.0005	0.09
17	16-Jun-87	22.4	0.001**	0.0005	0.09
18	17-Jun-87	20.6	0.001**	0.0005	0.09
19	18-Jun-87	20.5	0.001**	0.0005	0.09
20	19-Jun-87	23.2	0.001**	0.0005	0.10
29	06-Jul-87	19.8	0.001	0.0010	0.17
30	17-Jul-87	18.9	0.001**	0.0005	0.08
31	08-Jul-87	19.3	0.001**	0.0005	0.08
32	09-Jul-87	19.8	0.001	0.0010	0.17
34	14-Jul-87	21.0	0.001**	0.0005	0.09
35	15-Jul-87	19.5	0.001**	0.0005	0.08
36	25-Jul-87	19.6	0.001**	0.0005	0.08
37	16-Jul-87	19.7	0.001**	0.0005	0.08

ARITHMETIC MEAN:

22.3

0.10

**The concentration fell below the detection limit. For purposes of calculation, the concentration value was set at one-half the detection limit.

CDM METALS RESULTS

MOLYBDENUM

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.050	< DL*	0.00
2	27-May-87	23.2	0.050	< DL	0.00
3	28-May-87	23.6	0.050	< DL	0.00
4	12-Jun-87	25.8	0.050	< DL	0.00
5	31-May-87	19.3	0.050	< DL	0.00
6	01-Jun-87	27.0	0.050	< DL	0.00
8	03-Jun-87	20.5	0.050	< DL	0.00
9	04-Jun-87	19.9	0.050	< DL	0.00
10	07-Jun-87	21.1	0.050	< DL	0.00
11	08-Jun-87	38.4	0.050	< DL	0.00
12	09-Jun-87	29.2	0.050	< DL	0.00
13	10-Jun-87	24.8	0.050	< DL	0.00
14	11–Jun–87	23.1	0.050	< DL	0.00
15	14-Jun-87	21.1	0.050	< DL	0.00
16	15–Jun–87	21.9	0.050	< DL	0.00
17	16-Jun-87	22.4	0.050	< DL	0.00
18	17–Jun–87	20.6	0.050	< DL	0.00
19	18-Jun-87	20.5	0.050	< DL	0.00
20	1 9 -Jun-87	23.2	0.050	< DL	0.00
29	06-Jul-87	19.8	0.050	< DL	0.00
30	17-Jul-87	18.9	0.050	< DL	0.00
31	08-Jul-87	19.3	0.050	< DL	0.00
32	09-Jul-87	19.8	0.050	< DL	0.00
34	14-Jul-87	21.0	0.050	< DL	0.00
35	15-Jul-87	19.5	0.050	< DL	0.00
36	25-Jul-87	19.6	0.050	< DL	0.00
37	16-Jul-87	19.7	0.050	< DL	0.00
	C MEAN.	<u>,,,</u> ,			0.00
AKTINUELI	C PILAN:	22.5			0.00

*DL = Detection Limit

ARITHMETIC MEAN:

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CDM METALS RESULTS

NICKEL

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
				0.100	00.00
1	26-May-87	20.2	0.010	0.120	20.22
2	27-May-87	23.2	0.010	0.010	1.93
3	28-May-87	23.6	0.010	0.0/8	15.35
4	12-Jun-87	25.8	0.010	0.100	21.52
5	31-May-87	19.3	0.010	0.095	15.29
6	01-Jun-87	27.0	0.010	0.019	4.28
8	03-Jun-87	20.5	0.010	0.170	29.06
9	04-Jun-87	19.9	0.010	0.120	19.92
10	07-Jun-87	21.1	0.010	0.051	8.97
11	08-Jun-87	38.4	0.010	0.130	41.63
12	09-Jun-87	29.2	0.010	0.210	51.14
13	10-Jun-87	24.8	0.010	0.170	35.16
14	11-Jun-87	23.1	0.010	0.099	19.07
15	14-Jun-87	21.1	0.010	0.058	10.21
16	15-Jun-87	21.9	0.010	0.097	17.72
17	16-Jun-87	22.4	0.010	0.077	14.38
18	17-Jun-87	20.6	0.010	0.190	32.64
19	18-Jun-87	20.5	0.010	0.096	16.41
20	19-Jun-87	23.2	0.010	0.079	15.29
29	06-Jul-87	19.8	0.010	0.095	15.69
30	17-Jul-87	18.9	0.010	0.040	6.31
31	08-Jul-87	19.3	0.010	0.140	22.53
32	09 - Ju - 87	19.8	0.010	0.098	16.18
34	14 - Ju - 87	21.0	0.010	0.071	12.43
35	15 - Ju] - 87	19.5	0.010	0.023	3.74
36	25_Jul_87	19.6	0.010	0.098	16.02
37	16_Jul_87	19.7	0.010	0.078	12.82
	10-001-07	+ / • /	00020		

ARITHMETIC MEAN:

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22.3

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18.37

CDM METALS RESULTS

SELENIUM

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day_
			0.010		0.00
1	26-May-8/	20.2	0.010	< DL*	0.00
2	27-May-87	23.2	0.010	< DL	0.00
3	28-May-87	23.6	0.010	< DL	0.00
4	12-Jun-87	25.8	0.010	< DL	0.00
5	31-May-87	19.3	0.010	< DL	0.00
6	01–Jun–87	27.0	0.010	< DL	0.00
8	03–Jun–87	20.5	0.010	< DL	0.00
9	04-Jun-87	19.9	0.010	< DL	0.00
10	07-Jun-87	21.1	0.010	< DL	0.00
11	08-Jun-87	38.4	0.010	< DL	0.00
12	09-Jun-87	29.2	0.010	< DL	0.00
13	10-Jun-87	24.8	0.010	< DL	0.00
14	11-Jun-87	23.1	0.010	< DL	0.00
15	14-Jun-87	21.1	0.010	< DL	0.00
16	15-Jun-87	21.9	0.010	< DL	0.00
17	16-Jun-87	22.4	0.010	< DL	0.00
18	17-Jun-87	20.6	0.010	< DL	0.00
19	18-Jun-87	20.5	0.010	< DL	0.00
20	19-Jun-87	23.2	0.010	< DL	0.00
29	06-Jul-87	19.8	0.010	< DL	0.00
30	17-Jul-87	18.9	0.010	< DL	0.00
31	08-Jul-87	19.3	0.010	< DL	0.00
32	09 - Ju1 - 87	19.8	0.010	< DL	0.00
34	14 - 101 - 87	21.0	0.010	< DL	0.00
35	$15_{10} = 87$	19.5	0.010	< DL	0.00
36	$25_1 11 - 87$	19.6	0.010	< DL	0.00
37	$16_{-101}-87$	19.7	0.010	< DL	0.00
57	10-001-01	17.7	0.010	,	

ARITHMETIC MEAN:

22.3

0.00

*DL = Detection Limit

CDM METALS RESULTS

SILVER

Sample			Det.		Influent
Dav		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ррт	lb/day
1	26-May-87	20.2	0.020**	0.010	1.68
2	27-May-87	23.2	0.020**	0.010	1.93
3	28-May-87	23.6	0.020**	0.010	1.97
4	12-Jun-87	25.8	0.020**	0.010	2.15
5	31-May-87	19.3	0.020**	0.010	1.61
6	01-Jun-87	27.0	0.020**	0.010	2.25
8	03-Jun-87	20.5	0.020**	0.010	1.71
9	04-Jun-87	19.9	0.020**	0.010	1.66
10	07-Jun-87	21.1	0.020**	0.010	1.76
11	08-Jun-87	38.4	0.020**	0.010	3.20
12	09-Jun-87	29.2	0.020**	0.010	2.44
13	10-Jun-87	24.8	0.020**	0.010	2.07
14	11-Jun-87	23.1	0.020**	0.010	1.93
15	14–Jun–87	21.1	0.020**	0.010	1.76
16	15-Jun-87	21.9	0.020**	0.010	1.83
17	16-Jun-87	22.4	0.020**	0.010	1.87
18	17-Jun-87	20.6	0.020**	0.010	1.72
19	18-Jun-87	20.5	0.020**	0.010	1.71
20	19-Jun-87	23.2	0.020**	0.010	1.93
29	06-Jul-87	19.8	0.020**	0.010	1.65
30	17-Jul-87	18.9	0.020**	0.010	1.58
31	08-Jul-87	19.3	0.020**	0.010	1.61
32	09-Jul-87	19.8	0.020	0.034	5.61
34	14-Jul-87	21.0	0.020	0.038	6.66
35	15-Jul-87	19.5	0.020**	0.010	1.63
36	25-Jul-87	19.6	0.020**	0.010	1.63
37	16-Jul-87	19.7	0.020**	0.010	1.64

ARITHMETIC MEAN:

22.3

2.19

**The concentration fell below the detection limit. For purposes of calculation, the concentration value was set at one-half the detection limit.

CDM METALS RESULTS

THALLIUM

Sample Day		Flow	Det. Limit	Conc.	Influent Quantity
No.	Date	mga	_ppm_	_ppm_	
1	26-May-87	20.2	0.010	< DL*	0.00
2	27-May-87	23.2	0.010	< DL	0.00
3	28-May-87	23.6	0.010	< DL	0.00
4	12-Jun-87	25.8	0.010	< DL	0.00
5	31-May-87	19.3	0.010	< DL	0.00
6	01-Jun-87	27.0	0.010	< DL	0.00
8	03-Jun-87	20.5	0.010	< DL	0.00
9	04-Jun-87	19.9	0.010	< DL	0.00
10	07–Jun–87	21.1	0.010	< DL	0.00
11	08-Jun-87	38.4	0.010	< DL	0.00
12	09-Jun-87	29.2	0.010	< DL	0.00
13	10-Jun-87	24.8	0.010	< DL	0.00
14	11-Jun-87	23.1	0.010	< DL	0.00
15	14-Jun-87	21.1	0.010	< DL	0.00
16	15-Jun-87	21.9	0.010	< DL	0.00
17	16-Jun-87	22.4	0.010	< DL	0.00
18	17–Jun–87	20.6	0.010	< DL	0.00
19	18-Jun-87	20.5	0.010	< DL	0.00
20	19-Jun-87	23.2	0.010	< DL	0.00
29	06-Jul-87	19.8	0.010	< DL	0.00
30	17-Jul-87	18.9	0.010	< DL	0.00
31	08-Jul-87	19.3	0.010	< DL	0.00
32	09-Jul-87	19.8	0.010	< DL	0.00
34	14-Jul-87	21.0	0.010	< DL	0.00
35	15-Jul-87	19.5	0.010	< DL	0.00
36	25-Jul-87	19.6	0.010	< DL	0.00
37	16-Jul-87	19.7	0.010	< DL	0.00

ARITHMETIC MEAN:

22.3

0.00

* Detection Limit

CDM METALS RESULTS

ZINC

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day_
1	26-May-87	20.2	0.020	0.220	37.06
2	27-May-87	23.2	0.020	0.180	34.83
3	28-May-87	23.6	0.020	0.300	59.05
4	12-Jun-87	25.8	0.020	0.260	55.94
5	31-May-87	19.3	0.020	0.110	17.71
6	01-Jun-87	27.0	0.020	0.270	60.80
8	03-Jun-87	20.5	0.020	0.360	61.55
9	04-Jun-87	19.9	0.020	0.360	59.75
10	07-Jun-87	21.1	0.020	0.190	33.44
11	08-Jun-87	38.4	0.020	0.280	89.67
12	09-Jun-87	29.2	0.020	0.480	116.89
13	10-Jun-87	24.8	0.020	0.540	111.69
14	11-Jun-87	23.1	0.020	0.300	57.80
15	14-Jun-87	21.1	0.020	0.088	15.49
16	15-Jun-87	21.9	0.020	0.340	62.10
17	16-Jun-87	22.4	0.020	0.200	37.36
18	17-Jun-87	20.6	0.020	0.220	37.80
19	18-Jun-87	20.5	0.020	0.220	37.61
20	19-Jun-87	23.2	0.020	0.300	58.05
29	06-Jul-87	19.8	0.020	0.160	26.42
30	17-Jul-87	18.9	0.020	0.190	29.95
31	08-Jul-87	19.3	0.020	0.270	43.46
32	09-Jul-87	19.8	0.020	0.320	52.84
34	14-Jul-87	21.0	0.020	0.150	26.27
35	15-Jul-87	19.5	0.020	0.210	34.15
36	25-Jul-87	19.6	0.020	0.230	37.60
37	16-Jul-87	19.7	0.020	0.290	47.65

ARITHMETIC MEAN:

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22.3

49.74

GHR METALS RESULTS

ANTIMONY

		Det.		Influent
	Flow	Limit	Conc.	Quantity
Date	mgd	ppm	ppm	lb/day
1/5-6/88	25.7	0.005**	0.0025	0.54
2/2-3/88	32.1	0.020**	0.0100	2.68
3/2/88	30.0	0.020**	0.0100	2.50
4/5-6/88	30.0	0.020**	0.0100	2.50
5/3-4/88	28.6	0.020**	0.0100	2.39
6/1-2/88	24.6	0.020**	0.0100	2.05
7/5-6/88	18.9	0.020**	0.0100	1.58
8/2-3/88	27.3	0.020**	0.0100	2.28
9/7-8/88	20.5	0.025**	0.0125	2.14
10/5-6/88	25.8	0.025**	0.0125	2.69
11/7-8/88	22.8	-	0.0120	2.28
12/8-9/88	25.8	0.025**	0.0125	2.69
MFAN.	26.0			2 10
	Date 1/5-6/88 2/2-3/88 3/2/88 4/5-6/88 5/3-4/88 6/1-2/88 7/5-6/88 8/2-3/88 9/7-8/88 10/5-6/88 11/7-8/88 12/8-9/88	Date mgd 1/5-6/88 25.7 2/2-3/88 32.1 3/2/88 30.0 4/5-6/88 30.0 4/5-6/88 28.6 6/1-2/88 24.6 7/5-6/88 18.9 8/2-3/88 27.3 9/7-8/88 20.5 10/5-6/88 25.8 11/7-8/88 22.8 12/8-9/88 25.8	Flow Limit Date mgd ppm 1/5-6/88 25.7 0.005** 2/2-3/88 32.1 0.020** 3/2/88 30.0 0.020** 3/2/88 30.0 0.020** 4/5-6/88 30.0 0.020** 5/3-4/88 28.6 0.020** 6/1-2/88 24.6 0.020** 7/5-6/88 18.9 0.020** 8/2-3/88 27.3 0.020** 9/7-8/88 20.5 0.025** 10/5-6/88 25.8 0.025** 11/7-8/88 22.8 - 12/8-9/88 25.8 0.025**	Date mgd ppm ppm 1/5-6/88 25.7 0.005** 0.0025 2/2-3/88 32.1 0.020** 0.0100 3/2/88 30.0 0.020** 0.0100 3/2/88 30.0 0.020** 0.0100 4/5-6/88 30.0 0.020** 0.0100 5/3-4/88 28.6 0.020** 0.0100 6/1-2/88 24.6 0.020** 0.0100 7/5-6/88 18.9 0.020** 0.0100 8/2-3/88 27.3 0.020** 0.0100 9/7-8/88 20.5 0.025** 0.0125 10/5-6/88 25.8 0.025** 0.0125 11/7-8/88 22.8 - 0.0120 12/8-9/88 25.8 0.025** 0.0125

**The concentration fell below the detection limit. For purposes of calculation, the concentration value was set at one-half the detection limit.

GHR METALS RESULTS

ARSENIC

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	_ppm_	ppm	lb/day
1	1/5-6/88	25.7	0.020**	0.0100	2.14
2	2/2-3/88	32.1	0.005**	0.0025	0.67
3	3/2/88	30.0	0.005**	0.0025	0.63
4	4/5-6/88	30.0	0.020**	0.0100	2.50
5	5/3-4/88	28.6	0.020**	0.0100	2.39
6	6/1-2/88	24.6	0.002	0.0020	0.41
7	7/5-6/88	18.9	0.002**	0.0010	0.16
8	8/2-3/88	27.3	0.002**	0.0010	0.23
9	9/7-8/88	20.5	0.005**	0.0025	0.43
10	10/5-6/88	25.8	0.005**	0.0025	0.54
11	11/7-8/88	22.8	0.005**	0.0025	0.48
12	12/8-9/88	25.8	0.005**	0.0025	0.54
ARITHMETI	C MEAN:	26.0			0.92

**The concentration fell below the detection limit. For purposes of calculation, the concentration value was set at one-half the detection limit.

GHR METALS RESULTS

BERYLLIUM

		Det.		Influent
	Flow	Limit	Conc.	Quantity
Date	mgd	ppm	ppm	lb/day
1/5-6/88	25.7	0.020**	0.010	2.14
2/2-3/88	32.1	0.020**	0.010	2.68
3/2/88	30.0	0.020**	0.010	2.50
4/5-6/88	30.0	0.020**	0.010	2.50
5/3-4/88	28.6	0.020**	0.010	2.39
6/1-2/88	24.6	0.020**	0.010	2.05
7/5-6/88	18.9	0.020**	0.010	1.58
8/2-3/88	27.3	0.020**	0.010	2.28
9/7-8/88	20.5	0.020**	0.010	1.71
10/5-6/88	25.8	0.020**	0.010	2.15
11/7-8/88	22.8	0.020**	0.010	1.90
12/8-9/88	25.8	0.020**	0.010	2.15
C MEAN:	26.0			2.17
	Date 1/5-6/88 2/2-3/88 3/2/88 4/5-6/88 5/3-4/88 6/1-2/88 7/5-6/88 8/2-3/88 9/7-8/88 10/5-6/88 11/7-8/88 12/8-9/88 C MEAN:	Date mgd 1/5-6/88 25.7 2/2-3/88 32.1 3/2/88 30.0 4/5-6/88 30.0 5/3-4/88 28.6 6/1-2/88 24.6 7/5-6/88 18.9 8/2-3/88 27.3 9/7-8/88 20.5 10/5-6/88 25.8 11/7-8/88 22.8 12/8-9/88 25.8	Det. Limit Date mgd ppm 1/5-6/88 25.7 0.020** 2/2-3/88 32.1 0.020** 3/2/88 30.0 0.020** 4/5-6/88 30.0 0.020** 5/3-4/88 28.6 0.020** 6/1-2/88 24.6 0.020** 7/5-6/88 18.9 0.020** 8/2-3/88 27.3 0.020** 9/7-8/88 20.5 0.020** 10/5-6/88 25.8 0.020** 11/7-8/88 22.8 0.020** 12/8-9/88 25.8 0.020**	Date Flow Limit Conc. Date mgd ppm ppm 1/5-6/88 25.7 0.020** 0.010 2/2-3/88 32.1 0.020** 0.010 3/2/88 30.0 0.020** 0.010 3/2/88 30.0 0.020** 0.010 4/5-6/88 30.0 0.020** 0.010 5/3-4/88 28.6 0.020** 0.010 6/1-2/88 24.6 0.020** 0.010 7/5-6/88 18.9 0.020** 0.010 8/2-3/88 27.3 0.020** 0.010 9/7-8/88 20.5 0.020** 0.010 10/5-6/88 25.8 0.020** 0.010 11/7-8/88 22.8 0.020** 0.010 12/8-9/88 25.8 0.020** 0.010

**For purposes of calculation, the concentration value was set at one-half the detection limit. This constituent was not detected in the influent, but it was detected in the primary sludge samples.

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GHR METALS RESULTS

CADMIUM

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.005**	0.0025	0.54
2	2/2-3/88	32.1	0.005**	0.0025	0.67
3	3/2/88	30.0	0.005**	0.0025	0.63
4	4/5-6/88	30.0	0.001**	0.0005	0.13
5	5/2-3/88	28.6	0.001	0.0010	0.24
6	6/1-2/88	24.6	0.001**	0.0005	0.10
7	7/5-6/88	18.9	0.001**	0.0005	0.08
8	8/2-3/88	27.3	0.001	0.0010	0.23
9	9/7-8/88	20.5	0.005**	0.0025	0.43
10	10/5-6/88	25.8	0.005**	0.0025	0.54
11	11/7-8/88	22.8	-		
12	12/8-9/88	25.8	0.005**	0.0025	0.54
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ARITHMETIC	MEAN:	26.0			0.37

**The concentration fell below the detection limit. For purposes of calculation, the concentration value was set at one-half the detection limit.

GHR METALS RESULTS

CHROMIUM

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Conc. ppm	Influent Quantity lb/day
1	1/5-6/88	25.7	0.005	0.070	15.00
2	2/2-3/88	32.1	0.005	0.080	21.42
3	3/2/88	30.0	0.005	0.080	20.02
4	4/5-6/88	30.0	0.005	0.100	25.02
5	5/2-3/88	28.6	0.005	0.090	21.47
6	6/1-2/88	24.6	-	0.030	6.15
7	7/5-6/88	18.9	-	0.130	20.49
8	8/2-3/88	27.3	-	0.060	13.66
9	9/7-8/88	20.5		0.140	23.94
10	10/5-6/88	25.8	-	0.060	12.91
11	11/7-8/88	22.8	-	0.100	19.02
12	12/8-9/88	25.8	-	0.080	17.21
ARITHMETIC	MEAN:	26.0			18.03

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GHR METALS RESULTS

COPPER

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.005	0.110	23.58
2	2/2-3/88	32.1	0.005	0.110	29.45
3	3/2/88	30.0	0.005	0.100	25.02
4	4/5-6/88	30.0	0.005	0.060	15.01
5	5/2-3/88	28.6	0.005	0.070	16.70
6	6/1-2/88	24.6	0.005	0.080	16.41
7	7/5-6/88	18.9	-	0.050	7.88
8	8/2-3/88	27.3	-	0.080	18.21
9	9/7-8/88	20.5	-	0.230	39.32
10	10/5-6/88	25.8	-	0.140	30.12
11	11/7-8/88	22.8	-	0.130	24.72
12	12/8-9/88	25.8	-	0.110	23.67
ARITHMETIC	MEAN:	26.0			22.51

ARITHMETIC MEAN:

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GHR METALS RESULTS

CYANIDE

Sample		Det. Influen					
Day		Flow	Limit	Conc.	Quantity		
No.	Date	mgd	ppm	ppm	lb/day		
1	1/5-6/88	25.7	0.005**	0.0025	0.54		
2	2/2-3/88	32.1	0.005**	0.0025	0.67		
3	3/2/88	30.0	0.005**	0.0025	0.63		
4	4/5-6/88	30.0	0.020**	0.0100	2.50		
5	5/2-3/88	28.6	0.020**	0.0100	2.39		
6	6/1-2/88	24.6	0.020**	0.0100	2.05		
7	7/5-6/88	18.9	0.020**	0.0100	1.58		
8	8/2-3/88	27.3	0.025**	0.0125	2.85		
9	9/7-8/88	20.5	0.025**	0.0125	2.14		
10	10/5-6/88	25.8	0.020**	0.0100	2.15		
11	11/7-8/88	22.8	0.020**	0.0100	1.90		
12	12/8-9/88	25.8	0.020**	0.0100	2.15		
ARITHMETIC	MEAN:	26.0			1.79		

GHR METALS RESULTS

LEAD

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.005	0.0025	0.54
2	2/2-3/88	32.1	0.005	0.0450	12.05
3	3/2/88	30.0	0.005	0.0150	3.75
4	4/5-6/88	30.0	0.005	0.0120	3.00
5	5/2-3/88	28.6	0.005	0.0060	1.43
6	6/1-2/88	24.6	-	0.0190	3.90
7	7/5-6/88	18.9	-	0.0250	3.94
8	8/2-3/88	27.3	-	0.0180	4.10
9	9/7-8/88	20.5	, _	0.0140	2.39
10	10/5-6/88	25.8	-	0.0510	10.97
11	11/7-8/88	22.8	-	0.0390	7.42
12	12/8-9/88	25.8	-	0.0470	10.11
ARITHMETIC	MEAN:	26.0			5.30

GHR METALS RESULTS

MERCURY

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day_
1	1/5-6/88	25.7	0.001**	0.0005	0.11
2	2/2-3/88	32.1	0.001**	0.0005	0.13
3	3/2/88	30.0	0.001**	0.0005	0.13
4	4/5-6/88	30.0	0.001**	0.0005	0.13
5	5/2-3/88	28.6	0.001**	0.0005	0.12
6	6/1-2/88	24.6	0.001**	0.0005	0.10
7	7/5-6/88	18.9	0.001**	0.0005	0.08
8	8/2-3/88	27.3	0.001**	0.0005	0.11
9	9/7-8/88	20.5	-	-	-
10	10/5-6/88	25.8	0.001**	0.0005	0.11
11	11/7-8/88	22.8	0.001**	0.0005	0.10
12	12/8-9/88	25.8	0.001**	0.0005	0.11
ARTTHMETTC	MEAN:	26.0			0.10
		2010			0.10

GHR METALS RESULTS

NICKEL

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Conc. ppm	Influent Quantity lb/day
1 .	1/5-6/88	25.7	0.005	0.040	8.57
2	2/2-3/88	32.1	0.005	0.120	32.13
3	3/2/88	30.0	0.005	0.100	25.02
4	4/5-6/88	30.0	0.005	0.040	10.01
5	5/2-3/88	28.6	0.005	0.100	23.85
6	6/1-2/88	24.6	<u> </u>	0.220	45.14
7	7/5-6/88	18.9	-	0.060	9.46
8	8/2-3/88	27.3	-	0.050	11.38
9	9/7-8/88	20.9	-	0.130	22.66
10	10/5-6/88	25.8	-	0.180	38.73
11	11/7-8/88	22.8	-	0.110	20.92
12	12/8-9/88	25.8	-	0.060	12.91
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ARITHMETIC	MEAN:	26.0			21.73

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GHR METALS RESULTS

SELENIUM

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/8-6/88	25.7	0.100**	0.050	10.72
2	2/2-3/88	32.1	0.100**	0.050	13.39
3	3/2/88	30.0	0.100**	0.050	12.51
4	4/5-6/88	30.0	0.002**	0.001	0.25
5	5/2-3/88	28.6	0.002**	0.001	0.24
6	6/1-2/88	24.6	0.002**	0.001	0.21
7	7/5-6/88	18.9	-	0.015	2.36
8	8/2-3/88	27.3	0.010**	0.005	1.14
9	9/7-8/88	20.5	0.010**	0.005	0.85
10	10/5-6/88	25.8	0.010**	0.005	1.08
11	11/7-8/88	22.8	0.010**	0.005	0.95
12	12/8-9/88	25.8	0.010**	0.005	1.08
ARITHMETIC	MEAN:	26.0	,		3.73
ARITHMETIC	MEAN:	26.0			3.73

GHR METALS RESULTS

SILVER

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.005	0.0110	2.36
2	2/2-3/88	32.1	0.005	0.0090	2.41
3	3/2/88	30.0	0.005**	0.0025	0.63
4	4/5-6/88	30.0	0.005**	0.0025	0.63
5	5/2-3/88	28.6	0.005**	0.0025	0.60
6	6/1-2/88	24.6	-	0.0070	1.44
7	7/5-6/88	18.9	-	0.0050	0.79
8	8/2-3/88	27.3	-	0.0060	1.37
9	9/7-8/88	20.5	_	0.0070	1.20
10	10/5-6/88	25.8	-	0.0130	2.80
11	11/7-8/88	22.8		0.0070	1.33
12	12/8-9/88	25.8	-	0.0090	1.94
ARITHMETIC	MEAN:	26.0			1.46

GHR METALS RESULTS

THALLIUM

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.010**	0.005	1.07
2	2/2-3/88	32.1	0.010**	0.005	1.34
3	3/2/88	30.0	0.010**	0.005	1.25
4	4/5-6/88	30.0	0.010**	0.005	1.25
5	5/2-3/88	28.6	0.010**	0.005	1.19
6	6/1-2/88	24.6	0.010**	0.005	1.03
7	7/5-6/88	18.9	0.010**	0.005	0.79
8	8/2-3/88	27.3	0.010**	0.005	1.14
9	9/7-8/88	20.5	0.010**	0.005	0.85
10	10/5-6/88	25.8	0.010**	0.005	1.08
11	11/7-8/88	22.8	0.010**	0.005	0.95
12	12/8-9/88	25.8	0.010**	0.005	1.08
ARITHMETIC	MEAN:	26.0			1.08

**For purposes of calculation, the concentration value was set at one-half the detection limit. This constituent was not detected in the influent, but it was detected in the primary sludge samples.

GHR METALS RESULTS

ZINC

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.001	0.160	34.29
2	2/2-3/88	32.1	0.001	0.220	58.90
3	3/2/88	30.0	0.001	0.610	152.62
4	4/5-6/88	30.0	0.001	0.100	25.02
5	5/2-3/88	28.6	0.001	0.100	23.85
6	6/1-2/88	24.6	-	0.110	22.57
7	7/5-6/88	18.9	_	0.180	28.37
8	8/2-3/88	27.3	-	0.330	75.14
9	9/7-8/88	20.5	-	0.240	41.03
10	10/5-6/88	25.8	-	0.320	68.86
11	11/7-8/88	22.8	-	0.230	43.73
12	12/8-9/88	25.8	-	0.290	62.40
ARITHMET	IC MEAN:	26.0			53.07

CDM REVISED METALS RESULTS

ANTIMONY

Sample		·	Det.	<i>a</i>	Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	_ppm_	
1	26-May-87	20.2	0.010**	0.005	0.84
2	27-May-87	23.2	0.010**	0.005	0.97
3	28-May-87	23.6	0.010**	0.005	0.98
4	12-Jun-87	25.8	0.010**	0.005	1.08
5	31-May-87	19.3	0.010**	0.005	0.80
6	01-Jun-87	27.0	0.010**	0.005	1.13
8	03-Jun-87	20.5	0.010**	0.005	0.85
9	04-Jun-87	19.9	0.010**	0.005	0.83
10	07-Jun-87	21.1	0.010**	0.005	0.88
11	08-Jun-87	38.4	0.010**	0.005	1.60
12	09-Jun-87	29.2	0.010**	0.005	1.22
13	10-Jun-87	24.8	0.010**	0.005	1.03
14	11-Jun-87	23.1	0.010**	0.005	0.96
15	14-Jun-87	21.1	0.010**	0.005	0.88
16	15-Jun-87	21.9	0.010**	0.005	0.91
17	16-Jun-87	22.4	0.010**	0.005	0.93
18	17-Jun-87	20.6	0.010**	0.005	0.86
19	18-Jun-87	20.5	0.010**	0.005	0.85
20	19-Jun-87	23.2	0.010**	0.005	0.97
29	06-Jul-87	19.8	0.010**	0.005	0.83
30	17-Jul-87	18.9	0.010**	0.005	0.79
31	08-Jul-87	19.3	0.010**	0.005	0.80
32	09-Jul-87	19.8	0.010**	0.005	0.83
34	14-Jul-87	21.0	0.010**	0.005	0.88
35	15-Jul-87	19.5	0.010**	0.005	0.81
36	25-Jul-87	19.6	0.010**	0.005	0.82
37	16-Jul-87	19.7	0.010**	0.005	0.82
	C MEAN.	22 S			0.93
WUTTUNDIT.		22.5			0.,0

CDM REVISED METALS RESULTS

BERYLLIUM

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	_ppm_	<u>lb/day</u>
1	06 Mars 07	20.2	0.020++	0.010	1 68
1	20-May-07	20.2	0.020**	0.010	1 93
2	27-May-87	23.2	0.020**	0.010	1.95
3	28-May-87	23.0	0.020**	0.010	2 15
4	12-Jun-87	25.8	0.020**	0.010	1 61
5	31-May-87	19.3	0.020**	0.010	2.01
6	01-Jun-87	27.0	0.020**	0.010	2.2
8	03–Jun–87	20.5	0.020**	0.010	1./1
9	04–Jun–87	19.9	0.020**	0.010	1.00
10	07–Jun–87	21.1	0.020**	0.010	1./6
11	08–Jun–87	38.4	0.020**	0.010	3.20
12	09–Jun–87	29.2	0.020**	0.010	2.44
13	10-Jun-87	24.8	0.020**	0.010	2.07
14	11-Jun-87	23.1	0.020**	0.010	1.93
15	14-Jun-87	21.1	0.020**	0.010	1.76
16	15-Jun-87	21.9	0.020**	0.010	1.83
17	16-Jun-87	22.4	0.020**	0.010	1.87
18	17–Jun–87	20.6	0.020**	0.010	1.72
19	18-Jun-87	20.5	0.020**	0.010	1.71
20	19-Jun-87	23.2	0.020**	0.010	1.93
29	06-Jul-87	19.8	0.020**	0.010	1.65
30	17-Jul-87	18.9	0.020**	0.010	1.58
31	08-Jul-87	19.3	0.020**	0.010	1.61
32	09-Jul-87	19.8	0.020**	0.010	1.65
34	14-Jul-87	21.0	0.020**	0.010	1.75
35	15-Jul-87	19.5	0.020**	0.010	1.63
36	25-Jul-87	19.6	0.020**	0.010	1.63
37	16-Jul-87	19.7	0.020**	0.010	1.64

ARITHMETIC MEAN:

22.3

1.86

**For purposes of calculation, the concentration value set at one-half the detection limit. This constituent was not detected in the influent, but it was detected in the primary sludge samples.

CDM REVISED METALS RESULTS

CADMIUM

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ррт	lb/day
1	26-May-87	20.2	0.005**	0.0025	0.42
2	27-May-87	23.2	0.005**	0.0025	0.48
3	28-May-87	23.6	0.005**	0.0025	0.49
4	12-Jun-87	25.8	0.005**	0.0025	0.54
5	31-May-87	19.3	0.005**	0.0025	0.40
6	01-Jun-87	27.0	0.005**	0.0025	0.56
8	03-Jun-87	20.5	0.005**	0.0025	0.43
9	04-Jun-87	19.9	0.005**	0.0025	0.41
10	07-Jun-87	21.1	0.005**	0.0025	0.44
11	08-Jun-87	38.4	0.005**	0.0025	0.80
12	09-Jun-87	29.2	0.005**	0.0025	0.61
13	10-Jun-87	24.8	0.005**	0.0025	0.52
14	11-Jun-87	23.1	0.005**	0.0025	0.48
15	14-Jun-87	21.1	0.005**	0.0025	0.44
16	15-Jun-87	21.9	0.005**	0.0025	0.46
17	16-Jun-87	22.4	0.005**	0.0025	0.47
18	17-Jun-87	20.6	0.005**	0.0025	0.43
19	18-Jun-87	20.5	0.005**	0.0025	0.43
20	19-Jun-87	23.2	0.005**	0.0025	0.48
29	06-Jul-87	19.8	0.005**	0.0025	0.41
30	17-Jul-87	18.9	0.005**	0.0025	0.39
31	08-Jul-87	19.3	0.005**	0.0025	0.40
32	09-Jul-87	19.8	0.005**	0.0025	0.41
34	14-Jul-87	21.0	0.005**	0.0025	0.44
35	15-Jul-87	19.5	0.005**	0.0025	0.41
36	25-Jul-87	19.6	0.005**	0.0025	0.41
37	16-Jul-87	19.7	0.005**	0.0025	0.41

ARITHMETIC MEAN:

22.3

0.47

CDM REVISED METALS RESULTS

MOLYBDENUM

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd_	ppm	ррт	lb/day
1	26-May-87	20.2	0.050**	0.025	4.21
2	27-May-87	23.2	0.050**	0.025	4.84
3	28-May-87	23.6	0.050**	0.025	4.92
4	12-Jun-87	25.8	0.050**	0.025	5.38
5	31-May-87	19.3	0.050**	0.025	4.02
6	01-Jun-87	27.0	0.050**	0.025	5.63
8	03-Jun-87	20.5	0.050**	0.025	4.27
9	04-Jun-87	19.9	0.050**	0.025	4.15
10	07-Jun-87	21.1	0.050**	0.025	4.40
11	08-Jun-87	38.4	0.050**	0.025	8.01
12	09-Jun-87	29.2	0.050**	0.025	6.09
13	10-Jun-87	24.8	0.050**	0.025	5.17
14	11-Jun-87	23.1	0.050**	0.025	4.82
15	14-Jun-87	21.1	0.050**	0.025	4.40
16	15-Jun-87	21.9	0.050**	0.025	4.57
17	16-Jun-87	22.4	0.050**	0.025	4.67
18	17-Jun-87	20.6	0.050**	0.025	4.30
19	18-Jun-87	20.5	0.050**	0.025	4.27
20	19-Jun-87	23.2	0.050**	0.025	4.84
29	06-Jul-87	19.8	0.050**	0.025	4.13
30	17-Jul-87	18.9	0.050**	0.025	3.94
31	08-Jul-87	19.3	0.050**	0.025	4.02
32	09-Jul-87	19.8	0.050**	0.025	4.13
34	14-Jul-87	21.0	0.050**	0.025	4.38
35	15-Jul-87	19.5	0.050**	0.025	4.07
36	25-Jul-87	19.6	0.050**	0.025	4.09
37	16-Jul-87	19.7	0.050**	0.025	4.11

ARITHMETIC MEAN:

22.3

4.66

**For purposes of calculation, the concentration value set at one-half the detection limit. This constituent was not detected in the influent, but it was detected in the sludge samples.

CDM REVISED METALS RESULTS

SELENIUM

Sample			Det.	Cons	Influent
Day	- .	FLOW	Limit	conc.	Quantity
No.	Date	mgd	ppm	ppm	
1	26-May-87	20.2	0.010**	0.005	0.84
2	27-May-87	23.2	0.010**	0.005	0.97
3	28-May-87	23.6	0.010**	0.005	0.98
4	12-Jun-87	25.8	0.010**	0.005	1.08
5	31-May-87	19.3	0.010**	0.005	0.80
6	01-Jun-87	27.0	0.010**	0.005	1.13
8	03-Jun-87	20.5	0.010**	0.005	0.85
9	04-Jun-87	19.9	0.010**	0.005	0.83
10	07-Jun-87	21.1	0.010**	0.005	0.88
11	08-Jun-87	38.4	0.010**	0.005	1.60
12	09-Jun-87	29.2	0.010**	0.005	1.22
13	10-Jun-87	24.8	0.010**	0.005	1.03
14	11-Jun-87	23.1	0.010**	0.005	0.96
15	14-Jun-87	21.1	0.010**	0.005	0.88
16	15-Jun-87	21.9	0.010**	0.005	0.91
17	16-Jun-87	22.4	0.010**	0.005	0.93
18	17-Jun-87	20.6	0.010**	0.005	0.86
19	18-Jun-87	20.5	0.010**	0.005	0.85
20	19-Jun-87	23.2	0.010**	0.005	0.97
29	06-Jul-87	19.8	0.010**	0.005	0.83
30	17-Jul-87	18.9	0.010**	0.005	0.79
31	08-Jul-87	19.3	0.010**	0.005	0.80
32	09-Jul-87	19.8	0.010**	0.005	0.83
34	14-Jul-87	21.0	0.010**	0.005	0.88
35	15-Jul-87	19.5	0.010**	0.005	0.81
36	25-Jul-87	19.6	0.010**	0.005	0.82
37	16-Jul-87	19.7	0.010**	0.005	0.82

ARITHMETIC MEAN:

22.3

0.93

CDM REVISED METALS RESULTS

THALLIUM

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day_
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1	26-May-87	20.2	0.010**	0.005	0.84
2	27-May-87	23.2	0.010**	0.005	0.97
3	28-May-87	23.6	0.010**	0.005	0.98
4	12-Jun-87	25.8	0.010**	0.005	1.08
5	31-May-87	19.3	0.010**	0.005	0.80
6	01-Jun-87	27.0	0.010**	0.005	1.13
8	03-Jun-87	20.5	0.010**	0.005	0.85
9	04-Jun-87	19.9	0.010**	0.005	0.83
10	07-Jun-87	21.1	0.010**	0.005	0.88
11	08–Jun–87	38.4	0.010**	0.005	1.60
12	09-Jun-87	29.2	0.010**	0.005	1.22
13	10-Jun-87	24.8	0.010**	0.005	1.03
14	11-Jun-87	23.1	0.010**	0.005	0.96
15	14–Jun–87	21.1	0.010**	0.005	0.88
16	15-Jun-87	21.9	0.010**	0.005	0.91
17	16-Jun-87	22.4	0.010**	0.005	0.93
18	17–Jun–87	20.6	0.010**	0.005	0.86
19	18-Jun-87	20.5	0.010**	0.005	0.85
20	19-Jun-87	23.2	0.010**	0.005	0.97
29	06-Jul-87	19.8	0.010**	0.005	0.83
30	17-Jul-87	18.9	0.010**	0.005	0.79
31	08-Jul-87	19.3	0.010**	0.005	0.80
32	09-Jul-87	19.8	0.010**	0.005	0.83
34	14-Jul-87	21.0	0.010**	0.005	0.88
35	15-Jul-87	19.5	0.010**	0.005	0.81
36	25-Jul-87	19.6	0.010**	0.005	0.82
37	16-Jul-87	19.7	0.010**	0.005	0.82

ARITHMETIC MEAN:

22.3

0.93

**For purposes of calculation, the concentration value was set at one-half detection limit. This constituent was not detected in the influent, but it was detected in the primary sludge samples.

CDM VOC RESULTS

METHYLENE CHLORIDE

Sample Day	Dete	Flow	Det. Limit	Avg. Conc.	Influent Quantity
NO.	Date	mga	ppm	ppm	10/day
1	26-May-87	20.2	0.010*	0.0220	3.71
3	28-May-87	23.6	0.010*	0.0050	0.98
7	02-Jun-87	27.0	0.010*	0.0050	1.13
11	08-Jun-87	38.4	0.010*	0.0223	7.15
13	10-Jun-87	24.8	0.010*	0.0050	1.03
16	15-Jun-87	21.9	0.010*	0.0050	0.91
18	17-Jun-87	20.6	0.010*	0.0050	0.86
29	06-Jul-87	19.8	0.010*	0.0050	0.83
31	08-Jul-87	19.3	0.010*	0.0050	0.80
33	12-Jul-87	17.3	0.010*	0.0050	0.72
ARITHMETI	C MEAN:	23.3			1.81

* At least one of the concentrations used in this average fell below the detection limit. For purposes of calculation, any concentration less than the detection limit was set at one-half the detection limit.

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CDM VOC RESULTS

TRANS-1, 2-DICHLOROETHYLENE

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Avg. Conc. ppm	Influent Quantity lb/day
1	26-May-87	20.2	0.010*	0.005	0.84
3	28-May-87	23.6	0.010*	0.005	0.98
7	02-Jun-87	27.0	0.010*	0.005	1.13
11	08-Jun-87	38.4	0.010*	0.005	8.11
13	10-Jun-87	24.8	0.010*	0.005	1.03
16	15–Jun–87	21.9	0.010*	0.005	0.91
18	17-Jun-87	20.6	0.010*	0.007	1.20
29	06-Jul-87	19.8	0.010*	0.005	0.83
31	08-Jul-87	19.3	0.010*	0.005	0.80
33	12-Jul-87	17.3	0.010*	0.005	0.72
ARITHMETI	C MEAN:	23.3			1.65

CDM VOC RESULTS

CHLOROFORM

Sample Day		Flow	Det. Limit	Avg. Conc.	Influent Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.010	0.013	2.19
3	28-May-87	23.6	0.010	0.014	2.69
7	02-Jun-87	27.0	0.010	0.012	2.78
11	08-Jun-87	38.4	0.010*	0.005	1.60
13	10-Jun-87	24.8	0.010*	0.012	2.41
16	15-Jun-87	21.9	0.010*	0.008	1.40
18	17-Jun-87	20.6	0.010*	0.010	1.72
29	06-Jul-87	19.8	0.010	0.014	2.31
31	08-Jul-87	19.3	0.010*	0.012	1.89
33	12-Jul-87	17.3	0.010*	0.007	1.06
ARITHMETI	C MEAN:	23.3			2.01

CDM VOC RESULTS

1,2-DICHLOROETHANE

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Avg. Conc. ppm	Influent Quantity lb/day
1	26-May-87	20.2	0.010*	0.005	0.84
3	28-May-87	23.6	0.010*	0.005	0.98
7	02-Jun-87	27.0	0.010*	0.005	1.13
11	08-Jun-87	38.4	0.010*	0.005	1.60
13	10-Jun-87	24.8	0.010*	0.005	1.03
16	15-Jun-87	21.9	0.010*	0.005	0.91
18	17-Jun-87	20.6	0.010*	0.009	1.49
29	06-Jul-87	19.8	0.010*	0.005	0.83
31	08-Jul-87	19.3	0.010*	0.005	0.80
33	12-Jul-87	17.3	0.010*	0.005	0.72
ARITHMETI	C MEAN:	23.3			1.03

CDM VOC RESULTS

1,1,1-TRICHLOROETHANE

Sample Day		Flow	Det. Limit	Avg. Conc.	Influent Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.010*	0.005	0.84
3	28-May-87	23.6	0.010	0.037	7.35
7	02-Jun-87	27.0	0.010*	0.015	3.45
11	08-Jun-87	38.4	0.010*	0.005	1.60
13	10-Jun-87	24.8	0.010	0.051	10.48
16	15-Jun-87	21.9	0.010*	0.009	1.70
18	17-Jun-87	20.6	0.010*	0.007	1.15
29	06-Jul-87	19.8	0.010*	0.007	1.07
31	08-Jul-87	19.3	0.010*	0.005	0.80
33	12-Jul-87	17.3	0.010*	0,005	0.72
ARTTHMETT	C MEAN:	23.3			2,92

CDM VOC RESULTS

TRICHLOROETHYLENE

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Avg. Conc. ppm	Influent Quantity lb/day
1	26-May-87	20.2	0.010	0.016	2.70
3	28-May-87	23.6	0.010	0.017	3.35
7	02-Jun-87	27.0	0.010	0.017	3.75
11	08-Jun-87	38.4	0.010	0.022	6.94
13	10-Jun-87	24.8	0.010	0.018	3.79
16	15–Jun–87	21.9	0.010*	0.018	3.23
18	17-Jun-87	20.6	0.010	0.029	4.93
29	06-Jul-87	19.8	0.010*	0.009	1.49
31	08-Jul-87	19.3	0.010*	0.010	1.65
33	12-Jul-87	17.3	0.010*	0.005	0.72
ARITHMETI	C MEAN:	23.3			3.25

CDM VOC RESULTS

1,1,2,2-TETRACHLOROETHYLENE

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Avg. Conc. _ppm_	Influent Quantity _lb/day_
1	26-May-87	20.2	0.010*	0.005	0.84
3	28-May-87	23.6	0.010*	0.005	0.98
7	02-Jun-87	27.0	0.010*	0.005	1.13
11	08-Jun-87	38.4	0.010*	0.025	8.11
13	10-Jun-87	24.8	0.010*	0.005	1.03
16	15-Jun-87	21.9	0.010*	0.005	0.91
18	17-Jun-87	20.6	0.010*	0.005	0.86
29	06-Jul-87	19.8	0.010*	0.031	5.08
31	08-Jul-87	19.3	0.010	0.017	2.66
33	12-Jul-87	17.3	0.010*	0.005	0.72
ARITHMETI	C MEAN:	23.3			2.23

CDM VOC RESULTS

1,1,2,2-TETRACHLOROETHANE

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Avg. Conc. ppm	Influent Quantity lb/day
1	26-May-87	20.2	0.010	0.005	0.84
3	28-May-87	23.6	0.010	0.020	4.00
7	02-Jun-87	27.0	0.010	0.005	1.13
11	08-Jun-87	38.4	0.010*	0.005	1.60
13	10-Jun-87	24.8	0.010*	0.005	1.03
16	15-Jun-87	21.9	0.010*	0.005	0.91
18	17-Jun-87	20.6	0.010*	0.005	0.86
29	06-Jul-87	19.8	0.010	0.012	2.02
31	08-Jul-87	19.3	0.010*	0.005	0.80
33	12-Jul-87	17.3	0.010*	0.005	0.72
ARITHMETI	C MEAN:	23.3			1.39

CDM VOC RESULTS

TOLUENE

Sample Day	_	Flow	Det. Limit	Avg. Conc.	Influent Quantity
<u>No.</u>	Date	mgd	ppm	_ppm_	_lb/day_
1	26-May-87	20.2	0.010	0.035	5.90
3	28-May-87	23.6	0.010*	0.013	2.56
7	02-Jun-87	27.0	0.010	0.089	20.12
11	08-Jun-87	38.4	0.010	0.181	57.86
13	10-Jun-87	24.8	0.010	0.084	17.37
16	15–Jun–87	21.9	0.010	0.026	4.69
18	17-Jun-87	20.6	0.010	0.047	8.13
29	06-Jul-87	19.8	0.010	0.105	17.26
31	08-Jul-87	19.3	0.010	0.050	8.09
33	12-Jul-87	17.3	0.010*	0.005	0.72
ARITHMETI	C MEAN:	23.3			14.27

CDM VOC RESULTS

ETHYLBENZENE

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Avg. Conc. ppm	Influent Quantity lb/day
1	26-May-87	20.2	0.010*	0.005	0.84
3	28-May-87	23.6	0.010*	0.029	5.64
7	02-Jun-87	27.0	0.010*	0.042	9.46
11	08-Jun-87	38.4	0.010*	0.008	2.46
13	10-Jun-87	24.8	0.010*	0.007	1.52
16	15-Jun-87	21.9	0.010*	0.005	0.91
18	17-Jun-87	20.6	0.010*	0.005	0.86
29	06-Jul-87	19.8	0.010*	0.020	3.30
31	08-Jul-87	19.3	0.010*	0.007	1.05
33	12-Jul-87	17.3	0.010*	0.005	0.72
ARITHMETI	C MEAN:	23.3			2.68

CDM VOC RESULTS

TOTAL XYLENES

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Avg. Conc. ppm	Influent Quantity lb/day
1	26-May-87	20.2	0.010	0.0340	5.73
3	28-May-87	23.6	0.010	0.0347	6.82
7	02-Jun-87	27.0	0.010	0.2237	50.37
11	08-Jun-87	38.4	0.010	0.1550	49.64
13	10-Jun-87	24.8	0.010	0.0827	17.10
16	15-Jun-87	21.9	0.010*	0.0183	3.34
18	17–Jun–87	20.6	0.010	0.0207	3.55
29	06-Jul-87	19.8	0.010*	0.1021	16.86
31	08-Jul-87	19.3	0.010	0.0468	7.52
33	12-Jul-87	17.3	0.010*	0,0075	1.08
ARITHMETI	C MEAN:	23.3		x	16.20

CDM VOC RESULTS

2-BUTANONE

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Avg. Conc. ppm	Influent Quantity lb/day
1	26-May-87	20.2	0.010*	0.0075	1.26
3	28-May-87	23.6	0.010*	0.4117	81.03
7	02-Jun-87	27.0	0.010*	0.0075	1.69
11	08-Jun-87	38.4	0.010*	0.0075	2.40
13	10-Jun-87	24.8	0.010*	0.0075	1.55
16	15-Jun-87	21.9	0.010*	0.0075	1.37
18	17-Jun-87	20.6	0.010*	0.0075	1.29
29	06-Jul-87	19.8	0.010*	0.0075	1.24
31	08-Jul-87	19.3	0.010*	0.0075	1.21
33	12-Jul-87	17.3	0.010*	0.0075	1.08
ARITHMETI	C MEAN:	23.3			9.41

CDM VOC RESULTS

ACETONE

Sample Day No.	Date	Flow mgd_	Det. Limit ppm	Avg. Conc. ppm	Influent Quantity lb/day
1	26-May-87	20.2	0.010*	0.0075	1.26
3	28-May-87	23.6	0.010	0.4823	94.93
7	02-Jun-87	27.0	0.010*	0.0075	1.69
11	08-Jun-87	38.4	0.010*	1.2108	387.78
13	10-Jun-87	24.8	0.010*	0.0075	1.55
16	15-Jun-87	21.9	0.010*	0.3062	55.92
18	17-Jun-87	20.6	0.010	0.4200	72.16
29	06-Jul-87	19.8	0.010	0.3925	64.81
31	08-Jul-87	19.3	0.010*	0.2945	47.40
33	12-Jul-87	17.3	0.010*	0.0075	1.08
ARITHMETI	C MEAN:	23.3			72.86

GHR VOC RESULTS

METHYLENE CHLORIDE

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Avg. Conc. ppm	Influent Quantity lb/day
1	1/5-6/88	25.7	0.005	0.012	2.57
2	2/3/88	35.2	0.005	0.008	2.35
3	3/2/88	30.0	0.005	0.024	6.00
4	4/6/88	30.0	0.005	0.003	0.63
5	5/4/88	30.3	0.005	0.003	0.63
6	6/2/88	24.6	0.005	0.003	0.51
7	7/6/88	42.4	-	-	-
8	8/3/88	25.1	0.005	0.003	0.52
9	9/8/88	21.1	0.050	0.025	4.40
10	10/6/88	22.4	-	0.072	13.45
11	11/8/88	21.6	0.005	0.003	0.45
12	12/8/88	25.8	0.005	0.003	0.54
ARITHMETIC	MEAN:	27.9			2.67

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GHR VOC RESULTS

TRANS-1, 2-DICHLOROETHYLENE

Sample Day No.	Date	Flow mgd	Det. Limit _ppm_	Avg. Conc. _ppm_	Influent Quantity lb/day
1	1/5-6/88	25.7	0.005	0.0050	1.07
2	2/3/88	35.2	0.005	0.0100	2.94
3	3/2/88	30.0	0.005	0.0090	2.25
4	4/6/88	30.0	0.005*	0.0025	0.63
5	5/4/88	30.3	0.005*	0.0025	0.63
6	6/2/88	24.6	0.005	0.0040	0.82
7	7/6/88	42.4	-	0.0030	1.06
8	8/3/88	25.1	0.005	0.0070	1.47
9	9/8/99	21.1	0.005*	0.0025	0.44
10	10/6/88	22.4	0.030*	0.0150	2.80
11	11/8/88	21.6	0.005	0.0040	0.72
12	12/8/88	25.8	0.005	0.0030	0.65
ARITHMETIC	MEAN:	27.9			1.29

GHR VOC RESULTS

CHLOROFORM

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Avg. Conc. ppm	Influent Quantity lb/day
1	1/5-6/88	25.7	0.005	0.005	1.07
2	2/3/88	35.2	0.005	0.006	1.76
3	3/2/88	30.0	0.005	0.007	1.75
4	4/6/88	30.0	0.005	0.010	2.50
5	5/4/88	30.3	0.005	0.008	2.02
6	6/2/88	24.6	0.005	0.010	2.05
7	7/6/88	42.4	-	0.010	3.54
8	8/3/88	25.1	0.005	0.009	1.88
9	9/8/88	21.1	0.050*	0.025	4.40
10	10/6/88	22.4	-	0.011	2.05
11	11/8/88	21.6	0.005	0.013	2.34
12	12/8/88	25.8	0.005	0.006	1.29
ARITHMETIC	MEAN:	27.9			2.22

GHR VOC RESULTS

1,2-DICHLOROETHANE

Sample Day		Flow	Det. Limit	Avg. Conc.	Influent Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.005*	0.0025	0.54
2	2/3/88	35.2	0.005*	0.0025	0.73
3	3/2/88	30.0	0.005*	0.0025	0.63
4	4/6/88	30.0	0.005*	0.0025	0.63
5	5/4/88	30.3	0.005*	0.0025	0.63
6	6/2/88	24.6	0.005*	0.0025	0.51
7	7/6/88	42.4	-		-
8	8/3/88	25.1	0.005	0.007	1.47
9	9/8/88	21.1	0.050*	0.025	4.40
10	10/6/88	22.4	0.030*	0.015	2.80
11	11/8/88	21.6	0.005	0.004	0.72
12	12/8/88	25.8	0.005	0.003	0.65
ARITHMETI	C MEAN:	27.9			1.14

GHR VOC RESULTS

1,1,1-TRICHLOROETHANE

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Avg. Conc. ppm	Influent Quantity _lb/day
1	1/5-6/88	25.7	0.005	0.002	0.43
2	2/3/88	35.2	0.005	0.004	1.17
3	3/2/88	30.0	0.005	0.013	3.25
4	4/6/88	30.0	0.005	0.004	1.00
5	5/4/88	30.3	0.005	0.004	1.01
6	6/2/88	24.6	0.005	0.003	0.62
7	7/6/88	42.4		0.003	1.06
8	8/3/88	25.1	0.005	0.003	0.63
9	9/8/88	21.1	0.050*	0.025	4.40
10	10/6/88	22.4	0.030*	0.015	2.80
11	11/8/88	21.6	0.005	0.010	1.80
12	12/8/88	25.8	0.005	0.004	0.86
ARITHMETI	C MEAN:	27.9			1.59

GHR VOC RESULTS

TRICHLOROETHYLENE (trichloroethene)

Sample Day No.	Date	Flow mgd_	Det. Limit _ppm_	Avg. Conc. _ppm_	Influent Quantity lb/day
1	1/5-6/88	25.7	0.005	0.006	1.29
2	2/3/88	35.2	0.005	0.018	5.28
3	3/2/88	30.0	0.005	0.012	3.00
4	4/6/88	30.0	0.005	0.014	3.50
5	5/4/88	30.3	0.005	0.007	1.77
6	6/2/88	24.6	0.005	0.007	1.44
7	7/6/88	42.4	-	0.005	1.77
8	8/3/88	25.1	0.005	0.028	5.86
9	9/8/88	21.1	0.050*	0.025	4.40
10	10/6/88	22.4	0.060*	0.030	5.60
11	11/8/88	21.6	0.005	0.007	1.26
12	12/8/88	25.8	0.005	0.007	1.51
ARITHMETIC	MEAN:	27.9			3.06

GHR VOC RESULTS

1,1,2,2-TETRACHLOROETHANE

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Avg. Conc. ppm	Influent Quantity lb/day
1	1/5-6/88	25.7	0.005	0.003	0.54
2	2/3/88	35.2	0.005	0.003	0.73
3	3/2/88	30.0	0.005	0.003	0.63
4	4/6/88	30.0	0.005	0.003	0.63
5	5/4/88	30.3	0.005	0.003	0.63
6	6/2/88	24.6	0.005	0.003	0.51
7	7/6/88	42.4	-	0.003	0.88
8	8/3/88	25.1	0.005	0.003	0.52
9	9/8/88	21.1	0.050	0.025	4.40
10	10/6/88	22.4	0.030	0.015	2.80
11	11/8/88	21.6	0.005	0.003	0.45
12	12/8/88	25.8	0.005	0.003	0.54
ARITHMETIC	MEAN:	27.9			1.11

GHR VOC RESULTS

1,1,2,2-TETRACHLOROETHYLENE

Sample Day No.	Date	Flow mgd	Det. Limit <u>ppm</u>	Avg. Conc. _ppm	Influent Quantity lb/day
1	1/5-6/88	25.7	0.005	0.001	0.21
2	2/3/88	35.2	0.005	0.003	0.88
3	3/2/88	30.0	0.005	0.003	0.75
4	4/6/88	30.0	0.005	0.037	9.26
5	5/4/88	30.3	0.005	0.002	0.51
6	6/2/88	24.6	0.005	0.002	0.41
7	7/6/88	42.4	0.005	0.001	0.35
8	8/3/88	25.1	0.005	0.002	0.42
9	9/8/88	21.1	0.005*	0.025	4.40
10	10/6/88	22.4	0.030*	0.015	2.80
11	11/8/88	21.6	0.005	0.002	0.36
12	12/8/88	25.8	0.005	0.002	0.43
ARITHMET	IC MEAN:	27.9			1.73

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, any concentration less than the detection limit was set at one-half the detection limit.

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GHR VOC RESULTS

TOLUENE

Sample Day No.	Date	Flow mgd_	Det. Limit _ppm	Avg. Conc. _ppm_	Influent Quantity _lb/day
1	1/5-6/88	25.7	0.005	0.011	2.36
2	2/3/88	35.2	0.005	0.015	4.40
3	3/2/88	30.0	0.005	0.050	12.51
4	4/6/88	30.0	0.005	0.023	5.75
5	5/4/88	30.3	0.005	0.016	4.04
6	6/2/88	24.6	0.005	0.012	2.46
7	7/6/88	42.4	-	0.012	4.24
8	8/3/88	25.1	0.005	0.008	1.67
9	9/8/88	21.1	0.050	0.024	4.22
10	10/6/88	22.4	0.030	0.029	5.42
11	11/8/88	21.6	0.005	0.210	37.83
12	12/8/88	25.8	0.005	0.013	2.80
ARITHMET	IC MEAN:	27.9			7.31

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GHR VOC RESULTS

ETHYLBENZENE

Sample Day No.	Date	Flow mgd	Det. Limit _ppm_	Avg. Conc. ppm	Influent Quantity lb/day
1 2	1/5-6/88 2/3/88	25.7 35.2	0.005	0.001	0.21
3	3/2/88	30.0	0.005	0.004	1.00
4	4/6/88	30.0	0.005	0.003	0.75
5	5/4/88	30.3	0.005	0.003	0.76
6	6/2/88	24.6	0.005	0.002	0.41
7	7/6/88	42.4	-	0.001	0.35
8	8/3/88	25.1	0.005	0.003	0.63
9	9/8/88	21.1	0.050*	0.025	4.40
10	10/6/88	22.4	0.030*	0.015	2.80
11	11/8/88	21.6	0.005	0.010	1.80
12	12/8/88	25.8	0.005	0.002	0.43
ARITHMETIC	: MEAN:	27.9			1.20

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, any concentration less than the detection limit was set at one-half the detection limit.

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GHR VOC RESULTS

TOTAL XYLENES

Sample Dav		Flow	Det. Limit	Avg. Conc.	Influent Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.005	0.010	2.14
2	2/3/88	35.2	0.005	0.030	8.81
3	3/2/88	30.0	0.005	0.024	6.00
4	4/6/88	30.0	0.005	0.013	3.25
5	5/4/88	30.3	0.005	0.021	5.31
6	6/2/88	24.6	0.005	0.011	2.26
7	7/6/88	42.4	-	0.010	3.54
8	8/3/88	25.1	0.005	0.021	4.40
9	9/8/88	21.1	0.050*	0.025	4.40
10	10/6/88	22.4	0.030*	0.015	2.80
11	11/8/88	21.6	0.005	0.150	27.02
12	12/8/88	25.8	0.005	0.013	2.80
ARITHMETIC	C MEAN:	27.85			6.06

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, any concentration less than the detection limit was set at one-half the detection limit.

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GHR VOC RESULTS

2-BUTANONE

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Avg. Conc. ppm	Influent Quantity lb/day
1	1/5-6/88	25.7	0.010	0.005	1.07
2	2/3/88	35.2	0.010	0.003	0.88
3	3/2/88	30.0	0.010	0.090	22.52
4	4/6/88	30.0	0.010	0.005	1.25
5	5/4/88	30.3	0.010	0.005	1.26
6	6/2/88	24.6	0.010	0.005	1.03
7	7/6/88	42.4	-	_	_
8	8/3/88	25.1	0.010	0.005	1.05
9	9/8/88	21.1	0.100	0.050	8.80
10	10/6/88	22.4	-	-	-
11	11/8/88	21.6	0.010	0.005	0.90
12	12/8/88	25.8	0.010	0.005	1.08
ARITHMETIC	C MEAN:	27.9			3.98

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GHR VOC RESULTS

ACETONE

Sample Day	Data	Flow	Det. Limit	Avg. Conc.	Influent Quantity
NO.	Date	inga	_ppm_	_ppm	U/uay
1	1/5-6/88	25.7	0.010	0.130	27.86
2	2/3/88	35.2	0.010	0.160	46.97
3	3/2/88	30.0	0.010	0.290	72.56
4	4/6/88	30.0	0.010	0.140	35.03
5	5/4/88	30.3	0.010	0.130	32.85
6	6/2/88	24.6	0.010	0.091	18.67
7	7/6/88	42.4		0.025	8.84
8	8/3/88	25.1	0.010	0.100	20.93
9	9/8/88	21.1	0.100	0.130	22.88
10	10/6/88	22.4	-	0.670	125.17
11	11/8/88	21.6	0.010	0.089	16.03
12	12/8/88	25.8	0.010	0.170	36.58
ARITHMET	IC MEAN:	27.9			38.70

GHR VOC RESULTS

BENZENE

Sample			Det.	Avg.	Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.005*	0.0025	0.54
2	2/3/88	35.2	0.005*	0.0025	0.73
3	3/2/88	30.0	0.005*	0.0025	0.63
4	4/6/88	30.0	0.005	0.0020	0.50
5	5/4/88	30.3	0.005*	0.0025	0.63
6	6/2/88	24.6	0.005	0.0010	0.21
7	7/6/88	42.4	-	0.0010	0.35
8	8/3/88	25.1	0.005	0.0025	0.52
9	9/8/88	21.1	0.050*	0.0250	4.40
10	10/6/88	22.4	0.030*	0.0150	2.80
11	11/8/88	21.6	0.005	0.0020	0.36
12	12/8/88	25.8	0.005	0.0030	0.65
ARITHMETI	C MEAN:	27.9			1.03

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, any concentration less than the detection limit was set at one-half the detection limit.

GHR VOC RESULTS

4-METHYL 2-PENTANONE

Sample			Det.	Avg.	Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5 6/00	25 7	0.010	0.003	0.64
1	1/2-0/00	20.7	0.010	0.005	1 17
2	2/3/88	32.2	0.010*	0.005	1.4/
3	3/2/88	30.0	0.010	0.125	31.28
4	4/6/88	30.0	0.010*	0.005	1.25
5	5/4/88	30.3	0.010	0.009	2.27
6	6/2/88	24.6	0.010*	0.005	1.03
7	7/6/88	42.4	0.010*	0.005	1.77
8	8/3/88	25.1	0.010*	0.005	1.05
9	9/8/88	21.1	0.100*	0.050	8.80
10	10/6/88	22.4	0.060*	0.030	5.60
11	11/8/88	21.6	0.010*	0.005	0.90
12	12/8/88	25.8	0.010*	0.005	1.08
ARITHMETI	C MEAN:	27.9			4.76

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, any concentration less than the detection limit was set at one-half the detection limit.

CDM REVISED VOC RESULTS

BENZENE

Sample Day No.	Date	Flow mgd	Det. Limit _ppm	Avg. Conc. ppm	Influent Quantity lb/day
1	26-May-87	20.1	0.010*	0.005	0.84
3	28-May-87	23.6	0.010*	0.005	0.98
7	02–Jun–87	27.0	0.010*	0.005	1.13
11	08-Jun-87	38.4	0.010*	0.005	1.60
13	10-Jun-87	24.8	0.010*	0.005	1.03
16	15-Jun-87	21.9	0.010*	0.005	0.91
18	17-Jun-87	20.6	0.010*	0.005	0.86
29	06-Jul-87	19.8	0.010*	0.005	0.83
31	08-Jul-87	19.3	0.010*	0.005	0.80
33	12-Jul-87	17.3	0.010*	0.005	0.72
ARITHMET	IC MEAN:	23.3			0.97

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration value was set at one-half the detection limit.

CDM REVISED VOC RESULTS

4-METHYL 2-PENTANONE

Sample Day No.	Date	Flow mgd	Det. Limit _ppm_	Avg. Conc. _ppm	Influent Quantity lb/day
1	26-May-87	20.1	0.010*	0.005	0.84
3	28-May-87	23.6	0.010*	0.005	0.98
7	02-Jun-87	27.0	0.010*	0.005	1.13
11	08-Jun-87	38.4	0.010*	0.005	1.60
13	10-Jun-87	24.8	0.010*	0.005	1.03
16	15-Jun-87	21.9	0.010*	0.005	0.91
18	17–Jun–87	20.6	0.010*	0.005	0.86
29	06-Jul-87	19.8	0.010*	0.005	0.83
31	08-Jul-87	19.3	0.010*	0.005	0.80
33	12-Jul-87	17.3	0.010*	0.005	0.72
ARITHMETI	C MEAN:	23.3			0.97

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration value was set at one-half the detection limit.

CDM AB/N RESULTS

PHENOL

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.040	0.086	14.49
5	31-May-87	19.3	0.020 (1)	0.010	1.61
9	04-Jun-87	19 .9	0.020 (1)	0.010	1.66
11	08-Jun-87	38.4	0.020 (1)	0.010	3.20
13	10-Jun-87	24.8	0.020 (2)	0.010	2.07
15	14-Jun-87	21.1	0.010 (2)	0.005	0.88
16	15-Jun-87	21.9	0.020 (2)	0.010	1.83
18	17–Jun–87	20.6	0.020(2)	0.010	1.72
29	06-Jul-87	19.8	0.010	0.033	5.45
31	08-Jul-87	19.3	0.020 (2)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64

(1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

3.29

22.3

ARITHMETIC MEAN:

(2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM AB/N RESULTS

BENZYL ALCOHOL

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.040 (1)	0.020	3.37
5	31-May-87	19.3	0.020 (1)	0.010	1.61
9	04-Jun-87	19.9	0.020 (1)	0.010	1.66
11	08-Jun-87	38.4	0.020 (1)	0.010	3.20
13	10-Jun-87	24.8	0.020 (1)	0.010	2.07
15	14-Jun-87	21.1	0.010 (1)	0.005	0.88
16	15-Jun-87	21.9	0.020 (2)	0.010	1.83
18	17-Jun-87	20.6	0.020 (1)	0.010	1.72
29	06-Jul-87	19.8	0.010 (2)	0.005	0.83
31	08-Jul-87	19.3	0.020(1)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64
ARITHMETI	C MEAN:	22.3			1.86

(1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was sset at one-half the detection limit.

1.86

ARITHMETIC MEAN:

(2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM AB/N RESULTS

2-METHYLPHENOL

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.040 (1)	0.020	3.37
5	31-May-87	19.3	0.020 (1)	0.010	1.61
9	04-Jun-87	19.9	0.020 (1)	0.010	1.66
11	08-Jun-87	38.4	0.020 (1)	0.010	3.20
13	10-Jun-87	24.8	0.020 (1)	0.010	2.07
15	14-Jun-87	21.1	0.010 (1)	0.005	0.88
16	15–Jun–87	21.9	0.020 (1)	0.010	1.83
18	17-Jun-87	20.6	0.020 (1)	0.010	1.72
29	06-Jul-87	19.8	0.010 (1)	0.005	0.83
31	08-Jul-87	19.3	0.020 (2)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64

ARITHMETIC MEAN: 22.3

- (1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.
- (2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM AB/N RESULTS

4-METHYLPHENOL

Sample		Flow	Det. Limit	Conc	Influent Ouantity
No.	Date	mgd	ppm	ppm_	lb/day
1	26-May-87	20.2	0.040 (2)	0.020	3.37
5	31-May-87	19.3	0.020 (2)	0.010	1.61
9	04-Jun-87	19.9	0.020 (2)	0.010	1.66
11	08-Jun-87	38.4	0.020 (2)	0.010	3.20
13	10-Jun-87	24.8	0.020 (1)	0.010	2.07
15	14-Jun-87	21.1	0.010 (2)	0.005	0.88
16	15-Jun-87	21.9	0.020	0.022	4.02
18	17-Jun-87	20.6	0.020 (2)	0.010	1.72
29	06-Jul-87	19.8	0.010	0.039	6.44
31	08-Jul-87	19.3	0.020 (2)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64

ARITHMETIC MEAN: 22.3

- (1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.
- (2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM AB/N RESULTS

BENZOIC ACID

Sample	,		Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	_ppm_	ppm	lb/day
1	26-May-87	20.2	0.200 (2)	0.100	16.85
5	31-May-87	19.3	0.100 (1)	0.050	8.05
9	04-Jun-87	19.9	0.100 (1)	0.050	8.30
11	08-Jun-87	38.4	0.100 (1)	0.050	16.01
13	10-Jun-87	24.8	0.100 (1)	0.050	10.34
15	14-Jun-87	21.1	0.050 (1)	0.025	4.40
16	15–Jun–87	21.9	0.100(2)	0.050	9.13
18	17-Jun-87	20.6	0.100(2)	0.050	8.59
29	06-Jul-87	19.8	0.050 (1)	0.025	4.13
31	08-Jul-87	19.3	0.100(1)	0.050	8.05
37	18-Jul-87	19.7	0.100 (1)	0.050	8.21

ARITHMETIC MEAN: 22.3

- (1) The concentration fell below the detection limit. (Not detected) For purposes of calculation, the concentration was set at one-half the detection limit.
- (2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM AB/N RESULTS

4-CHLORO-3-METHYLPHENOL

Sample Day		Flow	Det. Limit	Conc.	Influent Ouantity
No.	Date	mgd	ppm	ррт	lb/day
1	26-May-87	20.2	0.040 (1)	0.020	3.37
5	31-May-87	19.3	0.020 (1)	0.010	1.61
9	04-Jun-87	19.9	0.020 (1)	0.010	1.66
11	08-Jun-87	38.4	0.020 (1)	0.010	3.20
13	10-Jun-87	24.8	0.020 (1)	0.010	2.07
15	14-Jun-87	21.1	0.010 (1)	0.005	0.88
16	15–Jun–87	21.9	0.020 (1)	0.010	1.83
18	17-Jun-87	20.6	0.020 (2)	0.010	1.72
29	06-Jul-87	19.8	0.010 (1)	0.050	8.26
31	08-Jul-87	19.3	0.020(1)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64

ARITHMETIC MEAN: 22.3

- The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.
- (2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM AB/N RESULTS

ISOPHORONE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.040 (2)	0.020	3.37
5	31-May-87	19.3	0.020 (1)	0.010	1.61
9	04-Jun-87	19.9	0.020 (1)	0.010	1.66
11	08-Jun-87	38.4	0.020 (1)	0.010	3.20
13	10-Jun-87	24.8	0.020 (1)	0.010	2.07
15	14-Jun-87	21.1	0.020 (1)	0.010	1.76
16	15–Jun–87	21.9	0.020 (1)	0.010	1.83
18	17-Jun-87	20.6	0.020 (1)	0.010	1.72
29	06-Jul-87	19.8	0.010 (1)	0.005	0.83
31	08-Jul-87	19.3	0.020(1)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64

ARITHMETIC MEAN: 22.3

(1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

1.94

(2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM AB/N RESULTS

1,2,4-TRICHLOROBENZENE

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Conc. ppm	Influent Quantity lb/day
1	26-May-87	20.2	0.040 (1)	0.020	3.37
5	31-May-87	19.3	0.020(1)	0.010	1.61
9	04-Jun-87	19.9	0.020(1)	0.010	1.66
11	08-Jun-87	38.4	0.020(1)	0.010	3.20
13	10-Jun-87	24.8	0.020(1)	0.010	2.07
15	14-Jun-87	21.1	0.020(1)	0.010	1.76
16	15–Jun–87	21.9	0.020(1)	0.010	1.83
18	17–Jun–87	20.6	0.020(1)	0.010	1.72
29	06-Jul-87	19.8	0.010 (2)	0.005	0.83
31	08-Jul-87	19.3	0.020(1)	0.010	1.61
37	18-Jul-87.	19.7	0.020 (1)	0.010	1.64
ARITHMETIC	MEAN:	22.3			1.94

- (1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.
- (2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM AB/N RESULTS

2-METHYLNAPHTHALENE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.040 (1)	0.020	3.37
5	31-May-87	19.3	0.020 (1)	0.010	1.61
9	04-Jun-87	19.9	0.020 (1)	0.010	1.66
11	08-Jun-87	38.4	0.020 (1)	0.010	3.20
13	10-Jun-87	24.8	0.020 (2)	0.010	2.07
15	14-Jun-87	21.1	0.020 (1)	0.010	1.76
16	15–Jun–87	21.9	0.020(1)	0.010	1.83
18	17-Jun-87	20.6	0.020 (2)	0.010	1.72
29	06-Jul-87	19.8	0.010(1)	0.005	0.83
31	08-Jul-87	19.3	0.020 (1)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64
ARITHMETI	C MEAN:	22.3			1.94

- (1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.
- (2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM AB/N RESULTS

DIMETHYL PHTHALATE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.040 (1)	0.020	3.37
5	31-May-87	19.3	0.020 (2)	0.010	1.61
9	04-Jun-87	19.9	0.020 (2)	0.010	1.66
11	08-Jun-87	38.4	0.020 (2)	0.010	3.20
13	10-Jun-87	24.8	0.020 (2)	0.010	2.07
15	14-Jun-87	21.1	0.020 (1)	0.010	1.76
16	15–Jun–87	21.9	0.020 (2)	0.010	1.83
18	17-Jun-87	20.6	0.020 (2)	0.010	1.72
29	06-Jul-87	19.8	0.010 (2)	0.005	0.83
31	08-Jul-87	19.3	0.020 (2)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64
ARITHMETI	C MEAN:	22.3			1.94

(1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

(2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM AB/N RESULTS

N-NITROSODIPHENYLAMINE

Sample		Flow	Det. Limit	Conc	Influent Ouentity
No.	Date	mgd	ppm	ppm_	lb/day_
1	26-May-87	20.2	0.040 (1)	0.020	3.37
5	31-May-87	19.3	0.020 (1)	0.010	1.61
9	04-Jun-87	19.9	0.020(2)	0.010	1.66
11	08-Jun-87	38.4	0.020 (1)	0.010	3.20
13	10-Jun-87	24.8	0.020 (1)	0.010	2.07
15	14–Jun–87	21.1	0.020 (1)	0.010	1.76
16	15–Jun–87	21.9	0.020 (1)	0.010	1.83
18	17–Jun–87	20.6	0.020 (2)	0.010	1.72
29	06-Jul-87	19.8	0.010(1)	0.005	0.83
31	08-Jul-87	19.3	0.020(2)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64

ARITHMETIC MEAN: 22.3

- (1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.
- (2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM AB/N RESULTS

DI-N-BUTYL-PHTHALATE

Sample Day		Flow	Det. Limit	Conc.	Influent Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.040 (1)	0.020	3.37
5	31-May-87	19.3	0.020 (1)	0.010	1.61
9	04-Jun-87	19.9	0.020 (2)	0.010	1.66
11	08-Jun-87	38.4	0.020 (1)	0.010	3.20
13	10-Jun-87	24.8	0.020 (1)	0.010	2.07
15	14-Jun-87	21.1	0.020 (1)	0.010	1.76
16	15-Jun-87	21.9	0.020 (1)	0.010	1.83
18	17–Jun–87	20.6	0.020 (2)	0.010	1.72
29	06-Jul-87	19.8	0.010 (2)	0.005	0.83
31	08-Jul-87	19.3	0.020(1)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64

ARITHMETIC MEAN: 22.3

- (1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.
- (2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM AB/N RESULTS

BUTYL-BENZYL-PHTHALATE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.040 (1)	0.020	3.37
5	31-May-87	19.3	0.020 (1)	0.010	1.61
9	04-Jun-87	19.9	0.020 (2)	0.010	1.66
11	08-Jun-87	38.4	0.020 (2)	0.010	3.20
13	10-Jun-87	24.8	0.020 (1)	0.010	2.07
15	14-Jun-87	21.1	0.020 (1)	0.010	1.76
16	15-Jun-87	21.9	0.020 (1)	0.010	1.83
18	17-Jun-87	20.6	0.020 (2)	0.010	1.72
29	06-Jul-87	19.8	0.010 (2)	0.005	0.83
31	08-Jul-87	19.3	0.020 (2)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64
ARITHMET	IC MEAN:	22.3			1.94

(1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

(2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM AB/N RESULTS

BIS(2-ETHYLHEXYL)PHTHALATE

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day_
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ARITHMETIC MEAN: 22.3

1.94

 The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

(2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM AB/N RESULTS

DI-N-OCTYL PHTHALATE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	_ppm_	ppm	lb/day
1	26-May-87	20.2	0.040 (1)	0.020	3.37
5	31-May-87	19.3	0.020 (1)	0.010	1.61
9	04-Jun-87	19.9	0.020 (1)	0.010	1.66
11	08-Jun-87	38.4	0.020 (1)	0.010	3.20
13	10-Jun-87	24.8	0.020(1)	0.010	2.07
15	14-Jun-87	21.1	0.020 (1)	0.010	1.76
16	15-Jun-87	21.9	0.020 (1)	0.010	1.83
18	17-Jun-87	20.6	0.020 (2)	0.010	1.72
29	06-Jul-87	19.8	0.010 (2)	0.005	0.83
31	08-Jul-87	19.3	0.020(1)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64
ARITHMETI	C MEAN:	22.3			1.94

(1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the

- detection limit.(2) The concentration fell below the detection Limit (Trace).
 - For purposes of calculation, the concentration was set at one-half the detection limit.

GHR AB/N RESULTS

PHENOL

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.010*	0.003	0.64
2	2/3/88	35.2	0.010*	0.003	0.88
3	3/2/88	30.0	0.010*	0.005	1.25
4	4/6/88	30.0	0.010*	0.003	0.75
5	5/4/88	30.3	0.010*	0.007	1.77
6	6/2/88	24.6	0.010*	0.005	1.03
7	7/6/88	42.4	-	0.017	6.01
8	8/3/88	25.1	0.010*	0.007	1.47
9	9/7/88	20.5	0.010*	0.010	1.71
10	10/5/88	25.8	0.010*	0.004	0.86
11	11/7/88	22.8	0.010*	0.014	2.66
12	12/8/88	25.8	0.010*	0.005	1.08
ARITHMETI	C MEAN:	28.2			1,68

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR AB/N RESULTS

BENZYL ALCOHOL

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.010*	0.005	1.07
2	2/3/88	35.2	0.010*	0.005	1.47
3	3/2/88	30.0	0.010*	0.005	1.25
4	4/6/88	30.0	0.010*	0.005	1.25
5	5/4/88	30.3	0.010*	0.005	1.26
6	6/2/88	24.6	0.010*	0.005	1.03
7	7/6/88	42.4	0.010	0.009	3.18
8	8/3/88	25.1	0.010	0.004	0.84
9	9/7/88	20.5	0.010*	0.005	0.85
10	10/5/88	25.8	0.010*	0.005	1.08
11	11/7/88	22.8	0.010	0.014	2.66
12	12/8/88	25.8	0.010	0.009	1.94
ARITHMETI	C MEAN:	28.2			1.49

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

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GHR AB/N RESULTS

2-METHYLPHENOL

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.010*	0.005	1.07
2	2/3/88	35.2	0.010*	0.005	1.47
3	3/2/88	30.0	0.010*	0.005	1.25
4	4/6/88	30.0	0.010*	0.005	1.25
5	5/4/88	30.3	0.010*	0.005	1.26
6	6/2/88	24.6	0.010*	0.005	1.03
7	7/6/88	42.4	0.010*	0.005	1.77
8	8/3/88	25.1	0.010*	0.005	1.05
9	9/7/88	20.5	0.010*	0.005	0.85
10	10/5/88	25.8	0.010*	0.005	1.08
11	11/7/88	22.8	0.010*	0.005	0.95
12	12/8/88	25.8	0.010*	0.005	1.08
ARITHMETIC	MEAN:	28.2			1.18

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR AB/N RESULTS

4-METHYLPHENOL

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
· 1	1/5-6/88	25.7	0.010	0.022	4.72
2	2/3/88	35.2	0.010	0.013	3.82
3	3/2/88	30.0	0.010	0.034	8.51
4	4/6/88	30.0	0.010	0.024	6.00
5	5/4/88	30.3	0.010	0.028	7.08
6	6/2/88	24.6	0.010	0.016	3.28
7	7/6/88	42.4	-	0.056	19.80
8	8/3/88	25.1	0.010	0.036	7.54
9	9/7/88	20.5	0.010	0.041	7.01
10	10/5/88	25.8	0.010	0.019	4.09
11	11/7/88	22.8	0.010*	0.005	0.95
12	12/8/88	25.8	0.010	0.025	5.38
ARTTHMETT	C MEAN:	28.2			6.51

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR AB/N RESULTS

BENZOIC ACID

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.050	0.029	6.22
2	2/3/88	35.2	0.050	0.042	12.33
3	3/2/88	30.0	0.050	0.110	27.52
4	4/6/88	30.0	0.050	0.040	10.01
5	5/4/88	30.3	0.050	0.067	16.93
6	6/2/88	24.6	0.050	0.044	9.03
7	7/6/88	42.4	0.050	0.050	17.68
8	8/3/88	25.1	0.050	0.049	10.26
9	9/7/88	20.5	0.050	0.083	14.19
10	10/5/88	25.8	0.050	0.058	12.48
11	11/7/88	22.8	0.050	0.120	22.82
12	12/8/88	25.8	0.050*	0.025	5.38
ARITHMETI	C MEAN:	28.2			13.74

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR AB/N RESULTS

4-CHLORO-3-METHYLPHENOL

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	_ppm_	lb/day
1	26-May-87	20.2	0.040 (1)	0.020	3.37
5	31-May-87	19.3	0.020 (1)	0.010	1.61
9	04–Jun–87	19.9	0.020 (1)	0.010	1.66
11	08-Jun-87	38.4	0.020 (1)	0.010	3.20
13	10-Jun-87	24.8	0.020 (1)	0.010	2.07
15	14–Jun–87	21.1	0.010 (1)	0.005	0.88
16	15–Jun–87	21.9	0.020(1)	0.010	1.83
18	17–Jun–87	20.6	0.020 (2)	0.010	1.72
29	06-Jul-87	19.8	0.010 (1)	0.050	8.26
31	08-Jul-87	19.3	0.020(1)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64
ARITHMETI	C MEAN:	22.3			2.53

(1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

(2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR AB/N RESULTS

ISOPHORONE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.010*	0.005	1.07
2	2/3/88	35.2	0.010*	0.005	1.47
3	3/2/88	30.0	0.010*	0.005	1.25
4	4/6/88	30.0	0.010*	0.005	1.25
5	5/4/88	30.3	0.010*	0.005	1.26
6	6/2/88	24.6	0.010*	0.005	1.03
7	7/6/88	42.4	_ *	0.005	1.77
8	8/3/88	25.1	0.010*	0.005	1.05
9	9/7/88	20.5	0.010	0.003	0.51
10	10/5/88	25.8	0.010*	0.005	1.08
11	11/7/88	22.8	0.010*	0.005	0.95
12	12/8/88	25.8	0.010*	0.005	1.08
ARTTHMETT	C MEAN:	28.2			1,15

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR AB/N RESULTS

1,2,4-TRICHLOROBENZENE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.010*	0.005	1.07
2	2/3/88	35.2	0.010*	0.005	1.47
3	3/2/88	30.0	0.010*	0.005	1.25
4	4/6/88	30.0	0.010*	0.005	1.25
5	5/4/88	30.3	0.010*	0.005	1.26
6	6/2/88	24.6	0.010*	0.005	1.03
7	7/6/88	42.4	0.010*	0.005	1.77
8	8/3/88	25.1	0.010*	0.005	1.05
9	9/7/88	20.5	0.010*	0.005	0.85
10	10/5/88	25.8	0.010*	0.005	1.08
11	11/7/88	22.8	0.010*	0.005	0.95
12	12/8/88	25.8	0.010*	0.005	1.08
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ARITHMETI	C MEAN:	28.2			1.18

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR AB/N RESULTS

2-METHYLNAPHTHALENE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.010	0.004	0.86
2	2/3/88	35.2	0.010*	0.005	1.47
3	3/2/88	30.0	0.010	0.003	0.75
4	4/6/88	30.0	0.010*	0.005	1.25
5	5/4/88	30.3	0.010	0.003	0.76
6	6/2/88	24.6	0.010	0.004	0.82
7	7/6/88	42.4	0.010*	0.005	1.77
8	8/3/88	25.1	0.010	0.003	0.63
9	9/7/88	20.5	0.010	0.003	0.51
10	10/5/88	25.8	0.010*	0.005	1.08
11	11/7/88	22.8	0.010	0.012	2.28
12	12/8/88	25.8	0.010	0.004	0.86
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ARITHMETI	C MEAN:	28.2			1.09

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR AB/N RESULTS

N-NITROSODIPHENYLAMINE

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Sample Day No.	Date	Flow mgd_	Det. Limit _ppm_	Conc. ppm	Influent Quantity
1	1/5-6/88	25.7	0.010*	0.005	1.07
2	2/3/88	35.2	0.010*	0.005	1.47
3	3/2/88	30.0	0.010*	0.005	1.25
4	4/6/88	30.0	0.010*	0.005	1.25
5	5/4/88	30.3	0.010*	0.005	1.26
6	6/2/88	24.6	0.010*	0.005	1.03
7	7/6/88	42.4	0.010*	0.005	1.77
8	8/3/88	25.1	0.010	0.037	7.75
9	9/7/88	20.5	0.010*	0.005	0.85
10	10/5/88	25.8	0.010	0.004	0.86
11	11/7/88	22.8	0.010*	0.005	0.95
12	12/8/88	25.8	0.010*	0.005	1.08
ARITHMETI	C MEAN:	28.2			1.72

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR AB/N RESULTS

DI-N-BUTYL PHTHALATE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day_
1	1/5-6/88	25.7	0.010*	0.005	1.07
2	2/3/88	35.2	0.010	0.004	1.17
3	3/2/88	30.0	0.010	0.005	1.25
4	4/6/88	30.0	0.010*	0.005	1.25
5	5/4/88	30.3	0.010	0.002	0.51
6	6/2/88	24.6	0.010	0.006	1.23
7	7/6/88	42.4	0.010	0.003	1.06
8	8/3/88	25.1	0.010	0.003	0.63
9	9/7/88	20.5	0.010	0.003	0.51
10	10/5/88	25.8	0.010	0.006	1.29
11	11/7/88	22.8	0.010	0.008	1.52
12	12/8/88	25.8	0.010	0.017	3.66
ARITHMETIC	MEAN:	28.2			1.26

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

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GHR AB/N RESULTS

BUTYL-BENZYL-PHTHALATE

Sample Day		Flow	Det. Limit	Conc.	Influent Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.010*	0.005	1.07
2	2/3/88	35.2	0.010	0.003	0.88
3	3/2/88	30.0	0.010*	0.005	1.25
4	4/6/88	30.0	0.010*	0.005	1.25
5	5/4/88	30.3	0.010*	0.005	1.26
6	6/2/88	24.6	0.010	0.006	1.23
7	7/6/88	42.4	0.010*	0.005	1.77
8	8/3/88	25.1	0.010	0.002	0.42
9	9/7/88	20.5	0.010	0.006	1.03
10	10/5/88	25.8	0.010	0.004	0.86
11	11/7/88	22.8	0.010	0.004	0.76
12	12/8/88	25.8	0.010	0.005	1.08
ARITHMETIC	MEAN:	28.2			1.07

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR AB/N RESULTS

DIETHYL-PHTHALATE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.010	0.020	4.29
2	2/3/88	35.2	0.010	0.003	0.88
3	3/2/88	30.0	0.010*	0.005	1.25
4	4/6/88	30.0	0.010*	0.005	1.25
5	5/4/88	30.3	0.010*	0.005	1.26
6	6/2/88	24.6	0.010	0.004	0.82
7	7/6/88	42.4	0.010*	0.005	1.77
8	8/3/88	25.1	0.010	0.005	1.05
9	9/7/88	20.5	0.010	0.008	1.37
10	10/5/88	25.8	0.010	0.008	1.72
11	11/7/88	22.8	0.010	0.009	1.71
12	12/8/88	25.8	0.010	0.008	1.72
ARITHMETI	C MEAN:	28.2			1.59

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.
GHR AB/N RESULTS

DI-N-OCTYL-PHTHALATE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.010*	0.005	1.07
2	2/3/88	35.2	0.010	0.005	1.47
3	3/2/88	30.0	0.010*	0.005	1.25
4	4/6/88	30.0	0.010*	0.005	1.25
5	5/4/88	30.3	0.010*	0.005	1.26
6	6/2/88	24.6	0.010	0.002	0.41
7	7/6/88	42.4	0.010*	0.005	1.77
8	8/3/88	25.1	0.010*	0.005	1.05
9	9/7/88	20.5	0.010*	0.005	0.85
10	10/5/88	25.8	0.010	0.003	0.65
11	11/7/88	22.8	0.010*	0.005	0.95
12	12/8/88	25.8	0.010*	0.005	1.08
ARITHMETI	C MEAN:	28.2			1.09

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR AB/N RESULTS

NAPTHALENE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day_
1	1/5-6/88	25.7	0.010	0.014	3.00
2	2/3/88	35.2	0.010	0.009	2.64
3	3/2/88	30.0	0.010	0.007	1.75
4	4/6/88	30.0	0.010	0.003	0.75
5	5/4/88	30.3	0.010	0.006	1.52
6	6/2/88	24.6	0.010	0.003	0.62
7	7/6/88	42.4	0.010*	0.005	1.77
8	8/3/88	25.1	0.010	0.005	1.05
9	9/7/88	20.5	0.010	0.015	2.56
10	10/5/88	25.8	0.010	0.010	2.15
11	11/7/88	22.8	0.010	0.017	3.23
12	12/8/88	25.8	0.010	0.028	6.02
ARITHMETIC	MEAN:	28.2			2.26

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR AB/N RESULTS

BIS(2-ETHYLHEXYL)PHTHALATE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.040	0.059	12.65
2	2/3/88	35.2	0.020	0.064	18.79
3	3/2/88	30.0	0.020	0.004	1.00
4	4/6/88	30.0	0.020*	0.005	1.25
5	5/4/88	30.3	0.020	0.024	6.06
6	6/2/88	24.6	0.020	0.012	2.46
7	7/6/88	42.4	0.020	0.006	2.12
8	8/3/88	25.1	0.020	0.013	2.72
9	9/7/88	20.5	0.010	0.065	11.11
10	10/5/88	25.8	0.020	0.160	34.43
11	11/7/88	22.8	0.020	0.040	7.61
12	12/8/88	25.8	0.010	0.074	15.92
ARTTHMETT	C MEAN:	28.2			9,68

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM REVISED AB/N RESULTS

4-CHLORO-3-METHYLPHENOL

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.040 (1)	0.020	3.37
5	31-May-87	19.3	0.020 (1)	0.010	1.61
9	04-Jun-87	19.9	0.020 (1)	0.010	1.66
11	08-Jun-87	38.4	0.020 (1)	0.010	3.20
13	10-Jun-87	24.8	0.020 (1)	0.010	2.07
15	14–Jun–87	.21.1	0.010 (1)	0.005	0.88
16	15–Jun–87	21.9	0.020 (1)	0.010	1.83
18	17–Jun–87	20.6	0.020 (2)	0.010	1.72
29	06-Jul-87	19.8	0.010 (1)	0.005	0.83
31	08-Jul-87	19.3	0.020 (1)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64
ARITHMETI	C MEAN:	22.3			1.86

- (1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.
- (2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM REVISED AB/N RESULTS

BIS(2-ETHYLHEXYL)PHTHALATE

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Conc. ppm	Influent Quantity _lb/day_
1	26-May-87	20.2	0.040 (1)	0.020	3.37
5	31-May-87	19.3	0.020	0.980	157.74
9	04–Jun–87	19.9	0.020 (1)	0.010	1.66
11	08-Jun-87	38.4	0.020(1)	0.010	3.20
13	10-Jun-87	24.8	0.020(1)	0.010	2.07
15	14-Jun-87	21.1	0.020(1)	0.010	1.76
16	15–Jun–87	21.9	0.020(1)	0.010	1.83
18	17–Jun–87	20.6	0.020	0.022	3.78
29	06-Jul-87	19.8	0.010 (1)	0.005	0.83
31	08-Jul-87	19.3	0.020	0.042	6.76
37	18-Jul-87	19.7	0.020	0.035	5.75
ARTTHMETT	C MEAN:	22.3			17.16

 The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM REVISED AB/N RESULTS

NAPTHALENE

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Conc. ppm	Influent Quantity lb/day
1	26-May-87	20.2	0.040 (2)	0.020	3.37
5	31-May-87	19.3	0.020 (1)	0.010	1.61
9	04-Jun-87	19.9	0.020 (1)	0.010	1.66
11	08-Jun-87	38.4	0.020 (2)	0.010	3.20
13	10-Jun-87	24.8	0.020 (2)	0.010	2.07
15	14-Jun-87	21.1	0.020 (1)	0.010	1.76
16	15-Jun-87	21.9	0.020 (2)	0.010	1.83
18	17-Jun-87	20.6	0.020 (2)	0.010	1.72
29	06-Jul-87	19.8	0.010 (2)	0.005	0.83
31	08-Jul-87	19.3	0.020(1)	0.010	1.61
37	18-Jul-87	19.7	0.020 (1)	0.010	1.64
ARITHMET	IC MEAN:	22.3			1.94

(1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

(2) The concentration fell below the detection Limit (Trace). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM REVISED AB/N RESULTS

DIMETHYL-PHTHALATE

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	26-May-87	20.2	0.040	<dl*< td=""><td>0.00</td></dl*<>	0.00
5	31-May-87	19.3	0.020	<dl*< td=""><td>0.00</td></dl*<>	0.00
9	04–Jun–87	19.9	0.020	<dl*< td=""><td>0.00</td></dl*<>	0.00
11	08-Jun-87	38.4	0.020	<dl*< td=""><td>0.00</td></dl*<>	0.00
13	10-Jun-87	24.8	0.020	<dl*< td=""><td>0.00</td></dl*<>	0.00
15	14–Jun–87	21.1	0.020	<dl*< td=""><td>0.00</td></dl*<>	0.00
16	15–Jun–87	21.9	0.020	<dl*< td=""><td>0.00</td></dl*<>	0.00
18	17–Jun–87	20.6	0.020	<dl*< td=""><td>0.00</td></dl*<>	0.00
29	06-Jul-87	19.8	0.010	<dl*< td=""><td>0.00</td></dl*<>	0.00
31	08-Jul-87	19.3	0.020	<dl*< td=""><td>0.00</td></dl*<>	0.00
37	18-Jul-87	19.7	0.020	<dl*< td=""><td>0.00</td></dl*<>	0.00
ARITHMETI	C MEAN:	22.3			0.00

* - Detection Limit.

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CDM PESTICIDE/PCB RESULTS

gamma-BHC (Lindane)

Sample Day No.	Date	Flow mgd	Det. Limit _ppm_	Conc. _ppm_	Influent Quantity _1b/day
3	28-May-87	23.6	0.00050*	0.000250	0.05
5	31-May-87	19.3	0.00050*	0.000250	0.04
9	04-Jun-87	19.9	0.00005	0.000150	0.02
11	08-Jun-87	38.4	0.00005	0.000150	0.05
13	10-Jun-87	24.8	0.00050*	0.000250	0.05
15	14-Jun-87	21.1	0.00005*	0.000025	0.00
16	15-Jun-87	21.9	0.00005*	0.000025	0.00
18	17-Jun-87	20.6	0.00005*	0.000025	0.00
29	06-Jul-87	19.8	0.00050*	0.000250	0.04
31	08-Jul-87	19.3	0.00050*	0.000250	0.04
37	18-Jul-87	19.7	0.00050*	0.000250	0.04
ARITHMETI	IC MEAN:	22.6			0.03

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR PESTICIDE/PCB RESULTS

gamma-BHC (Lindane)

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Conc. _ppm	Influent Quantity lb/day
1	1/5-6/88	25.7	0.00005*	0.00002	0.01
2	2/3/88	32.1	0.00005*	0.000025	0.01
3	3/2/88	30.0	0.00005*	0.000025	0.01
4	4/6/88	30.0	0.00005*	0.000025	0.01
5	5/4/88	30.3	0.00005*	0.000025	0.01
6	6/2/88	24.6	0.00005*	0.000025	0.01
7	7/6/88	42.4	0.00005*	0.000025	0.01
8	8/3/88	25.1	0.00005*	0.000025	0.01
9	9/7-8/88	20.5	0.00005*	0.000025	0.00
10	10/5-6/88	25.8	0.00008*	0.000004	0.00
11	11/7-8/88	22.8	0.00005*	0.000025	0.00
12	12/8-9/88	25.8	0.00004*	0.000002	0.00
ARITHMETIC	MEAN:	27.9			0.01

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR PESTICIDE/PCB RESULTS

4,4′-DDD

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Conc. ppm	Influent Quantity lb/day
1 ·	1/5-6/88	25.7	0.00010*	0.00005	0.01
2	2/3/88	35.2	0.00010*	0.00005	0.01
3	3/2/88	30.0	0.00010*	0.00005	0.01
4	4/6/88	30.0	0.00010*	0.00005	0.01
5	5/4/88	30.3	0.00010*	0.00005	0.01
6	6/2/88	24.6	0.00010*	0.00005	0.01
7	7/6/88	42.4	0.00010*	0.00005	0.02
8	8/3/88	25.1	0.00010*	0.00005	0.01
9	9/7-8/88	20.5	0.00010*	0.00005	0.01
10	10/5-6/88	25.8	0.00008*	0.00004	0.01
11	11/7-8/88	22.8	0.00010*	0.00005	0.01
12	12/8-9/88	25.8	0.00010*	0.00005	0.01
ARITHMETIC	C MEAN:	30.4			0.01

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR PESTICIDE/PCB RESULTS

4,4'-DDT

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.00010*	0.00005	0.01
2	2/3/88	35.2	0.00010*	0.00005	0.01
3	3/2/88	30.0	0.00010*	0.00005	0.01
4	4/6/88	30.0	0.00010*	0.00005	0.01
5	5/4/88	30.3	0.00010*	0.00005	0.01
6	6/2/88	24.6	0.00010*	0.00005	0.01
7	7/6/88	42.4	0.00010*	0.00005	0.02
8	8/3/88	25.1	0.00010*	0.00005	0.01
9	9/7-8/88	20.5	0.00010*	0.00005	0.01
10	10/5-6/88	25.8	0,00008*	0.00004	0.01
11	11/7-8/88	22.8	0.00010*	0.00005	0.01
12	12/8-9/88	25.8	0.00010*	0.00005	0.01
ARITHMETIC	: MEAN:	30.4			0.01

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

GHR PESTICIDE/PCB RESULTS

PCB-1242

Sample Day No.	Date	Flow	Det. Limit ppm	Conc.	Influent Quantity lb/day
1	1/5-6/88	25.7	0.00007*	0.00004	0.01
2	2/2-3/88	32.1	0.00040*	0.00020	0.05
3	3/2/88	30.0	0.00010*	0.00005	0.01
4	4/6/88	30.0	0.00050	0.00072	0.18
5	5/4/88	30.3	0.00010*	0.00005	0.01
6	6/2/88	24.6	0.00040	0.00106	0.22
7	7/6/88	42.4	0.00040*	0.00020	0.07
8	8/3/88	25.1	0.00080*	0.00040	0.08
9	9/7-8/88	20.5	0.00020*	0.00010	0.02
10	10/5-6/88	25.8	0.00080*	0.00040	0.09
11	11/7-8/88	22.8	0.00050*	0.00025	0.05
12	12/8-9/88	25.8	0.00040*	0.00020	0.04
ARITHMETIC	MEAN:	27.9			0.07

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

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GHR PESTICIDE/PCB RESULTS

PCB-1254

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	1/5-6/88	25.7	0.00007	0.00041	0.09
2	2/2-3/88	32.1	0.00040	0.00087	0.23
3	3/2/88	30.0	0.00010	0.00086	0.22
4	4/6/88	30.0	0.00050	0.00075	0.19
5	5/4/88	30.3	0.00007	0.00012	0.03
6	6/2/88	24.6	0.00010	0.00019	0.04
7	7/6/88	42.4	0.00040*	0.00020	0.07
8	8/3/88	25.1	0.00020*	0.00010	0.02
9	9/7-8/88	20.5	0.00020*	0.00010	0.02
10	10/5-6/88	25.8	0.00080*	0.00040	0.09
11	11/7-8/88	22.8	0.00050*	0.00025	0.05
12	12/8-9/88	25.8	0.00040	0.00052	0.11
ARITHMETIC	MEAN:	27.9			0.10

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM REVISED PESTICIDE/PCB RESULTS

4,4'-DDD

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Conc. ppm	Influent Quantity lb/day
3	28-May-87	23.6	0.00010*	0.00050	0.10
5	31-May-87	19.3	0.00010*	0.00050	0.08
9	04-Jun-87	19.9	0.00001*	0.00005	0.01
11	08-Jun-87	38.4	0.00001*	0.00005	0.02
13	10-Jun-87	24.8	0.00010*	0.00050	0.10
15	14-Jun-87	21.1	0.00001*	0.00005	0.01
16	15-Jun-87	21.9	0.00001*	0.00005	0.01
18	17-Jun-87	20.6	0.00001*	0.00005	0.01
29	06-Jul-87	19.8	0.00010*	0.00050	0.08
31	08-Jul-87	19.3	0.00010*	0.00050	0.08
37	18-Jul-87	19.7	0.00010*	0.00050	0.08
ARITHMETI	C MEAN:	22.6			0.05

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

CDM REVISED PESTICIDE/PCB RESULTS

4,4'-DDT

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
3	28-May-87	23.6	0.00010*	0.00050	0.10
5	31-May-87	19.3	0.00010*	0.00050	0.08
9	04-Jun-87	19.9	0.00001*	0.00005	0.01
11	08-Jun-87	38.4	0.00001*	0.00005	0.02
13	10-Jun-87	24.8	0.00010*	0.00050	0.10
15	14-Jun-87	21.1	0.00001*	0.00005	0.01
16	15-Jun-87	21.9	0.00001*	0.00005	0.01
18	17-Jun-87	20.6	0.00001*	0.00005	0.01
29	06-Jul-87	19.8	0.00010*	0.00050	0.08
31	08-Jul-87	19.3	0.00010*	0.00050	0.08
37	18-Jul-87	19.7	0.00010*	0.00050	0.08
ARITHMETIC	MEAN:	22.6			0.05

* The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

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CDM REVISED PESTICIDE/PCB RESULTS

PCB-1242

Sample Day No.	Date	Flow mgd	Det. Limit ppm	Conc. _ppm_	Influent Quantity lb/day
1	28-May-87	23.6	0.0050	<dl(2)< td=""><td>-</td></dl(2)<>	-
5	31-May-87	19.3	0.0050	<dl(2)< td=""><td>-</td></dl(2)<>	-
9	04-Jun-87	19.9	0.0005	0.00025	0.04
11	08-Jun-87	38.4	0.0005(1)	0.00025	0.08
13	10-Jun-87	24.8	0.0050	<dl(2)< td=""><td>-</td></dl(2)<>	-
15	14-Jun-87	21.1	0.0005(1)	0.00025	0.04
16	15-Jun-87	21.9	0.0005(1)	0.00025	0.05
18	17-Jun-87	20.6	0.0005(1)	0.00025	0.04
29	06-Jul-87	19.8	0.0050	<dl(2)< td=""><td>-</td></dl(2)<>	-
31	08-Jul-87	19.3	0.0050	<dl(2)< td=""><td>-</td></dl(2)<>	-
37	18-Jul-87	19.7	0.0050	<dl(2)< td=""><td>-</td></dl(2)<>	-
ARITHMETI	C MEAN:	22.6			0.05

(1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.

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(2) Detection limit (Not Detected). For purposes of calculation, one-half of the detection limit was not used as the concentration since the detection limit was too high.

CDM REVISED PESTICIDE/PCB RESULTS

PCB-1254

Sample			Det.		Influent
Day		Flow	Limit	Conc.	Quantity
No.	Date	mgd	ppm	ppm	lb/day
1	28-May-87	23.6	0.0050	<dl(2)< td=""><td>-</td></dl(2)<>	-
5	31-May-87	19.3	0.0050	<dl(2)< td=""><td>-</td></dl(2)<>	-
9	04-Jun-87	19.9	0.0010	0.0005	0.08
11	08-Jun-87	38.4	0.0010(1)	0.0005	0.16
13	10-Jun-87	24.8	0.0050	<dl(2)< td=""><td>_</td></dl(2)<>	_
15	14-Jun-87	21.1	0.0010(1)	0.0005	0.09
16	15-Jun-87	21.9	0.0010(1)	0.0005	0.09
18	17-Jun-87	20.6	0.0010(1)	0.0005	0.09
29	06-Jul-87	19.8	0.0100	<dl(2)< td=""><td>-</td></dl(2)<>	-
31	08-Jul-87	19.3	0.0100	<dl(2)< td=""><td>· _</td></dl(2)<>	· _
37	18-Jul-87	19.7	0.0100	<dl(2)< td=""><td>-</td></dl(2)<>	-
ARITHMETI	C MEAN:	22.6			0.10

- (1) The concentration fell below the detection limit (Not Detected). For purposes of calculation, the concentration was set at one-half the detection limit.
- (2) Detection limit (Not Detected). For purposes of calculation, one-half of the detection limit was not used as the concentration since the detection limit was too high.

PHASE 2 PRIMARY SLUDGE ANALYSIS

METALS ONLY

(mg/kg)

DIOD M

Metals	(Thickened) Feb 15 1989	(Thickened) Feb 16 1989	(Thickened) Feb 17 1989	(Thickened) Feb 22 1989	(Thickened) Feb 23 1989	(Thickened) Feb 24 1989	Allowable Conc. in ppm Dry Wt. Type II
Antimony	~ 520	2400	016		<171	×173	
Ancinony	(12)	1 0	V40 20	[1,000]	~12	~~~~	
Arsenic			50	×20		520	
Barium	341	345	246	430	448	239	
Beryllium	<6	<5	<4	0	3	3	
Boron	[255]	[165]	[122]	[229]	[79]	[188]	300
Cadmium	<35	<27	<23	<55	<18	<18	25
Chromium	886	1,020**	928	1,310**	1,580**	1,990**	1,000
Copper	1,030**	1,060**	754	1,290**	1,420**	1,420**	1,000
Lead	229	228	338	363	543	409	1,000
Mercury	<6	<5	<4	<9	S	3	10
Molybdenum	<118	<91	<77	<182	[78]	[105]	40
Nickel	[538]**	[630]**	560**	[707]**	856**	954**	200
Selenium	<16	<13	11>	<25	<9	<9	
Silver	[109]	[92]	[62]	[144]	[99]	[106]	
Thallium	<35	\$27	23	<55	<18	<18	
Zinc	1,470	1,440	1,170	1,840	2,030	2,160	2,500

< - Indicates element was analyzed for but not detected, and that its concentration is less than the indicated quantitative limit

- [] Indicates precision of concentratin reported is \pm 10–20%. ** Indicates concentration exceeds Type II criteria.

PHASE 2
PRIMARY SLUDGE ANALYSIS
(VOLATILE ORGANICS COMPOUNDS)
(ug/kg)

	(Thickened)	(Thickened)	(Thickened)	(Thickened)	(Thickened)	(Thickened)
	Feb 15	Feb 16	Feb 17	Feb 22	Feb 23	Feb 24
Volatile organics	1989	1989	1989	1989	1989	1989
	0000 #	4500 11		0.00 **	070	0/0
Benzene	3300 0	1500 0	380 0	960 U	2/0 0	340 0
BromodichLoromethane	3300 U	1500 U	380 U	960 U	2/0 U	340 U
Bromoform	3300 U	1500 U	380 U	960 U	270 U	340 U
Bromomethane	6700 U	2900 U	760 U	1900 U	530 U	680 U
Carbon Tetrachloride	3300 U	1500 U	380 U	960 U	270 U	340 U
Chlorobenzene	3300 U	1500 U	380 U	960 U	270 U	340 U
Chloroethane	6700 U	2900 U	760 U	1900 U	530 U	680 U
Chloroform	3300 U	1100 J	370 J	770 J	270 U	270 J
Chloromethane	6700 U	2900 U	760 U	1900 U	530 U	680 U
Dibromochloromethane	3300 U	1500 U	380 U	960 U	270 U	340 U
1,1-Dichloroethane	3300 U	1500 U	380 U	960 U	270 U	340 U
1,2-Dichloroethane	3300 U	1500 U	380 U	960 U	270 U	340 U
1,1-Dichloroethene	3300 U	1500 U	380 U	960 U	270 U	340 U
1,2-Dichloroethene	3300 U	1500 U	270 J	960 U	270 U	340 U
1,2-Dichloropropane	3300 U	1500 U	380 U	960 U	270 U	340 U
cis-1,3-Dichloropropane	3300 U	1500 U	380 U	960 U	270 U	340 U
trans-1,3-Dichloropropene	3300 U	1500 U	380 U	960 U	270 U	340 U
Ethylbenzene	3300 U	4200	2700	960 U	660	1700
Methylene Chloride	3300 U	1500 U	380 U	960 U	270 U	470 B
1,1,2,2-Tetrachloroethane	3300 U	1500 U	380 U	960 U	270 U	340 U
Tetrachloroethene	3300 U	2700	2100	960 U	290	1000
Toluene	17000	23000	13000	8400	3100	31000 E
1.1.1-Trichloroethane	3300 U	490 J	370 J	960 U	270 U	340 U
1.1.2-Trichloroethane	3300 U	1500 U	380 U	960 U	270 U	340 U
Trichloroethene	3300 U	1000 J	560	960 U	270 U	570

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(Continued)

PHASE 2 PRIMARY SLUDGE ANALYSIS (VOLATILE ORGANICS COMPOUNDS) (ug/kg)

Volatile organics	(Thickened) Feb 15 1989	(Thickened) Feb 16 1989	(Thickened) Feb 17 1989	(Thickened) Feb 22 1989	(Thickened) Feb 23 1989	(Thickened) Feb 24 1989
	(700) II	2000 11	760 11	1000 11	520 11	690 11
vinyi Unioride	6700 U	2900 0	760 0	1900 0	330.0	000 0
Carbon Disulfide	3300 U	1500 U	190 J	960 U	270 U	340 U
Acetone	10000	15000 B	8000 B	7300	2100	1800
Vinyl Acetate	6700 U	2900 U	760 U	1900 U	530 U	680 U
2-Butanone	6700 U	2900 U	3200	1900 U	530 U	680 U
4-Methyl-2-pentanone	6700 U	2900 U	760 U	1900 U	530 U	680 U
2-Hexanone	6700 U	2900 U	760 U	1900 U	530 U	680 U
Styrene	3300 U	1500 U	380 U	960 U	270 U	340 U
Total Xylenes	22000	33000	23000	4700	5900	17000

U - Analyzed for but not detected. Value reported is the detection limit.

- B Found in associated blank as well as sample.
- J Estimated value, below detection limit.
- E Estimated value, above calibration limit.

PHASE 2 PRIMARY SLUDGE ANALYSIS SEMI-VOLATILE ORGANICS (ng/kg)

	(Thickened)	(Thickened)	(Thickened)	(Thickened)	(Thickened)	(Thickened)
	Feb 15	Feb 16	Feb 17	Feb 22	Feb 23	Feb 24
Volatile organics	1989	1989	1989	1989	1989	1989
Phenol	7 U	12 U	7 U	730 U	270 U	250 U
bis(2-chloroethyl)ether	7 U	12 U	7 U	730 U	270 U	250 U
2-chlorophenol	7 U	12 U	7 U	730 U	270 U	250 U
1,3-Dichlorobenzene	7 U	12 U	7 U	730 U	270 U	250 U
1,4-Dichlorobenzene	7 U	12 U	7 ប	730 U	270 U	250 U
Benzyl alcohol	7 U	12 U	7 U	730 U	270 U	250 U
1,2-Dichlorobenzene	7 U	12 U	7 U	730 U	270 U	250 U
2-Methylphenol	7U ·	12 U	7 U	230 J	270 U	250 U
bis(2-Chloroisopropyl)ether	7 U	12 U	7 U	730 U	270 U	250 U
4-Methylphenol	57	60	34	730 U	270 U	250 U
N-Nitroso-di-n-propylamine	7 U	12 U	7 U	730 U	270 U	250 U
Hexachloroethane	7 U	12 U	7 U	730 U	270 U	250 U
Nitrobenzene	7 U	12 U	7 U	730 U	270 U	250 U
Isophorone	7 U	12 U	7 U	730 U	270 U	250 U
2-Nitrophenol	7 U	12 U	7 U	730 U	270 U	250 U
2,4—Dimethylphenol	7 U	12 U	7 U	730 U	270 U	250 U
Benzoic Acid	35	60 U	35 U	3650 U	1350 U	250 U
bis(2-chloroethoxy)methane	7 U	12 U	7 U	730 U	270 U	250 U
2,4—Dichlorophenol	7 U	12 U	7 U	730 U	270 U	250 U
1,2,4-Trichlorobenzene	7 U	12 U	7 U	730 U	270 U	250 U
Naphthalene	23	36	29	730 U	270 U	250 U
4-Chloroaniline	7 ប 、	12 U	7 U	730 U	270 U	250 U
Hexachlorobutadiene	7 U	12 U	7 U	730 U	270 U	250 U
4-Chloro-3-methylphenol	7 U	12 U	7 U	730 U	270 U	250 U
2-Methylnaphthalene	10	19	5	730 U	270 U	250 U
Hexachlorocyclopentadiene	7 U	12 U	7 U	730 U	270 U	250 U
2,4,6-Trichlorophenol	7 U	12 U	7 U	730 U	270 U	250 U
2,4,5-Trichlorophenol	35 U	60 U	35 U	3650 U	1350 U	250 U
2-Chloronaphthalene	7 U	12 U	7 U	730 U	270 U	250 U
2-Nitroaniline	35 U	60 U	35 U	3650 U	1350 U	250 U
Dimethylphthalate	7 U	12 U	1 J	730 U	270 U	250 U
Acenaphthylene	7 ប	12 U	7 U	730 U	270 U	250 U
2,6-Dinitrotoluene	7 U	12 U	7 U	730 U	270 U	250 U
3-Nitroaniline	35 U	60 U	35 U	3650 U	1350 U	1250 U

(Continued)

PHASE 2 PRIMARY SLUDGE ANALYSIS SEMI-VOLATILE ORGANICS (mg/kg)

	(Thickened)	(Thickened)	(Thickened)	(Thickened)	(Thickened)	(Thickened)
	Feb 15	Feb 16	Feb 17	Feb 22	Feb 23	Feb 24
Volatile organics	1989	. 1989	1989	1989	1989	1989
Acenaphthene	7 U	12 U	2 J	730 U	270 U	250 U
2,4-Dinitrophenol	35 U	60 U	35 U	3650 U	1350 U	1250 U
4-Nitrophenol	35 U	60 U	35 U	3650 U	1359 U	1250 U
Dibenzofuran	7 U	12 U	2 J	730 U	270 U	250 U
2,4-Dinitrotoluene	7 U	12 U	7 U	730 U	270 U	250 U
Diethylphthalate	7 U	12 U	7 U	730 U	270 U	250 U
4-Chlorophenyl-phenyl ether	7 U	12 U	7 U	730 บ	270 U	250 U
Fluorene	7 U	12 U	7 ט	730 U	270 U	250 U
4-Nitroaniline	35 U	60 U	35 U	3650 U	1350 U	1250 U
4,6-Dinitro-2-methylphenol	35 U	60 U	35 U	3650 U	1350 U	1250 U
N-Nitrosodiphenylamine	7 ប	12 U	2 J	730 U	270 U	250 U
4-Bromophenyl-phenyl ether	7 U	12 U	7 U	730 U	270 U	250 U
Hexachlorobenzene	7 U	12 U	7 U	730 U	270 U	250 U
Pentachlorophenol	35 U `	60 U	35 U	3650 U	1350 U	1250 U
Pentanthrene	3 J	4 J	5 J	730 U	270 U	250 U
Anthracene	7 บ	12 U	7 U	730 U	270 U	250 U
Di-n-butylphthalate	9	17	16	730 U	270 U	250 U
Flucanthene	2 J	3 J	2 J	730 U	270 U	250 U
Pyrene	7 U	12 U.	7 U	730 U	270 U	250 U
Butylbenzylphthalate	18	30	32	730 U	270 U	250 U
3,3-Diclorobenzidine	7 U	12 U	7 U	730 U	270 U	250 U
Benzo(a)anthracene	7 U	12 U	7 U	730 U	270 U	250 U
Chrysene	7 U	12 U	2 J	730 U	270 U	250 U
bis(2-Ethylhexyl)phthalate	130	240	230	480 J	310	260
Di-n-octylphthalate	7 J	8 J	10	730 U	270 U	250 U
Benzo(b)fluoranthene	7 U	12 U	7 U	730 U	270 U	250 U
Benzo(k)fluoranthene	7 U	12 U	7 U	730 U	270 U	250 U
Benzo(a)pyrene	7 U	12 U	7 U	730 U	270 U	250 U
Indeno(1,2,3-c,d)pyrene	7 U	12 U	7 U	730 U	270 U	250 U
Dibenz(a,h)anthracene	7 U	12 U	7 U	730 U	270 U	250 U
Benzo(g,h,i)pervlene	7 U	12 U	2 J	730 U	270 U	250 U

 \overline{U} – Analyzed for but not detected. Value reported is the detection limit. J – Estimated value, less than detection limit.

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		PHASE	3 2		
PRIMARY	SLUDGE	ANALYSIS	PESITCIDES	AND	PCB's
		(mg/1	(g)		

DEOE Max. Allowable

Pesticide/PCB	(Thickened) Feb 15 1989	(Thickened) Feb 16 1989	(Thickened) Feb 17 1989	(Thickened) Feb 22 1989	(Thickened) Feb 23 1989	(Thickened) Feb 24 1989	conc. in ppm Dry Wt. Type II
alpha-BHC	1.7 U	2.9 U	0.47 U	7.9 U	1.3 U	1.2 U	
beta-BHC	1.7 U	2.9 U	0.47 U	7.9 U	1.3 U	1.2 U	
delta-BHC	1.7 U	2.9 U	0.47 U	7.9 U	1.3 U	1.2 U	
gamma-BHC	1.7 U	2.9 U	0.47 U	7.9 U	1.3 U	1.2 U	
Heptachlor	1.7 U	2.9 U	0.47 U	7.9 U	1.3 U	1.2 U	—
Aldrin	1.7 U	2.9 U	0.47 U	7.9 U	1.3 U	1.2 U	
Heptachlor Epoxide	1.7 U	2.9 U	0.47 U	7.9 U	1.3 U	1.2 U	
Endosulfan I	1.7 U	2.9 U	0.47 U	7.9 U	1.3 U	1.2 U	
Dieldrin	3.3 U	5.9 U	0.94 U	16.0 U	2.6 U	2.4 U	
4,4'-DDE	3.3 U	5.9 U	0.94 U	16.0 U	2.6 U	2.4 U	
Endrin	3.3 U	5.9 U	0.94 U	16.0 U	2.6 U	2.4 U	
Endosulfan II	3.3 U	5.9 U	0.94 U	16.0 U	2.6 U	2.4 U	
4,4'-DDD	3.3 U	5.9 U	0.94 U	16.0 U	2.6 U	2.4 U	
Endrin Aldehyde	3.3 U	5.9 U	0.94 U	16.0 U	2.6 U	2.4 U	
Endosulfan Sulfate	3.3 U	5.9 U	0.94 U	16.0 U	2.6 U	2.4 U	
4,4'-DDT	3.3 U	5.9 U	0.94 U	16.0 U	2.6 U	2.4 U	
Methoxychlor	17.0 U	29.0 U	4.70 U	79.0 U	13.2 U	12.0 U	
Endrin Ketone	3.3 U	5.9 U	0.94 U	16.0 U	2.6 U	2.4 U	
alpha-Chlordane	17.0 U	29.0 U	4.70 U	79.0 U	13.2 U	12.0 U	
ganna-Chlordane	17.0 U	29.0 U	4.70 U	79.0 U	13.2 U	12.0 U	
Toxaphene	33.0 U	59.0 U	9.50 U	160.0 U	26.4 U	24.0 U	
Arochlor-1016	17.0 U	29.0 U	4.70 U	79.0 U	13.2 U	12.0 U :	
Arochlor-1221	17.0 U	29.0 U	4.70 U	79.0 U	13.2 U	12.0 U :	
Arochlor-1232	17.0 U	29.0 U	4.70 U	79.0 U	13.2 U	12.0 U :	
Arochlor-1242	17.0 U	29.0 U	4.70 U	79.0 U	13.2 U	12.0 U :	Total
Arochlor-1248	17.0 U	29.0 U	4.70 U	79.0 U	13.2 U	12.0 U :	of 10.0
Arochlor-1254	33.0 U	59.0 U	9.50 U	160.0 U	26.4 U	24.0 U :	
Arochlor-1260	33.0 U	59.0 U	9.50 U	160.0 U	11.7 U	11.2 U :	

U - Analyzed for but not detected. Value reported is the quantitative limit J - Estimated value, below quantitative limit

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PHASE 2 PRIMARY SLUCCE SAMPLING NUTRIENTS AND pH (mg/kg)

	(Thickened)	(Thickened)	(Thickened)	(Thickened)	(Thickened)	(Thickened)
	Feb 15	Feb 16	Feb 17	Feb 22	Feb 23	Feb 24
Parameter	1989	1989	1989	1989	1989	1989
Nitrogen, Total	2.940	2.530	3.010	2.830	2.100	3.450
Ammonia as N	0.360	0.307	0.295	0.398	0.386	0.356
Nitrate as N	<0.00250	<0.00738	<0.00488	<0.00185	<0.0292	<0.00126
Phosphorous	0.472	0.385	0.139	0.164	0.275	0.348
Potassium	0.206	0.190	0.171	0.215	0.141	0.169
pH (pH units)	5.5	5.6	5.4	5.6	5.5	5.5

PHASE 2 PRIMARY SLIDCE SAMPLING EP TOXICITY (ug/1)

	(Thickened)	(Thickened)	Allowable
	Feb 15	Feb 23	RCRA
Parameter	1989	1989	Limits
Arsenic	<75	<75	5,000
Barium	494.40	412.00	100,000
Cadmium	3	S	1,000
Chromium	59.00	181.00	5,000
Lead	<30	[60]	5,000
Mercury	<0.2	<0.2	200
Selenium	<50	<50	1,000
Silver	ଓ	[8]	5,000
alpha-BHC	0.10 U	0.10 U	
beta-BHC	0.10 U	0.10 U	
delta-BHC	0.10 U	0.10 U	
gamma-BHC	0.10 U	0.10 U	400
Heptachlor	0.10 U	0.10 U	
Aldrin	0.10 U	0.10 U	
Heptachlor Epoxide	0.10 U	0.10 U	
Endosulfan I	0.10 U	0.10 U	
Dieldrin	0.20 U	0.20 U	
4,4'-DDE	0.20 U	0.20 U	
Endrin	0.20 U	0.20 U	20
Endosulfan II	0.20 U	0.20 U	
4,4'-DDD	0.20 U	0.20 U	
Endosulfan Sulfate	0.20 U	0.20 U	
4.4'-DDT	0.20 U	0.20 U	
Methoxychlor	1.00 U	1.00 U	10,000
Endrin Ketone	0.20 U	0.20 U	,
alpha-Chlordane	1.00 U	1.00 U	
gamma-Chlordane	1.00 U	1.00 U	
Toxaphene	2.00 U	2.00 U	500

TABLE B-125 (Continued)

PHASE 2 PRIMARY SLIDGE SAMPLING EP TOXICITY (ug/1)

Deventor	(Thickened)	(Thickened)	Allowable
	Feb 15	Feb 23	RCRA
ratalieter	1909	1207	
Arochlor-1016	1.00 U	1.00 U	
Arochlor-1221 Arochlor-1232	1.00 U	1.00 U	
Arochlor-1242	1.00 U	1.00 U	
Arochlor-1248	1.00 U	1.00 U	
Arochlor—1254	2.00 U	2.00 U	
Arochlor—1260	2.00 U	2.00 U	
2,4-D	0.02 U	0.02 U	10,000
2,4,5-TP (SILVEX)	0.01 U	0.01 U	1,000

U - Analyzed for but not detected.

[] - Indicates precision of concentration reported is + 10-20%.

	PHASE 2
PRIMARY	SLUDGE ANALYSIS
	METALS
	(mg/kg)

	(Sludge Cake)	(Sludge Cake)	(Sludge Cake)	(Sludge Cake)	(Sludge Cake)	(Sludge Cake)	Allowable conc. in
	May 8	May 9	May 10	May 16	May 17	May 18	ppm Dry Wt.
Metals	1989	1989	1989	1989	1989	1989	Туре П
		<i>(</i> 0, Г	~ F	~ F	~ F	<i>с</i> о Г	
Antimony	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	
Arsenic	1.0	0.D	<1.0	1.1	<1.0	<1.0	
Barium	180	190	190	160	180	190	
Beryllium	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Boron	<50	<50	<50	<50	<50	<50	300
Cadmium	2.7	2.2	1.9	<1.0	3.1	2.0	25
Chromium	150	290	640	160	180	170	1000
Copper	1200**	1300**	1600**	1200**	1100**	1300**	1000
Cyanide	1.8	0.9	1.4	2.1	2.6	1.6	
Lead	170	170	120	170	160	180	1000
Mercury	0.34	<0.05	0.21	0.17	0.13	<0.05	10
Molybdenum	19	21	26	14	19	17	40
Nickel	170	260**	470**	160	170	180	200
Selenium	2.5	4.5	2.7	5.1	2.7	2.0	
Silver	13	16	14	16	15	20	
Thallium	0.1>	٩.0	<1.0	<1.0	1. 0	1. 0	
Zinc	790	740	700	700	700	750	2500

< - Indicates element was analyzed for but not detected, and that its concentration is less than the indicated detection limit.

** - Indicates concentration exceeds Type Π criteria.

PHASE 2 PRIMARY SLUDGE ANALYSIS VOLATILE ORGANICS (ug/kg)

	(Sludge Cake)					
	May 8	May 9	May 10	May 16	May 17	May 18
Volatile Organics	1989	1989	1989	1989	1989	1989
Benzene	<10	<10	<10	<10	<10	<10
Bromodichloromethane	<10	<10	<10	<10	<10	<10
Bromoform	<10	<10	<10	<10	<10	<10
Bromomethane	<50	<50	<50	<10	<10	<10
Carbon Tetrachloride	<10	<10	<10	<10	<10	<10
Chlorobenzene	<10	<10	<10	<10	<10	<10
Chloroethane	<50	<50	<50	<10	<10	<10
2-Chloroethylvinyl Ether	<50	<50	<50	<10	<10	<10
Chloroform	310	<10	<10	10	21	18
Choromethane	<50	<50	<50	<10	<10	<10
Dibromochloromethane	<10	<10	<10	<10	<10	<10
Dichlorodifluoromethane	<10	<10	<10	<10	<10	<10
1,2 Dichlorobenzene	<10	<10	<10	<10	<10	<10
1,3 Dichlorobenzene	<10	<10	<10	<10	<10	<10
1,4 Dichlorobenzene	1,200	<10	<10	40	52	36
1,1-Dichloroethane	<10	<10	<10	<10	<10	<10
1,2-Dichloroethane	<10	<10	<10	<10	<10	<10
1,1-Dichloroethene	<10	<10	<10	<10	<10	<10
1,2-Dichloroethene	310	<10	<10	<10	<10	<10
C-1,2-Dichloroethene	<10	<10	<10	<10	<10	<10
T-1,2-Dichloroethene	<10	<10	<10	<10	<10	<10
1,2-Dichloropropane	<10	<10	<10	<10	<10	<10
cis-1,3-Dichloropropene	<10	<10	<10	<10	<10	<10
trans-1,3-Dichloropropene	e <10	<10	<10	<10	<10	<10
Ethylbenzene	1,800	500	770	50	260	230
Methylene Chloride	<10	<10	<10	<10	<10	<10
1,1,2,2-tetrachloroethane	e <10	<10	<10	<10	<10	<10
Tetrachloroethene	2,400	400	<10	30	42	36

(Continued)

PHASE 2 PRIMARY SLIDGE ANALYSIS VOLATILE ORGANICS (ug/kg)

Volatile Organics	(Sludge Cake) May 8 1989	(Sludge Cake) May 9 1989	(Sludge Cake) May 10 1989	(Sludge Cake) May 16 1989	(Sludge Cake) May 17 1989	(Sludge Cake) May 18 1989
Toluene	3,500	1,700	480	230	600	440
1,1,1-Trichloroethane	<10	<10	<10	<10	<10	<10
1,1,2-Trichloroethane	<10	<10	<10	<10	<10	<10
Trichloroethene	520	100	<10	<10	21	<10
Trichlorofluoromethane	<10	<10	<10	<10	<10	<10
Vinyl Chloride	<10	<10	<10	<10	<10	<10
Carbon Disulfide	<10	<10	<10	35	31	18
Acetone	<200	160,000	<200	6,800	8,800	12,000
Vinyl Acetate	<200	<200	<200	<10	<10	<10
2-Butanone	<200	<200	<200	<10	<10	<10
4-Methyl-2-pentanone	8,400	3,600	<200	<10	<10	<10
2-Hexanone	<200	<200	<200	<10	<10	<10
Styrene	<200	<200	<200	<10	<10	<10
Total Xylenes	6,600	2,200	<200	220	840	730

< - Indicates compound was analyzed for but not detected, and that its concentraction is less than the detection limit.

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PHASE 2 PRIMARY SLUDGE ANALYSIS SEMI-VOLATILE ORGANICS

(mg/kg)

	(Sludge Cake)	(Sludge Cake)				
	May 8	May 9	May 10	May 16	May 17	May 18
Semi-Volatile Organics	1989	1989	1989	1989	1989	1989
Phenol	<75	<76	<68	<69	<71	<75
bis(2-chloroethyl)ether	<75	<76	<68	<69	<71	<75
2-chlorophenol	<75	<76	<68	<69	<71	<75
1,3-Dichlorobenzene	<75	<76	<68	<69	<71	<75
1,4-Dichlorobenzene	<75	<76	<68	<69	<71	<75
Benzyl alcohol	<75	<76	<68	<69	<71	<75
1,2-Dichlorobenzene	<75	<76	<68	<69	<71	<75
2-Methylphenol	<75	<76	<68	<69	<71	<75
bis(2-Chloroisopropyl)ethe	r <75	<76	<68	<69	<71	<75
4-Methylphenol	<75	<76	<68	<69	<71	<75
N-Nitroso-di-n-propylamine	<75	<76	<68	<69	<71	<75
Hexachloroethane	<75	<76	<68	<69	<71	<75
Nitrobenzene	<75	<76	<68	<69	<71	<75
Isophorone	<75	<76	<68	<69	<71	<75
2-Nitrophenol	<75	<76	<68	<69	<71	<75
2,4-Dimethylphenol	<75	<76	<68	<69	<71	<75
Benzoic Acid	<360	<370	<330	<330	<340	<360
bis(2-chloroethoxy)methane	<75	<76	<68	<69	<71	<75
2,4-Dichlorophenol	<75	<76	<68	<69	<71	<75
1,2,4-Trichlorobenzene	<75	<76	<68	<69	<71	<75
Naphthalene	<75	<76	<68	<69	<71	<75
4-Chloroaniline	<75	<76	<68	<69	<71	<75
Hexachlorobutadiene	<75	<76	<68	<69	<71	<75
4-Chloro-3-methylphenol	<75	<76	<68	<69	<71	<75
2-Methylnaphthalene	<75	<76	<68	<69	<71	<75
Hexachlorocyclopentadiene	<75	<76	<68	<69	<71	<75
2,4,6-Trichlorophenol	<75	<76	<68	<69	<71 ·	<75
2,4,5-Trichlorophenol	<360	<370	<330	<330	<340	<360
2-Chloronaphthalene	<75	<76	<68	<69	<71	<75
2-Nitroaniline	<360	<76	<330	<330	<340	<360
Dimethylphthalate	<75	<370	<68	<69	<71	<75
Acenaphthylene	<75	<76	<68	<69	<71	<75
3-Nitroaniline	<360	<370	<330	<330	<340	<360

(Continued)

PHASE 2 PRIMARY SLUDGE ANALYSIS SEMI-VOLATILE ORGANICS (ng/kg)

	(Sludge Cake)					
	May 8	May 9	May 10	May 16	May 17	May 18
Semi-Volatile Organics	1989	1989	1989	1989	1989	1989
Acenaphthene	<75	<76	<68	<69	<71	<75
2,4-Dinitrophenol	<360	<370	<330	<330	<340	<360
4-Nitrophenol	<360	<370	<330	<330	<340	<360
Dibenzofuran	<75	<76	<68	<69	<71	<75
2,4-Dinitrotoluene	<75	<76	<68	<69	<71	<75
2,6-Dinitrotuluene	<75	<76	<68	<69	<71	<75
Diethylphthalate	<75	<76	<68	<69	<71	<75
4-Chlorophenyl-phenyl ethe	r <75	<76	<68	<69	<71	<75
Fluorene	<75	<76	<68	<69	<71	<75
4-Nitroaniline	<360	<370	<330	<330	<340	<360
4,6-Dinitro-2-methylphenol	<360	<370	<330	<330	<340	<360
N-Nitrosodiphenylamine	<75	<76	<68	<69	<71	<75
4-Bromophenyl-phenyl ether	<75	<76	<68	<69	<71	<75
Hexachlorobenzene	<75	<76	<68	<69	<71	<75
Pentachlorophenol	<360	<370	<330	<330	<340	<360
Pentanthrene	<75	<76	<68	<69	<71	<75
Anthracene	<75	<76	<68	<69	<71	<75
Di-n-butylphthalate	<75	<76	<68	<69	<71	<75
Fluoanthene	<75	<76	<68	<69	<71	<75
Pyrene	<75	<76	<68	<69	<71	<75
Butylbenzylphthalate	<75	<76	<68	<69	<71	<75
3,3-Diclorobenzidine	<150	<150	<140	<140	<140	<150
Benzo(a)anthracene	<75	<76	<68	<69	<71	<75
Chrysene	<75	<76	<68	<69	<71	<75
bis(2-Ethylhexyl)phthalate	e 100	<76	<68	77	<71	77
Di-n-octylphthalate	<75	<76	<68	<69	<71	<75
Benzo(b)fluoranthene	<75	<76	<68	<69	<71	<75
Benzo(k)fluoranthene	<75	<76	<68	<69	<71	<75
Benzo(a)pyrene	<75	<76	<68	<69	<71	<75
Indeno(1,2,3-c,d)pyrene	<75	<76	<68	<69	<71	<75
Dibenz(a,h)anthracene	<75	<76	<68	<69 *	<71	<75
Benzo(g,h,i)perylene	<75	<76	<68	<69	<71	<75

K - Indicates compound was analyzed for but not detected and that its concentraction is less than the detection limit.

PHASE 2 PRIMARY SLIDGE ANALYSIS PESTICIDES/PCBs (ng/kg)

							Allowable
	(Sludge Cake) May 8	(Sludge Cake) May 9	(Sludge Cake) May 10	(Sludge Cake) May 16	(Sludge Cake) May 17	(Sludge Cake) May 18	conc. in ppm Dry Wt.
Pesticide/PCB	1989	1989	1989	1989	1989	1989	Туре П
alpha-BHC	<1.0	<1.0	<0.4	<0.25	<0.25	<0.25	
gamma-BHC	<1.0	<1.0	≪0.4	<0.25	<0.25	<0.25	
beta-BHC	<1.0	<1.0	<0.4	<0.25	<0.25	<0.25	
delta-BHC	<1.0	<1.0	<0.4	<0.25	<0.25	<0.25	
Heptachlor	<1.0	<1.0	<0.4	<0.25	<0.25	<0.25	
Aldrin	<1.0	<1.0	<0.4	<0.25	<0.25	<0.25	
Heptachlor Epoxide	e <1.0	<1.0	<0.4	<0.25	<0.25	<0.25	
Endosulfan I	<1.0	<1.0	<0.4	<0.25	<0.25	<0.25	
4,4'-DDE	<1.0	<1.0	<0.4	<0.25	<0. 25	<0.25	
Dieldrin	0.1>	<1.0	<0.4	<0.25	<0.25	<0.25	
Endrin	0.1>	<1.0	<0.4	<0.25	<0. 25	<0.25	
4,4'-DDD	0.1>	3.0	<0.4	0.75	40.25	<0.25	
Endosulfan II	0.1>	<1.0	<0.4	<0.25	<0.25	<0.25	
4,4'-DDT	0.1>	0.1>	0.55	<0.25	<0. 25	<0.25	
Endrin Aldehyde	0.1>	0.1>	<0.4	<0.25	<0. 25	<0.25	
Endosulfan Sulfate	a (1. 0	1. 0	≪0.4	<0.25	40. 25	<0.25	
Methoxychlor	1.0	1. 0	≪0.4	<0. 25	<0.25	<0.25	
Chlordane	<2.0	<2.0	<0.7	<0.5	<0.5	<0.5	
Toxaphene	<2.0	<2.0	<0.7	≪0.5	≪0.5	<0.5	
Arochlor-1016	<2.0	<2.0	<0.7	<1.5	<1.5	<1.5 :	
Arochlor-1221	<2.0	<2.0	<0.7	<1.5	<1.5	<1.5 :	
Arochlor-1232	<2.0	<2.0	<0.7	<1.5	<1.5	<1.5 :	
Arochlor-1242	3.8	3.1	2.1	5.3	5.9	4.7 :	Total
Arochlor-1248	<2.0	<2.0	<0.7	<1.5	<1.5	<1.5 :	of 10
Arochlor-1254	3.8	3.5	3.0	5.6	6.6	5.8 :	
Arochlor-1260	<2.0	<2.0	<0.7	<1.5	<1.5	<1.5 :	

< - Indicates compound was analyzed for but not detected, and that its concentration is less than the detection limit.

DEQE Max.

PHASE 2 PRIMARY SLUCCE ANALYSIS NUTRIENTS AND pH (mg/kg)

Parameter	(Sludge Cake) May 8 1989	(Sludge Cake) May 9 1989	(Sludge Cake) May 10 1989	(Sludge Cake) May 16 1989	(Sludge Cake) May 17 1989	(Sludge Cake) May 18 1989
Nitrogen, Total	20,600	9,530	12,400	16,300	3,920	3,160
Ammonia as N	4,000	2,680	1,910	2,460	2,440	2,280
Nitrate as N	215	<15	<15	<15	<15	<15
Phosphorous	1,940	2,720	2,430	1,980	1,530	1,390
Potassium	720	700	700	660	690	620
pH (pH units)	5.73	5.59	5.45	5.69	5.75	5.92

AIR SAMPLING ANALYSIS SPECIFIC VOC COMPOUNDS (ng)

	TPI 2A,2B	TPI 3A,3B	TPI 4A,4B	TPI 5A,5B	TPI 6A,6B	ТРІ 7А,7В	TPI 8A,8B
Benzene	140	140	180	41	210	420	650
Bromodichloromethane	85	100	ND	27	ND	ND	ND
Chlorobenzene	ND	42	ND	ND	ND	ND	ND
Chloroform	530	680	ND	220	ND	1,100**	2,400**
1,1 Dichloroethane	ND	ND	ND	ND	ND	ND	61
1,1 Dichloroethene	ND	56	40	ND	580	ND	620
Ethylbenzene	300	460	1,400**	220	1,700**	1,800**	5,600**
Methylene Chloride	250	170	510	ND	7,300**	320	5,800**
Tetrachloroethene	380	1,400**	1,300**	110	960	1,000	6,800**
Toluene	2,100**	2,600**	24,000**	930	40,000**	5,100**	90,000**
1,1,1-Trichloroethane	640	1,500**	1,400**	370	18,000**	1,800**	16,000**
Trichloroethene	920	980	950	360	2,700**	1,100**	6,100**
Trichloroflouromethane	ND	83	330	ND	110	52	5,900**
Vinyl Chloride	37	ND	ND	ND	ND	ND	ND
Acetone	170	240	130	110	680	265	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	160
Z-Butanone	ND	ND	ND	ND	ND	ND	990
Vinyl Acetate	ND	ND	870	ND	ND	ND	240
Total Xylene	1,900**	3,000**	6,400**	1,700**	8,100**	4,400**	46,000**
Methyl-t-Butylether	ND	55	ND	ND	ND	ND	ND
TOTAL	7,452	11,506	37,510	4,088	80,340	17,357	187,321

** - Exceeded calibration range

.

TOTAL NON-METHANE ORGANICS RESULTS

	CONCENTR	CONCENTRATIONS		
	METHANE	TNMO		
SAMPLE ID	(ppm)	(ppm)		
NB-AIR-TPI-1C	8.57	ND		
NB-AIR-TPI-2C	21.2	ND		
NB-AIR-TPI-3C	12.6	ND		
NB-AIR-TPI-4C	9.76	ND		
NB-AIR-TPI-5C	TRACE	TRACE		
NB-AIR-TPI-6C	ND	TRACE		
NB-AIR-TPI-7C	ND	TRACE		
NB-AIR-TPI-8C	48.2	14.2		

ND - Not detected at <5 ppm.

TRACE - Detected at <5 ppm.

QA/QC PROJECT PLAN

FOR

CITY OF NEW BEDFORD, MASSACHUSETTS WWTP PHASE II FACILITIES PLANNING FOR SLUDGE AND AIR SAMPLING PROGRAM

Prepared by: Camp Dresser & McKee Inc. One Center Plaza Boston, MA 02108

August 1988

Rev. May 1989
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1.0 Introduction

An integral component of the City of New Bedford's Phase II Facilities Planning for Wastewater Treatment and Sludge Disposal is the collection of representative sludge and air samples and assurance of sample integrity during processing and analysis. The purpose of this document is to identify the quality control and quality assurance steps required to achieve these goals. This document conforms in detail with the requirements of EPA.

- 2.0 Project Description
- 2.1 Objectives

The sampling program is designed to produce data of known and acceptable quality to be used for two primary purposes:

- To evaluate non-conventional pollutants in the sludge generated at the existing plant and determine the impacts it has on sludge disposal alternatives.
- To evaluate air quality impacts at the existing plant, primarily focused on the expected level of VOC emissions and the odor potential of the wastewater.
- 2.2 Monitoring Locations

Samples will be taken at specific, predetermined locations as shown on Figures 2.1 and 2.2 and as described below:

Sludge Sampling

Grab samples of gravity thickened sludge will be collected at the sampling spigots located on the discharge side of the gravity thickener sludge pumps.

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Grab samples of dewatered sludge cake will be collected at the discharge end of the centrifuges.

Air Sampling

Air sampling will be taken from the plant's influent channel immediately downstream of the mechanical screens, below the grating.

2.3 Monitoring Parameters and Frequency of Collection

Sludge Sampling

The liquid sludge sampling program will consist of three sampling days per week for two consecutive weeks for a total of six sample days, to examine sludge variability. Grab samples of thickened primary sludge will be taken every 6 hours, beginning at 8 AM, each sampling day. For each sampling day 4 grab samples will be collected, composited and analyzed for priority pollutant (PP) metals plus boron, molybdenum and cyanide, PP/HSL ABN's, pesticides/PCB's, and nutrients. One daily composite sample per week will be analyzed for EP toxicity. An additional 4 grab samples of thickened primary sludge will be taken per sampling day, and composited and analyzed for PP/HSL VOC's.

The sludge cake sampling program will consist of three sampling days per week for two consecutive weeks for a total of six sample days, to examine sludge variability. One grab sample of dewatered sludge will be taken each sampling day. Each grab will be analyzed for priority pollutant metals plus boron, molybdenum and cyanide, PP/HSL ABN's, pesticides/PCB's and nutrients. An additional grab of cake will be collected each sampling day and analyzed for PP/HSL VOC's.

Air Sampling

The air sampling program will be conducted on two separate days, spaced out by one week as a minimum. Four grab sample sets will be collected over a twelve hour period each sampling day (8:00 AM - 8:00

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PM). Each grab sample set will be analyzed for total non-methane organic (TNMO) compounds and selected volatile organic compounds (VOC's). The selected individual PP/HSL VOC's will be identified and quantified. Non-HSL components present in the gas stream will be tentatively identified using EPA/NBS/NIH library search.

2.4 Data Usage

The data will be used to project future non-conventional pollutants in the residual sludges that will be generated from a new secondary treatment facility. The data will also be used to evaluate if anaerobic digestion will be inhibited by the non-conventional pollutants in the sludge. Threshold limits for anaerobic digestion are presented in Table 2.1. The data will also be used to classify the sludge type, in accordance to the Massachusetts Land Application Regulations to evaluate land disposal suitability. Criteria for classification of sludge is presented in Table 2.2. EP toxicity results will be compared to EPA's RCRA Maximum Allowable limits. If the sludge is to be classified as non-hazardous, it must not exceed the limits presented in Table 2.3. The air quality data will be used to estimate total VOC emissions generated from a new secondary treatment facility, and then evaluate the need for and magnitude of ozone precursor controls and for screening of air toxics based on the State's Chem/AAL guidelines. The Massachusetts allowable ambient levels for air are presented in Table 2.4.

2.5 Monitoring Network Design and Rationale

The sludge samples taken will be indicative of the mass/contaminant loading of the new proposed plant. The liquid sludge sampling procedures have been designed so the samples taken are representative of the entire volume of thickened primary sludge processed during a specific sampling interval.

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ANAEROBIC DIGESTION THRESHOLD INHIBITION LEVELS

Pollutant	Recommended Inhibition Threshold* (mg/l)
Metals/Nonmetal Inorganics	
Codmium	20
	110
	110
Chromium (III)	130
Copper	40
Lead	340
Nickel	10
Zinc	400
Arsenic	1.6
Silver	13**
Cyanide	4
Ammonia	1500
Sulfate	500
Sulfide	50
Organics	
Acrylonitrile	5
Carbon Tetrachloride	2.9
Chlorobenzene	0.96
Chloroform	1
1,2-Dichlorobenzene	0.23
1,4-Dichlorobenzene	1.4
Methylchloride	3.3
Pentachlorophenol	0.2
Tetrachloroethylene	20
Trichloroethylene	1

*Total pollutant inhibition levels, unless otherwise indicated **Dissolved metal inhibition levels

MASSACHUSETTS D.E.Q.E. LAND APPLICATION OF SLUDGE CRITERIA

	Maximum Allowable Concentration (mg/kg)				
Heavy Metals or Chemicals	<u>Type I</u>	Type II	<u>Type III</u>		
Boron (Water Soluble)	300	300	*		
Cadmium	2	25	*		
Chromium (Total)	1,000	1,000	*		
Copper	1,000	1,000	*		
Lead	300	1,000	*		
Mercury	10	10	*		
Molybdenum	10	10	*		
Nickel	200	200	*		
Zinc	2,500	2,500	*		
PCB's	2	10	*		

*Type III if the concentration of any substance exceeds any Type II sludge limit.

EP TOXICITY LIMITATIONS

Pollutant	Maximum Concentration (mg/l)
Arsenic	5.0
Barium	100.0
Cadmium	1.0
Chromium	5.0
Lead	5.0
Mercury	0.2
Selenium	1.0
Silver	5.0
Endrin	0.02
Lindane	0.4
Methoxychlor	10.0
Toxaphene	0.5
2,4-D	10.0
2,4,5-TP	1.0

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AIR QUALITY LIMITS

Chaminal	Allowable Ambient Level
chemical	(pp0)
Acetone	68.03
Benzene	0.04
Chlorodaine	0.002
Chlorobenzene	1.36
Chloroethane	136.05
Chloroform	0.01
p-Cresol	2.72
2-Dichlorobenzene	13.61
4-Dichlorobenzene	0.03
1,2-Dichloroethane	0.01
1,2-Dichloroethylene	27.21
Dichloromethane	0.07
1,2-Dichloropropane	0.01
Di(2-Ethylhexyl)Phthalate	0.05
Ethylbenzene	27.21
2-Hexanone	2.66
Methyl Bromide	0.68
Napthalene	2.72
Nitrobenzene	1.36
Pentachlorophenol	0.001
Phenol	13.61
Styrene	0.41
1,1,2,2-Tetrachloroethene	68.03
1,1,2,2-Tetrachloroethane	0.003
Tetrachloroethylene	0.003
Toluene	2.72
1,1,1-Trichloroethane	190.48
1,1,2-Trichloroethane	0.01
Trichloroethylene	0.11
2,4,6-Trichlorophenol	
Vinyl Acetate	2.72
Vinyl Chloride	0.15
Xylenes	2.72
Methyl Isobutyl Ketone	13.61
-	

3.0 Schedule of Tasks and Products

Task schedule for the sampling program is as follows:

Date	Task Description
September 21, 1988	Receive Approvals from DEQE and EPA on sampling program
September 22, 1988	Sampling site visit by CDM personnel
September 23, 1988	Equipment installation starts
September 26, 1988	Equipment installation complete
September 26, 1988	Sampling period begins
September 26, 1988	Air Sampling period ends
October 3, 1988	Sludge sampling period ends
October 21, 1988	Sampling data available and Technical Memorandum submitted
May 8, 1989	Sludge cake sampling begins
May 18, 1989	Sludge cake sampling ends
June 15, 1989	Sampling data available and Technical Memorandum submitted

4.0 Project Organization and Responsibility.

The sampling program will be conducted under the overall supervision of Camp Dresser & McKee Inc. The individuals and their roles in this program are described below:

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William F. Callahan (Senior Vice President/CDM): Monitors overall project to assure applicability of sampling to other tasks in the Facility Plan effort.

James W. Small (Project Manager/Program QA/QC Officer/CDM): Responsible for the sampling program QA, and audits and corrective action.

William J. Hotz (Project Engineer/Project QA/QC Coordinator/CDM Field Work): Responsible for validating data and insuring that the data meets the planned objectives. Responsible for day-to-day field work coordination. Co-Author of field portion of QA/QC Plan.

Donald Muldoon (Laboratory Manager and QA/QC Officer/CDM): Overall responsibility for CDM lab work and subcontract laboratories.

James F. Occhialini (Laboratory Supervisor/CDM): Responsible for CDM's day-to-day analytical services.

Lab Chemists - CDM has 8 chemists that will perform the sample analysis. Approximately 1 of the chemists will be exclusively on this project.

Sampling Technicians - CDM will have 2 technicians to perform the actual sampling. These technicians will have had training in sampling techniques.

5.0 Data Quality Requirements and Assessments.

A major requirement of every sampling and analytical plan is to assure that all data collected be of known and acceptable quality. The concept of data quality refers to a quantitative estimate of the level of uncertainty associated with a data set. This section specifies a level of data quality for each parameter being investigated that is consistent with the purpose of the sampling event and the use of the data. It is important to note that the assurance of proper data

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quality begins with the writing of the project's Sampling and Analytical Plan, the adherence to the specified sampling operating procedures, sample custody procedures, and laboratory QA/QC procedures, and ends with the data validation process.

Data quality requirements are specified using the precision, accuracy, representatives, completeness, and comparability (PARCC) criteria. Analytical parameters to be used in the sludge testing are listed in Table 5.1. Sample preparation/extraction for sludge testing shall be acid digestion for metals analysis. For each testing parameter, Table 5.1 lists the testing method, the proposed detection limit, the sample preservation requirements and the maximum sample holding times. A brief discussion of each PARCC parameter and the associated QA/QC tasks is presented in this section. Table 5.2 lists the quality assurance objectives for the applicable parameters. The VOST air sample tubes will be analyzed via purge and trap gas chromatography/mass spectrometry. The analytical procedures are as described in SW-846 Method 5040 which utilizes thermal desorbtion of the Tenax and Tenax-Charcoal cartridges. Detection limits of individual VOC's in the air sample will be 0.1 to 0.5 ug/m^3 . TNMO analysis of air samples will be performed using gas chromatograph (FID) operated in the methane/nonmethane mode. This instrument uses a backflush valve to facilitate the analysis of methane and total back-flushable organics. Detection limits will be approximately 5 ppmv as methane and 20 ppmv as propane.

5.1 Precision

The criterion of precision is a measure of the reproducibility of a given group of analyses under a given set of conditions. The overall precision of environmental monitoring data is the sum of the sampling precision and the analytical precision. Sampling precision is a function of the standard operating procedure used to collect the sample and the variability and/or homogeneity of the media being sampled. Analytical precision is a function of the procedure used, the analyst's technique, instrument performance and sample

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	CTI 0//6	Required			
	Sw 040 Method	Detection	Sample	Sample	Holding
Parameter	For Solids	Level	Matrix	Preservation	Time
Total Metals:*					
Antimony	EPA 7041	2.5 mg/kg	sludge	HNO3 bH2	6 months
Arsenic	EPA 7060	0.5 mg/kg	sludge	HNO ₃ <ph2< td=""><td>6 months</td></ph2<>	6 months
Barium	EPA 6010	5.0 mg/kg	sludge	HNO ₃ <ph2< td=""><td>6 months</td></ph2<>	6 months
Beryllium	EPA 6010	1.0 mg/kg	sludge	HNO ₃ <ph2< td=""><td>6 months</td></ph2<>	6 months
Boron	EPA 6010	5.0 mg/kg	sludge	HNO_ <ph2< td=""><td>6 months</td></ph2<>	6 months
Cadmium	EPA 6010	1.0 mg/kg	sludge	HNO_ <ph2< td=""><td>6 months</td></ph2<>	6 months
Chromium	EPA 6010	2.0 mg/kg	sludge	HNO ₃ <ph2< td=""><td>6 months</td></ph2<>	6 months
Copper	EPA 6010	2.0 mg/kg	sludge	HNO ₃ <ph2< td=""><td>6 months</td></ph2<>	6 months
Lead	EPA 7421	0.5 mg/kg	sludge	HNO ₃ <ph2< td=""><td>6 months</td></ph2<>	6 months
Mercury	EPA /4/1	0.1 mg/kg	sludge	HNO ₃ <ph2< td=""><td>28 days</td></ph2<>	28 days
Molybdenum	EPA 6010	5.0 mg/kg	sludge	HNO ₃ <ph2< td=""><td>6 months</td></ph2<>	6 months
Nickel	EPA 6010	2.0 mg/kg	sludge	HNO ₃ <ph2< td=""><td>6 months</td></ph2<>	6 months
Selenium	EPA //40	2.5 mg/kg	sludge	HNO ₃ <ph2< td=""><td>6 months</td></ph2<>	6 months
Silver	EPA 6010	2.0 mg/kg	sludge	HNO ₃ <ph2< td=""><td>6 months</td></ph2<>	6 months
Thallium	EPA /841	2.5 mg/kg	sludge		6 months
Zinc	EPA 6010	2.0 mg/kg	studge	HINO3 <dhz< td=""><td>6 months</td></dhz<>	6 months
Volatile Organics:**					
Acrolein	EPA 8240	100 ug/kg	sludge	Cool, 4°C	7 days
Acrylonitrile	EPA 8240	100 ug/kg	sludge	Cool, 4°C	7 days
Chloromethane	EPA 8240	10 ug/kg	sludge	Cool, 4°C	7 days
Bromomethane	EPA 8240	10 ug/kg	sludge	Cool, 4°C	7 days
Vinyl Chloride	EPA 8240	10 ug/kg	sludge	Cool, 4°C	7 days
Chloroethane	EPA 8240	10 ug/kg	sludge	Cool, 4°C	7 days
Methylene Chloride	EPA 8240	10 ug/kg	sludge	Cool, 4°C	7 days
Trichlorofluoromethane	EPA 8240	10 ug/kg	sludge	Cool, 4°C	/ days
1,1-Dichloroethylene	EPA 8240	10 ug/kg	sludge	Cool, 4°C	/ days
1,1-Dichloroethane	EPA 8240	10 ug/kg	sludge	Cool, 4°C	/ days
Trans-1,2-Dichloroethylene	EPA 8240	10 ug/kg	sludge	Cool, 4°C	/ days
Chloroform	EPA 8240	10 ug/kg	sludge	Cool, 4°C	/ days
1,2-Dichloroethane	EPA 8240	10 ug/kg	sludge	Cool, 4°C	/ days
1,1,1-Trichloroethane	EPA 8240	10 ug/kg	sludge	Cool, 4°C	/ days
Carbon Tetrachloride	EPA 8240	10 ug/kg	sludge	Cool, 4°C	/ days
Bromodichloromethane	EPA 8240	10 ug/kg	sludge	Cool, 4°C	/ days
1,2-Dichloropropane	EPA 8240	10 ug/kg	studge	Cool, 4°C	/ days
Trans-1,3-Dichloropropene	EPA 8240	10 ug/kg	sludge	Cool, 4°C	/ days
Dibromochloromethan	EPA 8240	10 ug/kg	sludge	Cool, 4°C	/ days
CIS-1,3-Dichloropropene	EPA 8240	10 ug/kg	studge	Cool, 4°C	/ days
1,1,2-Trichloroethylene	EPA 8240	10 ug/kg	studge	Cool, 4°C	7 days
benzene	EPA 8240	IU Ug/kg	studge		/ days
2-chloroethylvinylether	EPA 8240	IU Ug/Kg	studge	Cool, 4°C	/ days
	EPA 8240		studge	$\frac{1}{2}$	7 days
letrachioroethylene	EPA 8240		studge	$1001, 4^{\circ}C$	/ days
1.1.2.2-letrachloroethane	EPA 8240	TO UE/KE	strage	0001.4°C	/ davs

*Sample Preparation/Extraction by Acid Digestion Method 3050. **Sample Preparation/Extraction by Method 3540 or 3550.

TABLE 5.1 ANALYTICAL PARAMETERS (Cont'd)

	SV 846	Minimum			
	Method	Detection	Sample	Sample	Holding
Parameter	For Solids	Level	Matrix	Preservation	Time
Toluene	EPA 8240	10 ug/kg	sludge	Cool. 4°C	7 davs
Chlorobenzene	EPA 8240	10 ug/kg	sludge	Cool. 4°C	7 davs
Ethylbenzene	EPA 8240	10 ug/kg	sludge	Cool, 4°C	7 days
4-Methyl 2-Pentatone	EPA 8240	25 ug/kg	sludge	Cool, 4°C	7 days
2-Hexanone	EPA 8240	25 ug/kg	sludge	Cool, 4°C	7 days
Acetone	EPA 8240	25 ug/kg	sludge	Cool, 4°C	7 days
Styrene	EPA 8240	10 ug/kg	sludge	Cool, 4°C	7 days
Total Xylenes	EPA 8240	10 ug/kg	sludge	Cool, 4°C	7 days
Carbon Disulfide	EPA 8240	25 ug/kg	sludge	Cool, 4°C	7 days
Vinyl Acetate	EPA 8240	25 ug/kg	sludge	Cool, 4°C	7 days
2-Butanone	EPA 8240	25 ug/kg	sludge	Cool, 4°C	7 days
Semi-Volatile Organics:					
N-Nitrosodimethylamine	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
					analysis
Phenol	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days
			-		extraction
					28 days
					analysis
Bis(2-Chloroethyl)Ether	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days
					extraction
					28 days
2 Chlavarhana]		100	aludaa	Cas] //0C	analysis 7 daug
2-untorophenot	EPA 8270	TOO UE/KE	strage	001, 4°C	/ days
					28 dava
			,		20 uays analysis
1.3-Dichlorobenzene	EPA 8270	100 ug/kg	sludæ	Cool. 4°C	7 days
1,5-DIGHOLOBELEIR	Lan 02/0	100 08/18	STUDEC		extraction
					28 days
					analysis1.
4-Dichlorobenzene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days
		0.0	U	,	extraction
					28 days
					analysis
1,2-Dichlorobenzene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days
					extraction
					28 days
					analysis
Bis(2-Chloroisopropy1)Ether	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days
					extraction
					28 days
N Nitroso Di N Duomilamine	FDA 9770	100 100/100	aludaa		analysis 7 dour
14-141 (1020-DT-14-LTODATSHITUE	EFA 02/U	TOO URVER	straße	001, 4°C	/ uays
					28 dave
					analysis

Parameter	SW 846 Method For Solids	Required Minimum Detection Level	Sample Matrix	Sample Preservation	Holding
Hexachloroethane	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Nitrobenzene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Isophorone	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
2-Nitrophenol	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
2,4-Dimethylphenol	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Bis(2-Chloroethoxy) Methane	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
2,4-Dichlorophenol	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Naphthalene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Hexachlorobutadiene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
P-Chloro-M-Cresol	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Hexachlorocyclopentadiene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
2,4,6-Trichlorophenol	EPA 8270	100 ug/kg	sludge	Cool, 4⁰C	7 days extraction 28 days analysis

TABLE 5.1 ANALYTICAL PARAMETERS (Cont'd)

.

	Parameter	SW 846 Method For Solids	Required Minimum Detection Level	Sample Matrix	Sample Preservation	Holding
	2-Chloronaphthalene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	Dimethyl Phthalate	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	Acenaphthylene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	Acenaphthene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	2,4-Dinitrophenol	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Ò	4-Nitrophenol	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	2,4-Dinitrotoluene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	4-Nitrophenol	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	2,4-Dinitrotoluene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	2,6-Dinitrotoluene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	Diethyl Phthalate	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	4-Chloropheny Phenyl Ether	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis

Parameter	SW 846 Method For Solids	Required Minimum Detection Level	Sample . Matrix	Sample Preservation	Holding Time
Fluorene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
N-Nitrosodiphenylamine	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Hexachlorobenzene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Phenanthrene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Anthracene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Di-N-Butyl Phthalate	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Fluoranthene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Benzidine	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Pyrene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Butylbenzyl Phthalate	EPA 8270	100 ug/kg	sludge	Cool, 4°C	analysis 7 days extraction 28 days
3,3-Dichlorobenzidine	EPA 8270	100 ug/kg	sludge	Cool, 4°C	analysis 7 days extraction 28 days
Benzo(A)Anthracene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	analysis 7 days extraction 28 days analysis

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Parameter	SW 846 Method For Solids	Required Minimum Detection Level	Sample Matrix	Sample Preservation	Holding Time
Bis(2-Ethylhexyl)Phthalate	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Chrysene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Di-N-Octyl Phthalate	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Benzo(K)Fluoranthene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Benzo(A)Pyrene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Indeno(1,2,3-C,D)Pyrene	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Benzo(G,H,I)Perylene	EPA 8270	100 ug/kg	sludge	Cool, 4ºC	7 days extraction 28 days analysis
1,2-Diphenyl-Hydrazine	EPA 8270	100 ug/kg	sludge	Cool, 4ºC	7 days extraction 28 days analysis
P-Chloro-M-Cresol	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
4,6-Dinitro-O-Cresol	EPA 8270	100 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Pesticides:					
Aldrin	EPA 8080	0.5 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis

Parameter	SW 846 Method For Solids	Required Minimum Detection Level	Sample <u>Matrix</u>	Sample Preservation	Holding Time
Alpha-BHC	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Beta-BHC	EPA 8080	500 ug/kg	sludge	Cool, 4°C	analysis 7 days extraction 28 days analysis
Gamma-BHC	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Delta-BHC	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Technical Chlordane	EPA 8080	500 ug/kg	sludge	Cool, 4ºC	7 days extraction 28 days analysis
4,4-DDT	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
4,4-DDE	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
4,4-DDD	EPA 8080	500 ug/kg	sludge	Cool, 4℃	7 days extraction 28 days analysis
Dieldrin	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Endosulfan I	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Endosulfan II	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
Endosulfan Sulfate	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis

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	Parameter	SW 846 Method For Solids	Required Minimum Detection Level	Sample <u>Matrix</u>	Sample Preservation	Holding Time
	Endrin	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days
	Endrin Aldehyde	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	Endrin Keytone	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
•	Heptachlor	EPA 8080	500 ug/kg	sludge	Cool, 4ºC	7 days extraction 28 days analysis
	Heptachlor Epoxide	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	Methoxychlor	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	Toxaphene	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	PCBs:					
	Arochlor 1016	EPA 8080	1000 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	Arochlor 1221	EPA 8080	1000 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	Arochlor 1232	EPA 8080	1000 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
	Arochlor 1242	EPA 8080	1000 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis

TABLE 5.1 ANALYTICAL PARAMETERS (Cont'd)

Parameter	SW 846 Method For Solids	Required Minimum Detection Level	Sample Matrix	Sample Preservation	Holding Time
Arochlor 1248	EPA 8080	1000 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Arochlor 1254	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis
Arochlor 1260	EPA 8080	500 ug/kg	sludge	Cool, 4°C	7 days extraction 28 days analysis

Method References

Methods with SM prefix	Standard Methods for the Examination of Water and sludge APHA/AWWA/WPCF 16th Edition 1985
Method Nos. 100-499	Methods for Chemical Analysis of Water and Wastes EPA-600/4-79-020 Revised March 1983
Method Nos. 600-699	Methods for Organic Chemical Analysis of Municipal and Industrial sludge EPA-600/4-82-057 July 1982
Method SW846	Test Methods for Evaluating Solid Waste, November, 1986, Third Edition

TABLE 5.2 QUALITY ASSURANCE OBJECTIVES

Program QC Sa <u>Blanks</u> 1/20(5%)	Metals 80 - 120 20 Volatile Organics 75 - 120 25 Semi-Volatile Organics 35 - 110 50 Pesticide/PCBs 75 - 120 40	ParameterAccuracyPrecision(% Recovery of Iab Matrix(Field Replicate)Spike or Iab Control Sample)RPD, % (I)
<u>Blanks</u> 1/20(5%)	£ 8 % 8	Precision fatrix (Field Replicate) Sample) RPD, %
	1/20(5%)	Blanks

1. Relative Percent Difference (RPD) is defined by the following equation:

$$RPD = \left| \frac{D_1 - D_2}{D} \right| \times 100$$

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Where:

$$\overline{D} = (D_1 + D_2)/2$$

 $D_1 = First Sample Result$
 $D_2 = Second Sample Result (Replicate)$

A control limit of \pm the detection limit will be used for sample values less than three times the reported detection limit.

characteristics. Given this relationship and the many possible sources of systematic and random error, field replicate samples will be taken to assess the overall precision of the sludge sampling and analytical program and field duplicate samples will be taken to assess the overall precision of the air sampling and analytical program. Field replicated samples are samples obtained by dividing a sample into two representative portions immediately after the sample is collected. Field duplicate samples are independent samples collected by using a second set of apparatus drawing from the same sampling location. This will provide precision information beginning with sample handling through shipping, storage, preparation and analysis. Field replicated samples will provide most program precision information and will be included at a frequency of one per every twenty (5%) program samples for the daily parameters. Field replicate data will be evaluated using criteria presented in Table 5.2.

Laboratory precision data obtained from laboratory replicates and duplicates will be summarized and reported in the final laboratory QA/QC report.

5.2 Accuracy

Accuracy is a determination of bias in a measurement system. Unlike precision, accuracy is difficult to measure for the entire measurement system. Sources of error that pertain to accuracy are the sampling process, field contamination, preservation, handling, sample matrix, calibration and analysis or any source of systematic error. Accuracy will be monitored for this project by the use of field and laboratory blanks and matrix and surrogate spikes. Spike data will be reported as percent recovery.

The minimumization of false positive and false negative values is accomplished through the use of blanks and matrix spikes. The blanks used for this program will be trip blanks (samples of analyte-free water that is submitted blind to the laboratory for analysis) and internal laboratory blanks. Laboratory matrix spikes will be used to

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determine whether a sample is exhibiting any form of interference or matrix effect.

Trip blanks will be submitted for analysis at a frequency of one per every sample set.

Laboratory blanks will be analyzed in accordance with the laboratory's QA/QC plan and laboratory matrix spikes will be analyzed in accordance with the laboratories QA/QC plan or with those specified in the method identified, whichever is greater.

Percent recovery guidelines for laboratory matrix spikes are presented in Table 5.2

5.3 Representativeness

The criterion of representativeness expresses the degree to which sample data, a subset of the total population, represents the characteristic(s) of the total population. Representativeness is a qualitative parameter which is most concerned with sampling program design. Representativeness is best addressed by describing sampling techniques and the rationale used to select sampling locations. Sampling stations were primarily selected for this program to best represent the wastewater entering and leaving the plant. Process sampling points were chosen to provide the best evaluation of process performance.

Representativeness can be assured somewhat through the proper use of standard operating procedures.

The representativeness of each sampling location has been verified by Mr. William Hotz of CDM.

5.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement program compared to the amount that was expected to be obtained under normal conditions. Completeness is usually expressed as a percentage. Access to the sampling location, sampling problems, analysis problems and the data validation process can all contribute to missing data. Overall completeness goals, expressed as a percentage, are 95% of the sludge samples and 75% of the air samples to be collected to assure that enough data of sufficient quality are obtained from the measurement system to fulfill the objective of this study.

5.5 Comparability

The criterion of comparability expresses the confidence with which one data set can be compared to another. The use of approve sampling and analytical standard operating procedures and the reporting of analytical data in the appropriate units will satisfy this criterion.

5.6 Report Levels of Detection

The detection limits that will be reported for the parameters of interest are listed in Table 5-1.

6.0 Sampling Procedures

This section discusses the field sampling techniques, describes the field equipment, and lists the preservative chemicals needed.

6.1 Field Sampling Procedures

This section outlines the sampling technique checklist to be followed by the sampling crews. Sampling preservation and collection for grab samples are included. Steps are in the order that they will be followed.

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There are only two sites to be sampled. The field sampling procedures are as follows:

- New Bedford Plant Influent

o Grab sample of air

- Feed to Centrifuge
 - o Grab samples of gravity thickened sludge for metals, VOC's, ABN's, pesticides and PCB's EP Toxicity and nutrients testing.
- Solids Discharge from Centrifuge
 - Grab sample of dewatered sludge cake for metals, VOC's, ABN's, pesticides/PCB's, and nutrients testing.

Labeling Scheme

Sludge Sample bottles will be labeled with an identifying code. The code will be in the following format:

Client - type - location - sample no.

The client is NB for New Bedford.

The type codes are \underline{TS} for thickened sludge, \underline{DS} for dewatered sludge, and AIR for air.

The location codes are \underline{TPI} for treatment plant influent, \underline{CF} for centrifuge feed, and CD for centrifuge discharge.

Each sample collected will be assigned a sequential number. Samples collected at the same time will be given the same number.

As an example of the labeling system, the first grab sample collected at the treatment plant influent would be labeled as follows:

NB-TS-CF-001

Date of the sampling shall also be included on the label.

- 6.1.1 Liquid Sludge Grab Samples
 - Check in with the plant operator on duty with assigned responsibility.
 - Ask the operator if any unusually events took place in the preceding 24 hours that may have influenced the sampling program and then record the total volume of gravity thickened sludge pumped to the centrifuges.
 - 3. Open up the sampling spigot on the feed to the centrifuge in service prior to polymer addition and let run for one minute before collecting three samples, two for VOC's and one for metals, ABN's, pesticides/PCB's, EP toxicity and nutrients.
 - 4. Collect a sample in a 1 liter amber glass bottle for total metals, ABN's, pesticides/PCB's and EP toxicity testing. VOC testing of the sludge will require a second sample. The VOC sample shall be collected in two separate 40 ml vials. While filling each vial, the vial shall be inclined at a 45 degree angle and filled slowly to avoid bubbling and spilling.
 - 5. The VOC sample vial shall be filled completely making sure a meniscus is present above the top. The top should be used to add the last few drops to produce the meniscus. The meniscus will help in sealing the vial without producing an air bubble.

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- Carefully close the VOC vial with the teflon-lined screw cap putting the cap perpendicularly on the bottle. Make sure the cap is screwed on tightly.
- Invert the vial and check for air bubbles. If any bubbles are present, repeat steps 4 through 6 with a new vial.
- Label the bottles with the proper site identity code and sample description and record the time.
- Put the full sample bottles in the transportation cooler packed with ice.

10. Complete the chain of custody report/sample sheets.

6.1.2 Sludge Cake Grab Samples

- Check in with the plant operator on duty with assigned responsibility.
- Ask the operator if any unusual events took place in the preceding 24 hours that may have influenced the sampling program.
- 3. Collect one grab sample in a 1 liter amber glass bottle for total metals, ABN's, pesticides/PCB's, and nutrients. VOC testing of the sludge will require a second sample. The VOC sample shall be collected in two separate 40 ml vials. The VOC sample vials shall be filled completely, making sure there are no air spaces.
- 4. Label the bottles with the proper site identity code and sample description and record the time.

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- Put the full sample bottles in the transportation cooler packed with ice.
- 6. Complete the chain of custody report/sample sheets.
- 6.1.3 VOC Air Sampling (to be done by Allowable Technologies Corporation)
 - Air samples will be collected as per the EPA Volatile Organic Sampling Train (VOST) Protocol, with some modifications. This method utilizes a pair of sorbent cartridges to collect the volatile organic components of the air sample via adsorption.
 - Using a constant flow sampling pump, a twenty (20) liter sample of air will be collected over 20-30 minutes every two hours for the VOST analytical work.
 - 3. All cartridges used for sampling will be conditioned, prepared and cleaned following the procedures of the VOST protocol. Prior to delivery of the sample cartridges to the field, verification of the adequacy of the cleaning must be determined.
 - All cartridges must be kept on ice both before and after sampling.
 - 5. Upon taking the sample, label the cartridge properly and fill out the appropriate sample forms.
 - 6. The sample cartridges shall be shipped in specially designed culture tubes to prevent breakage and contamination.
 - 7. For purposes of testing for total VOC's, an air sample will be collected in a 12 liter Tedlar bag using an evacuated lung sampling system. This sample shall be collected over the same period as the VOST sampling (20-30 minutes every two hours).

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- 8. Place the Tedlar bag in a rigid leak-tight container and turn on the vacuum pump. The pump will pull a vacuum on the sealed container which in turn draws air into the Tedlar bag. The pump shall be set at a pump rate of about 0.2 liter per minute (0.2 l/m).
- 9. Once the sample bag is filled, seal and label the bag.

10. Fill out the appropriate sample forms.

6.2 Field Notes

Careful documentation of both expected and unexpected events through field notes is as important as the actual collection of samples. Each sample location will have a loose leaf notebook that contains all the necessary instructions and forms required at that location.

6.2.1 Sampling Procedures

Each day, the sampling crew will receive a work plan outline of the day's events. These outlines will refer to various sampling procedure checklists made from the sample procedures in Section 6.1. The outlines will also include any deviations from the procedures found in these checklists as well as special instructions required. After each item is completed, it should be checked off. At the end of the crew shift, the person in charge should also include the time of the shift and his signature.

Figures 6.1 and 6.2 display sampling procedure checklists for each sampling location.

SAMPLING PROCEDURE CHECKLIST FIGURE 6.1 GRAVITY THICKENED SLUDGE COLLECTION SHEET

Date	Time	Sample No.	Centrifuge No. (1,2 or both)	Moyno Setting	Flow	Collected By

Note: Please allow drainage at sample spigot for at least 1 minute before collection of sample. Also, please make sure two samples are collected for every sample time (one for metals, pesticides/PCB, EP Toxicity, and nutrients analysis and two vials for VOC analysis). Samples are to be collected every 6 hours. Composite samples into given collection jars.

SAMPLING PROCEDURE CHECKLIST FIGURE 6.2 AIR SAMPLING

Date	Time	Sample No.	Pump Setting	Collected By

Note: Samples are to be collected every two hours while operating.

7.0 Sample Custody Procedures

7.1 Chain Of Custody

Each sample is considered to be physical evidence from the Facility. The chain of custody procedures will provide documentation of the handling of each sample from the time it is collected until it is destroyed. This documentation will assure that each sample collected is of known and ascertainable quality.

A "Chain of Custody Record" will be filled out for each sample type at each sampling location to maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory which will analyze the sample (which will then continue the chain of custody within their laboratory records). Each time the samples are transferred to another custodian, signatures of both the person relinquishing the sample and the person receiving the sample, as well as the time and date, will be collected to document the transfer. A sample Chain of Custody Record is shown in Figure 7-1. Actual field forms will include two to three copies so that forms are filled out simultaneously. The sampling team leader retains the original and his own copy, one copy remains with the samples until they are received by the laboratory. If samples are split to different labs, a copy will go to each lab. Care must be taken that all copies are legible. If additional duplicate sheets are required, the person relinquishing the samples is responsible for filling out additional copies, or making reproductions. The original must be returned by the sampling team to the City for the project records and the sampling team will retain their copy.

The Chain of Custody Record will be placed in a ziplock bag and be included with each sample delivery. All sludge samples will be hand delivered to the CDM laboratory. All air samples will be delivered to Alliance of Bedford, Massachusetts and Triangle Research Laboratory (TRL) of Durham, North Carolina. If a sample is to be analyzed by a

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Camp Dresser & McKee Inc.



Figure

7.1

PROJECT NAME_____

2

CHAIN OF CUSTODY RECORD

PROJECT NUMBER

Field Log Book Reference No.____

les	SAMPLE NUMBER	DATE	TIME	SAM	PLE LOCATION	SAMPLE TYPE	AI AI	NAL	YSI R S	ES	30/14 50/14				NUMBER OF CONTAINEI	LOG BOOK RS PG. NO.	REMARKS
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subcontracted laboratory, that sample will be shipped via overnight delivery in compliance with chain of custody procedures.

7.2 Laboratory Custody Procedures

The CDM laboratory has designated a sample custodian for this program. In addition, the laboratory has set aside a secured sample storage area. This is a clean, dry, isolated room with sufficient refrigerator space that is securely locked from the outside.

Samples will be handled by the minimum possible number of persons.

Incoming samples will be received by the custodian who will indicate receipt by signing the chain-of-custody record sheet accompanying the samples and retaining the sheet as a permanent record.

Immediately upon receipt, the custodian places the samples in the sample room, which will be locked at all times expect when samples are removed or replaced by the custodian. To the maximum extent possible, only the custodian shall be permitted in the sample room.

The custodian shall insure that all samples are properly stored, preserved and maintained.

Samples will be distributed to personnel who are to perform tests by the sample custodian under the direction of the laboratory supervisor.

The analyst records in his laboratory notebook or analytical worksheet, identifying information describing the sample, the procedures performed, and the results of the testing. The notes are dated, indicating who performed the tests, and include any abnormalities that occurred during the testing procedure. The notes are retained as a permanent record by the laboratory.

Only approved methods of laboratory analyses shall be used.

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Laboratory personnel are responsible for the care and custody of a sample once it is released to them.

The laboratory area is maintained as a secured area and is restricted to the authorized personnel.

Once the sample analyses are completed, the unused portion of the sample together with identifying labels and other documentation, is returned to the custodian. The returned sample is then retained in the custody room until permission to destroy the sample is received by the custodian.

Samples are destroyed only upon the order of the laboratory supervisor. The same destruction procedure is true for tags.

For samples which are delivered to the laboratory without applicable or with incomplete chain-of-custody documentation, the sample` custodian will acknowledge receipt of samples and initiate the chain-of-custody. Sampling results for such samples will be reported with the following disclaimer:

Samples were received:

_____ without proper chain-of-custody deficient chain-of-custody

8.0 Documentation, Data Reduction and Reporting

Field notebooks are to be used for recording all data information that is not otherwise noted on the sampling procedure check lists (Figures 6.1 & 6.2). Field notebooks shall be bound, 5 X 7 1/2 inch books with consecutively numbered pages. All notebook and checklist entries should be made in pen. No erasures are permitted. If an incorrect entry is made, it should be crossed out with a single strike mark and initialed. Sample checklists, field notebooks, analytical data, and all other original documents associated with this program are to be kept in the program file.

All data entered into a computerized database must be reviewed and verified to assure that there are no transcription errors.

9.0 Data Validation

Validation of New Bedford's analytical data will be performed on two separate levels: Internal Laboratory Data Validation and External Program Data Validation.

9.1 Internal Laboratory Data Validation

All analytical data produced by the CDM laboratory is validated prior to its release. This validation is conducted routinely as part of the laboratory's internal quality control program, using the guidelines established in the Laboratory QA/QC Plans.

Performance goals and quality control evaluation procedures are documented individually for each analytical procedure used. This information is located within the individual analytical procedures, specific to each parameter analyzed.

In general, all laboratory data is reviewed as it pertains to calibration, instrument performance, blank analysis, replicate analysis, and matrix and surrogate recovery. Also, the data is reviewed for the reasonableness of the analytical result (for example, suspended solids result greater than the total solids result of a sample), calculation and transcription errors. Of greatest importance is the elimination of false positive and false negative results. This validation process is complete when the sample analyst and laboratory supervisor sign off on the analytical report.

9.2 External Program Data Validation

The sampling and analytical plan for the New Bedford project has its own QA/QC plan, which is independent of the laboratory's. This plan covers both the sampling and analytical component of the total measurement system. As such, the QA/QC information generated by following the plan will reflect both laboratory and field sampling performance.

This sampling and analytical plan specifies the inclusion of blind blanks and replicate/duplicate samples into the analytical system. These QC samples are prepared by the sampling team so that their true identity is unknown to laboratory personnel.

These external QC samples provide the majority of the information used to review the data from a program perspective. The precision of the field duplicates is assessed and compared to the performance goals stated in Section 5.0 of this document. Field blank data and reported detection limits are also reviewed. Also, the laboratory QA/QC information reported with the analytical reported with the analytical data is evaluated at this time.

The output of this program data validation is a usability report which attests to the suitability of the data or its intended use. Recommendations are included in this report which qualify specific pieces of data (if required) so that the information is not used incorrectly by project engineers. These recommendations are usually in the form of qualifying a reported value as an estimate rather than an absolute value or the rejection of some reported values because of field blank contamination.

10.0 Performance and System Audit

Performance and systems audits are an essential part of every quality assurance/quality control (QA/QC) plan. A performance audit independently collects measurements data using performance valuation

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samples. A system audit consists of systematic, comprehensive review of the total data production process which includes on-site reviews of a field and laboratory's operational systems and physical facilities for sampling, calibration and measurement protocols.

The audits conducted in support of the New Bedford project serve three general purposes:

- to determine if a particular group has the capability to conduct the monitoring before the project is initiated;
- to verify that the QA Project Plan and associated standard operating procedures (SOPs) are being implemented; and
- to detect and define problems so that immediate corrective action can begin.

The CDM laboratory participates in the U.S. EPA Water Supply (WS) and Water Pollution (WP) ongoing performance evaluations, which will serve as performance audits for this project.

Systems audit of the sampling and analytical portion of this project are the responsibility of the Project Quality Assurance Officer William Hotz. The Quality Assurance Officer will present a schedule of when audits will be conducted and what each audit will cover. All audits will be conducted by individuals who are not directly involved in the measurement process and who are competent in the fields they are auditing.

A preliminary meeting will be conducted prior to initiating any system audit. During this meeting, the auditor will identify key personnel, define scope of audit, establish communication with Field and laboratory staff, describe auditing plan and schedule, and set a date for completion along with a final briefing. The documentation required for audits include a Quality Assurance Notice form and Nonconformance Report.

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The results of all performance and system audits will be available to the Project QA/QC Officer on request and will be used to determine usability of the data collected.

11.0 Corrective Action Program

The corrective action program in place during this phase of the New Bedford project has the capability to discern errors or defects in the project implementation process.

The Project Quality Assurance Officer has the authority to make appropriate corrections and improvements as may be necessary in techniques and methods used by field and laboratory personnel.

Field and laboratory personnel are required to report to project management and the QA Officer any statistical data or other information that reflects the need for corrective action that should be implemented on a particular procedure or process.

Inspection steps taken during sampling, calibration and measurements should detect defects, malfunctions, or other problems which could jeopardize the sampling and analytical process and will trigger corrective actions to rectify the causes and stabilize the system.

All corrective actions required during this project will be evaluated by the Project QA Officer to determine the impact on data usability and included in the final data evaluation.

QUALITY ASSURANCE PLAN

FOR

CITY OF NEW BEDFORD'S PHASE I FACILITIES PLANNING FOR WASTEWATER TREATMENT AND SLUDGE DISPOSAL

AND

PHASE II FACILITIES PLANNING FOR COMBINED SEWER OVERFLOWS WASTEWATER AND AIR SAMPLING PROGRAM

COVER SIGNATURES

Project Name:

Project Requested By:

Date of Request:

Date of Project Initiation:

Project Officer:

Quality Assurance Officer:

1.0 INTRODUCTION

An integral component of the City of New Bedford's Phase I Facilities Planning for Wastewater Treatment and Sludge Disposal and Phase II Facilities Planning for Combined Sewer Overflows Wastewater and Air Sampling Program is the collection of representative wastewater and air samples and assurance of sample integrity during processing and analysis. The purpose of this document is to identify the quality control and quality assurance steps required to achieve these goals. This document conforms in detail with the requirements of EPA's May 1984 "Guidance for Preparation of Combined Work/Quality Assurance Project Plans for Environmental Monitoring."

The references cited in this manual present the most effective and current laboratory analysis and field sampling practices. The procedures and techniques described are by no means the only methods available, but are rather those which are to be followed in this sampling project. Camp Dresser & McKee's (CDM) Laboratory standard of practice is available upon request. All methods not included in CDM's standard of practice are clearly explained in this document and have been developed by CDM personnel who have had experience in sampling and laboratory analysis.

2.0 PROJECT DESCRIPTION

2.1 Objectives

The sampling program is designed to produce data of known and acceptable quality to be used for three primary purposes:

- 1. Data for evaluation of wastewater treatment plant processes including evaluation of outfall sites; nutrient potential, and conventional discharge permit parameters.
- 2. Wastewater data for use in evaluation of residual treatment and disposal alternatives.
- 3. Data for evaluation of air quality impacts, primarily focused on the expected level of VOC emissions and the odor potential of the wastewater.

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2.2 Sampling Locations

Initially, there will be one influent sampling location at the entrance of the plant and one wastewater effluent sampling location.

The sampling program will be divided into two flow periods. The first period will be 28 days in the late Spring/early Summer of 1987, and the second period will be 14 days in the Summer of 1987. The Spring period was selected to monitor parameters during a high flow period andthe period was selected to give parameter values during a low flow period.

2.3 Sampling Plan

2.3.1 BOD₅, TS, TSS, Settleable Solids and Chlorides

The conventional parameters, BOD5, TS, TSS, Settleable Solids, and Chlorides will be samples at the influent for 28 days in the first period and for 14 days in the second period. Samples will be collected as time proportioned twenty-four hour composites.

These conventional parameters will also be sampled from the plant effluent for five days.

2.3.2 pH

The conventional parameter, pH, will be grab sampled at the influent to the plant for a total of 7 days of sampling in the initial period. pH grab sampling will also be done at the effluent from the plant for the 5 days. In the second sampling period pH will be sampled for 3 days at the influent to the plant and for 2 days at the effluent.

2.3.3 Oil and Grease

The conventional parameter, oil and grease, is to be sampled at the influent to the plant initially for 7 days and for 3 days during the second period. In addition, it will be sampled at the effluent for initially 5 days and then 2 days during the second period.

2.3.4 Priority Pollutants

Samples will be collected and then analyzed for Priority Pollutants including Hazardous Substance List (HSL) Organic Compounds. There are four distinct subsets under this category:

o PCB/Pesticides o Acid/Bases o Metals o Volatile Organics

The PCB/Pesticides and (A-B/N) will be daily 24-hour composites, samples during the first period at the influent to the plant for 10 days. For five days during that time, effluent samples will

also be collected. The influences to the plant will be again sampled during the second sampling period for a total of 4 days and the effluent for 2 days.

Daily 24-hour composite sampling for priority pollutant metals plus boron, molybdenum and cyanide will be done at the influent to the treatment plant for 20 days. For 2 days effluent samples will be collected from the plant. During the second period an additional 8 days of samples for metals are to be collected from the plant's influent and one day from the effluent.

For Volatile Organics Analysis (VOA) the samples are required to be grab samples. The samples will either cover a 24-hour period during which 4 samples will be collected at 6 hour intervals or a 12 hour period during which 2 samples will be collected at 6 hour intervals.

The VOA grab samples will be taken at the influent of the treatment plant four times daily for 7 days and at the effluent for 2 days. During the second period, the influent will be sampled for 3 days and the effluent once.

For one daily sample the analysis will include identification of up to twenty additional compounds the VOA and Acid/Base Neutral fraction during the analytical scan. Those compounds detected in either fraction (VOA/ABN) with a chromatographic area of at least 25% of the operative internal standard will be identified and a semi-quantitative estimate of concentration will be given. Samples will be screened for these additional compounds for four days that samples are collected from the influent, and two days of effluent sampling.

2.3.5 COD/TOC, VSS, TS, TKN and Total Phosphorus

Twenty four hour composites samples will be collected daily and analyzed for parameters COD/TOC, VSS, TS, TKN, and total phosphorus. The program will collect samples from the influent to the plants for 10 days during the first period and for four days during the second period.

The analysis of COD and or TOC is much more rapid than that for BOD₅. It is normally possible to establish a proportional relationship between these parameters such that if one is known the other two can be extrapolated. Therefore, during the first days of the sampling program both BOD5 and COD or TOC will be measured and once the relationship is clearly established then thereafter the COD or TOC analysis only will be run. If after the relationship is established, an individual sample results in a COD or TOC reading that is abnormally high or low then a BOD5 will be run on a duplicate sample.

The samples will also be analyzed for Ammonia Nitrogen for ten days in the first period and four days in the second preiod.

2.3.6 Sulfides

One other process parameter to be sampled is sulfides. The sulfide samples will be grab samples collected four times daily and them conposited into a daily sample for analysis. Samples will be collected for seven days at the influent to the plant during the first period and in the second period for three days at the influent to the plant.

2.3.7 Hydrogen Sulfide

Ambient hydrogen sulfide monitoring will be conducted at the plant site. A hydrogen sulfide monitor with continuous char recorder will be located at the treatment plant to monitor the working air environment.

2.3.8 Split Samples

For six consecutive days, including one weekend day, a split sampling program will be conducted. The daily influent composite samples and grab samples taken at the treatment plant will be split between CDM's lab and the lab at New Bedford. CDM will also, if requested, provide DEQE with split samples from these two locations.

The following split sample parameters will be monitored:

Parameter

Sample Type

24 hour composite

BOD5 TSS Settleable Solids pH Chlorides Oil & Grease

24 hour composite
24 hour composite
Grab at 6 hour intervals - 4/day
24 hour composite
Grab at 6 hour intervals - 4/day

Each lab will receive approximately 1/2 gallon of the 24 hour composite and an appropriate size oil and grease sample preserved in a separate container.

2.4 Purpose of Data

2.4.1 BOD₅, TSS, Settleable Solids, pH

These conventional parameters are required as a basis for evaluating treatment alternatives.

The plant effluent is sampled for these parameters in coordination with the outfall siting work.

2.4.2 Oil & Grease

This data is primarily intended for the Phase I Wastewater Treatment Plant and Sludge Facilities Plan.

2.4.3 Priority Pollutants and Additional HSL List Compounds

PCB/Pesticides and Acid/Base-Neutral

Based upon past data, the concentrations of PCB/Pesticides and Acid/Base-Neutrals in the west stream are not expected to be the controlling variable, however, there is little recent data, therefore the sampling program will analyze for these compounds. The PCB data are needed for the outfall siting needs. The data will also be used to evluate the acceptability of treated sludge as regulated by Massachusetts Land Application Regulations.

Metals

The concentration of toxic metals is expected to be one of the controlling parameters for both the facilities plan and the outfall siting portion. Therefore metal analysis will be conducted for boron, molybdenum compounds and cyanide compounds as well as the priority pollutant metals.

VOA

One of the primary goals of the VOA sampling program is to identify and quantify the Volatile Organic Compounds (VOC) presently volatilizing at a specific site. Influent and effluent wastewater will therefore be sampled, and analyzed for VOAs and the difference in concentration calculated. Data will then be used to evaluate the need for, and magnitude of ozone precursor controls. Data will also be used for a screening of air toxics based upon the State's Chem/AAL guidelines.

2.4.4 COD/TOC, VSS, TS, TKN, Total Phosphates, Ammonia Nitrogen

This data will be used to evaluate treatment process design criteria. Criteria include the availability and level of nutrients present and needed to sustain biological treatment systems.

2.4.5 Sulfides

The sulfides content of the wastewater will be used to evaluate both its treatability and its H_2S odor potential.

2.4.6 Hydrogen Sulfide

The purpose of continuously monitoring ambient levels of hydrogen sulfide is to identify the operational periods when H_2S levels are maximum, determine the time dependency of H_2S levels, evaluate operator health and safety issues, and to provide a data base for evaluation of odor control equipment.

2.4.7 Split Samples

The purpose of the split sampling program is to evaluate the

homogeneity of samples, compare results from different laboratories, establish the precision for various analytical procedures and establish a relationship between the data from this sampling program and other sources of historical treatment plant data.

2.5 Monitoring Network Design and Rationale

2.5.1 Location Rationale

Refer to Section 2.3 for the purpose of the data. A sample taken at the Treatment Plant influent will be indicative of the mass/contaminant loading of the proposed new plant.

2.5.2 Homogeneity of Samples

Sampling procedures have been designed so that samples are taken that are representative of the entire volume of wastewater passing the sampling location during a specific sampling interval. Presented in actual procedures are in Section 7.

2.6 Monitoring Parameters and Analytical Methods

Tables 2.1 through 2.5 list all that wastewater analytical parameters. The type of sample, samplinng orientation to the water surfce, sampling frequency, and analytical method are also discussed.

3.0 PROJECT FISCAL INFORMATION

This sampling program is one element of the Phase I Facilities Plan for Wastewater Treatment and Sludge Disposal. The scope of work and budget for the Facility Plan is contained within a separate document titled "Exhibit A To Agreement Between Owner and Engineer."

4.0 SCHEDULE OF TASKS AND PRODUCTS

The task schedule for the sampling project is as follows:

Date	Task Description
April 20, 1987	Sampling site visit by CDM personnel
April 27, 1987	Equipment installation starts.
April 30, 1987	Equipment installation complete. Start of the trial sampling period
May 4, 1982	First sampling period begins
June 4, 1987	First sampling period ends
July 15, 1987	First sampling period report data

TABLE 2.1: SAMPLE COLLECTION AND ANALYTICAL PROCEDURES BY PARAMETER

Conventional and Process Parameters	Sample Type	Water Surface (WS) ⁴ Sampling Orientation	Sampling ³ Frequency	Analytical Method		
BOD 5 day	24 Hr Composite	Below WS	1/hr Min	507 ¹		
Total Solids	24 Hr Composite	Below WS	1/hr Min	160.3 ²		
Total Suspended Solids	24 Hr Composite	Below WS	1/hr Min	160.2 ²		
Total Volatile Suspended Sol	24 Hr Composite	Below WS	1/hr Min	160.4 ²		
Settleable Solids	24 Hr Composite	Below WS	1/hr Min	2095 ¹		
Chemical Oxygen Demand	24 Hr Composite	Below WS	1/hr Min	410.4 ²		
Total Organic Carbon	24 Hr Composite	Below WS	1/hr Min	415.2 ²		
Chloride	24 Hr Composite	Below WS	1/hr Min	300 ²		
Total Kjeldahl Nitrogen	24 Hr Composite	Below WS	1/hr Min	351.3 ²		
Ammonia Nitrogen	24 Hr Composite	Below WS	1/hr Min	350.2 ²		
Sulfide	Grab	Below WS	4/dav	376.1 ²		
Oil and Grease	Grab	Includes WS	4/day	413.1 ²		
Total Phosphorous	24-Hr Composite	Below WS	1/Hr Min	365.2 ²		

¹ Standard Methods for the Examination of Water and Wastewater, 16th Edition, 1985.

² Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983.

3 Samples are to be collected daily on a 24-hour composited basis at influent with a minimum sample collection of once per hour. Plant effluent samples will be time composited hourly and then each hourly sample will be flow composited based upon recorded flows that hour.

4 Samples below water surface are samples collected from within the moving water and do not include any floating films. TABLE 2.2: SAMPLE COLLECTION AND ANALYTICAL PROCEDURES BY METAL

Metals	Sample Type	Water Surface (WS) Sampling Orientation	Sampling ² Frequency	Analytical Method	
Antimony	24 Hr Composite	Below WS	1/hr Min	204.2	
Arsenic	24 Hr Composite	Below WS	1/hr Min	206.2	
Beryllium	24 Hr Composite	Below WS	1/hr Min	210.2	
Boron	24 Hr Composite	Below WS	1/hr Min	HOYB	
Cadmium	24 Hr Composite	Below WS	1/hr Min .	213.2	
Chromium	24 Hr Composite	Below WS	1/hr Min	218.2	
Copper	24 Hr Composite	Below WS	1/hr Min	220.2	
Cyanide	24 Hr Composite	Below WS	1/hr Min	335.23	
Lead	24 Hr Composite	Below WS	1/hr Min	239.2	
Mercury	24 Hr Composite	Below WS	1/hr Min	245.1	
Molybdenum	24 Hr Composite	Below WS	1/hr Min	246.2	
Nickel	24 Hr Composite	Below WS	1/hr Min	249.2	
Selenium	24 Hr Composite	Below WS	1/hr Min	270.2	
Silver	24 Hr Composite	Below WS	1/hr Min	272.2	
Thallium	24 Hr Composite	Below WS	1/hr Min	279.2	
Zinc	24 Hr Composite	Below WS	1/hr Min	289.2	

1 All methods contained in <u>Methods for Chemical Analysis of Water and Wastes</u>, EPA-600/4-79-020, March 1987.

Samples are to be collected daily on a 24-hour composited basis at influent with a minimum sample collection of once per hour. Plant effluent samples will be time composited hourly and then each hourly sample will be flow composited based upon recorded flows for that hour.

3 Actual, For Chemical Dundysis of Water 3 Standors methods for the examination of Weiter and Wasterrotter, 16th eclition, F185

TABLE 2.3: SAMPLE COLLECTION AND ANALYTICAL PROCEDURES BY COMPOUNDS

a contraction of the second		Water Surface (WS)	Sampling	Analytical		
Volatile Organic Compounds	Sample Type	Sampling Orientation	Frequency	Method		
Priority Pollutants						
Chloromethane	Grabs	Includes WS	2 or 4/day	40 CFR		
Bromomethane	Grabs	Includes WS	2 or 4/day	Part 136		
Vinvl Chloride	Grabs	Includes WS	2 or 4/day	Friday,		
Chloroethane	Grabs	Includes WS	2 or 4/day	Oct 26, 1984		
Methylene Chloride	Grabs	Includes WS	2 or 4/day	Method 624		
Trichlorofluoromethane	Grabs	Includes WS	2 or 4/day			
1.1-Dichloroethylene	Grabs	Includes WS	2 or 4/day			
1.1-Dichloroethane	Grabs	Includes WS	2 or 4/day			
Trans1.2-Dichloroethylene	Grabs	Includes WS	2 or 4/day			
Chloroform	Grabs	Includes WS	2 or 4/day			
1.2-Dichloroethane	Grabs	Includes WS	2 or 4/day			
1.1.1-Trichloroethane	Grabs	Includes WS	2 or 4/day			
Carbon Tetrachloride	Grabs	Includes WS	2 or 4/day			
Bromodichloromethane	Grabs	Includes WS	2 or 4/day			
1.2-Dichloropropane	Grabs	Includes WS	2 or 4/day			
Trans-1.3-Dichloropropene	Grabs	Includes WS	2 or 4/day			
Trichloroethylene	Grabs	Includes WS	2 or 4/day			
Dibromochloromethane	Grabs	Includes WS	2 or 4/day			
CIS-1.3-Dichloropropene	Grabs	Includes WS	2 or 4/day			
1.1.2-Trichloroethane	Grabs	Includes WS	2 or 4/day			
Benzene	Grabs	Includes WS	2 or 4/day			
2-Chloroethylvinylether	Grabs	Includes WS	2 or 4/day			
Bromoform	Grabs	Includes WS	2 or 4/day			
[etrachloroethy]ene	Grabs	Includes WS	2 or 4/day			
1.1.2.2-Tetrachloroethane	Grabs	Includes WS	2 or 4/day			
Toluene	Grabs	Includes WS	2 or 4/day			
Chlorobenzene	Grabs	Includes WS	2 or 4/day			
Ethylbenzene	Grabs	Includes WS	2 or 4/day			
Add'l Hazardous Substances L	ist Compounds					
Styrene	Grabs	Includes WS	2 or 4/day			
Total Xylenes	Grabs	Includes WS	2 or 4/day			
Carbon Disulfide	Grabs	Includes WS	2 or 4/day			
Vinyl Acetate	Grabs	Includes WS	2 or 4/day			
2-Butanone	Grabs	Includes WS	2 or 4/day			
Acetone	Grabs	Includes WS	2 or 4/day			
2-Hexanone	Grabs	Includes WS	2 or 4/day			
4-Methyl-2-Pentanone	Grabs	Includes WS	2 or 4/day			

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Grab samples will be taken at 6-hour intervals. Selected days will be sampled four times over a 24-hour period. At other times samples over a 12-hour period will be sampled.

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TABLE 2.4: SAMPLE COLLECTION AND ANALYTICAL PROCEDURES BY COMPOUNDS

cid/Base/Neutral Compounds	Sample Type	Water Surface (WS) Sampling Orientation	Sampling Frequency	Analytical Method
N-Nitrosodimethylamine	24 Hr Composite	Below WS	1/hr Min	40 CFR
Phenol	24 Hr Composite	Below WS	1/hr Min	Part 136
Aniline	24 Hr Composite	Below WS	1/hr Min	Friday,
Bis(2-Chloroethyl)Ether	24 Hr Composite	Below WS	1/hr Min	Oct 26, 1984
2-Chlorophenol	24 Hr Composite	Below WS	1/hr Min	Method 625
1,3-Dichlorobenzene	24 Hr Composite	Below WS	1/hr Min	
1,4-Dichlorobenzene	24 Hr Composite	Below WS	1/hr Min	
Benzyl Alcohol	24 Hr Composite	Below WS	1/hr Min	
1,2-Dichlorobenzene	24 Hr Composite	Below WS	1/hr Min	
2-Methylphenol	24 Hr Composite	Below WS	1/hr Min	
Bis(2-Chloroisopropyl)Ether	24 Hr Composite	Below WS	1/hr Min	
4-Methylphenol	24 Hr Composite	Below WS	1/hr Min	
N-Nitroso-Di-N-Propylamine	24 Hr Composite	Below WS	1/hr Min	
Hexachloroethane	24 Hr Composite	Below WS	1/hr Min	
Nitrobenzene	24 Hr Composite	Below WS	1/hr Min	
Isophorone	24 Hr Composite	Below WS	1/nr Min	
2-Nitrophenol	24 Hr Composite	Below WS	1/hr Min	
2,4-Dimethylphenol	24 Hr Composite	Below WS	1/hr Min	
Benxoic Acid	24 Hr Composite	Below WS	1/hr Min	
Bis(2-Chloroethoxy)Methane	24 Hr Composite	Below WS	1/nr Min	
2,4-Dichlorophenol	24 Hr Composite	Below WS	1/hr Min	
1,2,4-Irichlorobenzene	24 Hr Composite	Relow M2	1/nr Min	
Naphthalene	24 Hr Composite	Below WS	1/hr Min	
4-Chloroaniline	24 Hr Composite	Below WS	1/nr min	
Nexachiorodutadiene	24 Hr Composite	Below WS	1/nr min 1/br Min	
P-Chioro-M-Cresol	24 Hr Composite	Delow HS	1/hr Min	
Z-metnyinaphtnaiene	24 Hr Composite	Below WS	1/nr min 1/br Min	
	24 Hr Composite	Bolow WS	1/br Min	
	24 Hr Composite	Bolow WS	1/br Min	
2,4,5-irichiorophenoi	24 Hr Composite	Delow WS	1/Hr Min	
2-Unioronaphtnaiene	24 Hr Composite	Below WS	1/nr min 1/br Min	
	24 Hr Composite	Delow WS	1/hr Min	
Dimetnyi Phthalate	24 Hr Composite	Below WS	1/nr min 1/br Min	
Acenaphinylene	24 Hr Composite	Bolow WS	1/br Min	
S-NILFOANIIINE	24 Hr Composite	Bolow WS	1/hr Min	
Acenaphinene 2 A.Dinitrophonol	24 Hr Composite	Below WS	1/hr Min	
A-Nitrophenol	24 Hr Composite	Below WS	1/hr Min	
Dibenzofuran	24 Hr Composite	Below WS	1/hr Min	
2 4-Dinitrotoluene	24 Hr Composite	Below WS	1/hr Min	
2.6-Dinitrotoluene	24 Hr Composite	Below WS	1/hr Min	
Diethyl Phthalate	24 Hr Composite	Below WS	1/hr Min	
4-Chlorophenyl Phenyl Ether	24 Hr Composite	Below WS	1/hr Min	
Fluorene	24 Hr Composite	Below WS	1/hr Min	
4-Nitroaniline	24 Hr Composite	Below WS	1/hr Min	
4.6-Dinitro-2-Methylphenol	24 Hr Composite	Below WS	1/hr Min	

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TABLE 2.4 (CONT'D.): SAMPLE COLLECTION AND ANALYTICAL PROCEDURES BY COMPOUNDS

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Acid/Base/Neutral Compounds	Sample Type	Water Surface (WS) Sampling Orientation	Sampling Frequency	Analytical Method
N-Nitrosodiphenylamine	24 Hr Composite	Below WS	1/hr Min	40 CFR
4-Bromophenyl Phenyl Ether	24 Hr Composite	Below WS	1/hr Min	Part 136
Hexachlorobenzene	24 Hr Composite	Below WS	1/hr Min	Friday,
Phenanthrene	24 Hr Composite	Below WS	1/hr Min	Oct 26, 1984
Anthracene	24 Hr Composite	Below WS	1/hr Min	Method 625
Di-N-Butyl Phthalate	24 Hr Composite	Below WS	1/hr Min	
Fluoranthene	24 Hr Composite	Below WS	1/hr Min	
Benzidine	24 Hr Composite	Below WS	1/hr Min	
Pyrene	24 Hr Composite	Below WS	1/hr Min	
Butylbenzyl Phthalate	24 Hr Composite	Below WS	1/hr Min	
3,3-Dichlorobenzidine	24 Hr Composite	Below WS	1/hr Min	
Benzo(A)Anthracene	24 Hr Composite	Below WS	1/hr Min	
Bis(2-Ethylhexyl)Phthalate	24 Hr Composite	Below WS	1/hr Min	
Chrysene	24 Hr Composite	Below WS	1/hr Min	
Di-N-Octyl Phthalate	24 Hr Composite	Below WS	1/hr Min	
Benzo(B)Fluoranthene	24 Hr Composite	Below WS	1/hr Min	
Benzo(K)Fluoranthene	24 Hr Composite	Below WS	1/hr Min	
Benzo(A)Pyrene	24 Hr Composite	Below WS	1/hr Min	
Indeno(1,2,3-C,D)Pyrene	24 Hr Composite	Below WS	1/hr Min	
Dibenzo(A,H)Anthracene	24 Hr Composite	Below WS	1/hr Min	
Benzo(G.H.I)Perylene	24 Hr Composite	Below WS	1/hr Min	

TABLE 2.5: SAMPLE COLLECTION AND ANALYTICAL PROCEDURES BY COMPOUNDS

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PCB/PESTICIDE Sample Type		Water Surface (WS) Sampling Orientation	Sampling Frequency	Analytical Method	
Compound					
Aldrin Alpha-BHC Beta-BHC Gamma-BHC Delta-BHC Technical Chlordane 4,4-DDT 4,4-DDE 4,4-DDD Dieldrin Endosulfan I Endosulfan Sulfate Endrin Endrin Aldehyde Endrin Ketone	24 Hr Composite 24 Hr Composite	Below WS Below WS	1 hr/Min 1/hr Min 1/hr Min	40 CFR Part 136 Friday, Oct 26, 1984 Method 608 40 CFR Part 136	
Heptachlor Heptachlor Epoxide Methoxychlor Arochlor 1016 Arochlor 1221 Arochlor 1232 Frochlor 1242 Arochlor 1248 Arochlor 1254 Arochlor 1260 Toxaphene	24 Hr Composite 24 Hr Composite	Below WS Below WS Below WS Below WS Below WS Below WS Below WS Below WS Below WS Below WS	1/nr Min 1/hr Min 1/hr Min 1/hr Min 1/hr Min 1/hr Min 1/hr Min 1/hr Min 1/hr Min 1/hr Min	Dct 26, 1984 Method 608	

TABLE 2.6: AIR SAMPLE COLLECTION AND ANALYTICAL PROCEDURES BY COMPOUNDS

Volatile Organic Compounds	Sample Type ¹	Sampling ² Frequency	Analytical ³ <u>Method</u>
Priority Pollutants			
Bromomethane	Grabs	4/day	2520
Vinyl Chloride	Grabs	4/day	1007
Methylene Chloride	Grabs	4/day	1005
1.1-Dichloroethane	Grabs	4/day	1003
Trans1.2-Dichloroethylene	Grabs	4/day	1003
Chloroform	Grabs	4/day	1003
1.2-Dichloroethane	Grabs	4/day	1003
1.1.1-Trichloroethane	Grabs	4/day	1003
Carbon Tetrachloride	Grabs	4/day	1003
Trichloroethylene	Grabs	4/day	\$336
Benzene	Grabs	4/day	1501
Bromoform	Grabs	4/day	1003
Toluene	Grabs	4/day	1501
Chlorobenzene	Grabs	4/day	1003
Ethylbenzene	Grabs	4/day	1501
Add'l Hazardous Substances L	ist Compounds		
Styrene	Grabs	4/day	1501
Total Xylenes	Grabs	4/day	1501
2-Butanone	Grabs	4/day	2500
Scetone	Grabs	4/day	1300
2-Hexanone	Grabs	4/day	1300
4-Methyl-2-Pentanone	Grabs	4/day	1300

An initial screening using both Tedlar bag samples and N10SH carbon adsorption/ desorption samples will be collected and analyzed. Flow rates will be monitored also. A determination will be made as to accuracy of both methods, and the actual methods, and the actual samples will be run on selected method.

² Grab samples will be taken at 6-hour intervals.

³ Analytical methods referenced are N1OSH methods. Results will be reported with percent recovery and carbon will be separately analyzed for front end and back end to monitor for breakthrough.

July 20, 1987

August 5, 1987

Begin second sampling period

End second sampling period

September 11, 1987

Second period sampling data available, final memo prepared

5.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The sampling program will be conducted under the overall responsibility of Camp Dresser & McKee Inc. The individual's role can be described as follows:

WILLIAM F. CALLAHAN (Senior Vice President/CDM): Monitors overall project to assure applicability of sampling to other tasks in the Facility Plan effort.

STEPHEN J. HICKOX (Project Manager/CDM): Has overall responsibility for the sampling program.

WILLIAM A. KANE (Assistant Project Engineer/CDM/Fieldwork): Responsible for day-to-day field work coordination with Mistry Associates. Co-Author of field portion of QA/QC plan.

DONALD MULDOON (Laboratory Manager/CDM): Overall responsibility for CDM lab work and subcontract laboratories.

JAMES F. OCCHIALINI (Laboratory Supervisor/CDM): Responsible for CDM's day-to-day analytical services. Author of lab portion of QA/QC plan.

LAB CHEMISTS - CDM has 10 chemists that will perform the sample analysis. Approximately 5 of the chemists will work exclusively on this project.

SAMPLING TECHNICIANS - CDM will have between 2 and 4 Technicians to perform the actual sampling. These technicians will be given up to one week of training in sampling techniques.

Addresses and Phone Numbers

For CDM Employees:

Contact: STEPHEN J. HICKOX Camp Dresser & McKee Inc. One Center Plaza Boston, MA 02108 Tel: 742-5151

For Mistry Associates Employees:

Contact: ANDREW AGAPOW Mistry Associates, Inc. 315 Main Street Reading, MA 02215 Tel: 944-6400

6.0 DATA QUALITY REQUIREMENTS AND ASSESSMENTS

A major requirement of every sampling and analytical plan is to assure that all data collected be of known quality. The concept of data quality refers to the level of uncertainty associated with a data set. This section specifies a level of data quality for each parameter being investigated that is consistent with the purpose of the sampling event and the use of the data. It is important to note that the assurance of proper data quality begins with the writing of the project's sampling and analytical plan, the adherence to the specified sampling SOPs, sample custody procedures, and laboratory QA/QC procedures, and ends with the data validation process.

Data quality requirements are specified using the precision, accuracy, representativeness, completeness, and comparability (PARCC) criteria. The required method detection limits for each parameter are also specified at this time. A brief discussion of each PARCC parameter as it relates to the sampling and analytical plan follows.

Precision

The criterion of precision is a measure of the reproducibility of a given group of analyses under a given set of conditions. The overall precision of environmental monitoring data is the sum of the sampling precision and the analytical precision. Sampling precision is a function of the standard operating procedure used to collect the sample and the variability and/or homogeneity of the media being sampled. Analytical precision is a function of the procedure used, the analyst's technique and instrument performance. Given this relationship and the many possible sources of introduced error, the best method to assess the overall precision of the entire sampling and analytical event is through the use of collocated samples.

Collocated samples are independent samples collected in such a manner that they are equally representative of the parameter(s) of interest at a given

point in space and time. The design of the sampling and analytical plan requires that the collocated samples be collected and processed by the same organization, thus providing precision information for the entire measurement system including sample acquisition, homogeneity, handling, shipping, storage, preparation and analysis. Collocated samples will be collected using side by side automatic samplers and simultaneous grab sampling techniques drawing from the same sampling location. Collocated samples will be included in the sampling and analytical program at a frequency of one per each individual location.

Field replicated samples are the next best method of assessing the overall precision of the sampling and analytical program. Field replicated samples are samples obtained by dividing a sample into two representative portions immediately after the sample is taken and provide precision information beginning with sample handling through shipping, storage, preparation and analysis. Due to the inherent logistical problems associated with the collection of collocated samples, field replicated samples will provide the most program precision information and will be included at a frequency of one per every twenty investigative samples.

Laboratory (analytical) precision will also be evaluated using the laboratory's quality control criteria stated in the laboratory QA/QC plan. An attempt will be made to estimate the precision of the sampling process itself by comparing laboratory precision to collocated sample precision. It is expected that collocted sample precision will be less than laboratory precision, with the difference being attributed to sampling error and the homogeneity of the wastewater.

A split sample program using field replicated samples will also be coordinated with the New Bedford Treatment Plant's existing influent andeffluent sampling program. This split sample data will be evaluated for the New Bedford Treatment Plant's internal use as well as providing a source of inter-laboratory precision data for this project.

A split sample program using field replicated samples will also be coordinated, if requested, with the Massachusetts DEQE.

Accuracy

Accuracy is a measurement of bias in a measurement system. Unlike precision, accuracy is difficult to measure for the entire measurement system. Sources of error that pertain to accuracy are the sampling process, field contamination, preservation, handling, sample matrix, calibration and analysis. Accuracy will be monitored for this project by the use of field and laboratory blanks and matrix and surrogate spikes. Spike data will be reported as percent recovery.

The elimination of false positive and false negative values from the measurement system is the primary objective of the accuracy criterion, using both external program and laboratory QC. The potential for false positive values is monitored primarily by the use of field and laboratory blanks. The potential for false negative values is monitored through the use of spike recovery information.

In addition to providing false negative information, the use of laboratory matrix spikes also can be used to document if a sample is exhibiting any form of interference or matrix effect during the course of an analysis. A matrix effect is a phenomenon that occurs when the sample composition interferes with the analysis of the analyte(s) of interest. This can bias the sample result either in a positive or negative way, with the negative bias being the most common. Matrix spikes supply percent recovery information which documents the magnitude of a matrix effect, and thus the amount of bias in the measurement system for that analyte. Percent recovery information can be used by the data user to adjust reported concentrations by the application of the appropriate correction factor or as a part of a mental process where sample results can be considered to be somewhat "higher" or "lower" than the reported values. It is not recommended that sample values actually be adjusted for percent recovery unless a "worst case" scenario is being developed.

The frequency of inclusion and the types of QC samples used, as well as instrument calibration procedures, are documented in the laboratory's QA/QC plan. The plans are on file at the laboratories used. For wastewater they are CDM Labs, One Center Plaza, Boston, MA. Tables 6-1 documents the performance goals for laboratory matrix spikes for each parameter of interest.

Representativeness

The criterion of representativeness expresses the degree to which sample data represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter which is most concerned with sampling program design.

Representativeness is best addressed by describing sampling techniques and the rationale used to select sampling locations. The sampling station was selected for this project so as to represent influent wastewater to ensure that no mass was lost in preliminary treatment. The field locations for these samples has been verified by Mr. William Kane.

Representativeness can be assured somewhat through the proper use of sampling standard operating procedures. Representativeness can be assessed to some degree by the use of collocated samples. By definition, collocated samples are collected so that they are equally representative of a given point in space and time. By evaluating the precision information obtained, an estimate of the variability at each location can be determined.

Completeness

Completeness is a measure of the amount of valid data obtained from a measurement program compared to the amount that was expected to be obtained under normal conditions. Completeness is usually expressed as a percentage. Access to the sampling location, sampling programs, analysis problems and the data validation process can all contribute to missing data. An overall completeness goal, expressed as a percentage, is 75% of the samples to be collected to assure that enough data of sufficient quality are obtained from the measurement system to fulfill the objective of this study.

Comparability

The criterion of comparability expresses the confidence with which one data set can be compared to another. The use of approved sampling and analytical standard operating procedures and the reporting of analytical data in the appropriate units will satisfy this criteria.

Reported Levels of Detection

The detection limits that will be reported for the parameters of interest are listed in Table 6-2. The detection limits for metals and VOA's has been set at lower levels than standard practice because of the impacts that even low levels of these compounds may have on the Facilities Plan. It should be noted that matrix effects or, high concentrations of some sample constituents will cause detection limits to be raised.

7.0 SAMPLING PROCEDURES

7.1 Introduction

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This section discusses the field sampling techniques, describes the field equipment, and lists the preservative chemicals needed. Reference to laboratory methods of analysis are included in the Parameter Table in Section 6 and refer to CDM's laboratory standard of practice. This document is on record in the CDM laboratory.

7.2 Field Sampling Procedures

This section outlines the sampling technique checklist to be followed by the sampling crews. Sampling preservation and collection for grab samples are included. Steps are in the order that they will be followed.

There are two sites to be samples. The procedure for each site will include the procedures listed herein as necessary for that site. The sites and procedures are as follows:

- o New Bedford Plant Influent
- Automatic time composited 24-hour influent samples using an ISCO Sampler
- o Sulfide, pH, oil and grease influent grab samples
- o H₂S air samples
- o New Bedford Plant Effluent
 - Time composited grab samples from effluent channels
 - o Sulfide, oil and grease, pH grab samples
 - o VOA grab samples

There will be one time composite ISCO sampler maintained in standby status to be used in the event of a mechanical malfunction of any of the other automatic samplers.

The daily composited samples will be collected from approximately mid-day to mid-day.

Labelling Scheme

Sample bottles will be labeled with an identifying code. The code will be in the following format:

Client - type - location - sample no.

The client is NB for New Bedford.

The type is WW for wastewater.

The location codes are given below for each of the 2 sample locations:

TPI = Treatment Plant Influent

TPE = Treatment Plant Effluent

Each sample collected at a given location will be assigned a sequential number. Samples collected at the same time and location will be given the same number.

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As an example of the labelling system, the first 24-hour composite sample collected at the Treatment Plant influent would be labelled NB WW-TPI-001.

Grab samples for VOA, sulfides, and oil and grease would receive the label NB-WW-TPI-002. This is because the grabs represent samples just from that instant of time, whereas the composite represents a sample for a 24-hour period.

7.2.1 Processing of the fully automatic time composited sample

- 1. Check in with the plant operator on duty with assigned responsibility.
- Ask the operator if any unusual events took place in the proceeding 24 hours that may have influenced the sampling program and then record the flow by hour for preceeding 24 hours (if possible).
- 3. Turn off automatic sampler and record the time.
- 4. Open the sampler door.
- 5. Record any observed problems or questions about the condition of the sample or how the automatic sampler is running.

- 6. Remove the sample bottles and pour into a large glass container.
- 7. Label the bottle with the proper site identity code and sample description.
- 8. Visually check to see if the sampling tube is clogged, unclog, and/or replace if necessary.
- 9. Put the full sample bottles in the transportation cooler packed with ice.
- 10.Install clean, empty sample bottles (rated for priority pollutants if required) in the sampler.

11.Close the door

- 13.Turn on the sampler and record the time
- 13.Complete the chain of custody report

7.2.2 pH, Oil and Grease, Sulfide, Cyanide Grab Samples

- 1. Calibrate the pH meter.
- 2. At the same influent channel location as the automatic sampler sample chamber, use the grab sample device with a collection container attached to take a sample at the water surface being sure to collect any floating material.
- 3. Test the pH directly from the collection container.
- 4. Record the pH on the collection form
- 5. Pour an appropriate size sample into the oil & grease sample bottle. (Surface matter is allowed.)
- 6. Following the preservation techniques for Oil and Grease samples, preserve the sample.
- 7. Pour a sufficient size sample into the 125 millileter plastic sulfide sample bottle to fill to the top.
- 8. Following the preservation techniques for Sulfides, preserve the sample.
- 9. Label the grab sample bottles and fill out the sample custody forms.

7.2.3 Wastewater VOA Samples

1. At the same influent channel location as the automatic sampler, use the grab sample device with a 1 liter amber glass bottle attached to it and take a sample just below the water surface.

- 2. Record the time to the nearest minute.
- 3. Select vial for the volatile organics sample, remove cap and incline vial at about a 45° angle. (Note: Caps with orange colored septums should be examined carefully before using. If the teflon (shiny) side of the septum faces away from the sample, discard vial and select another.)
- 4. Slowly fill vial with a portion of the one liter amber bottle grab sample. Avoid bubbling and spilling while pouring.
- 5. Fill vial completely making sure a meniscus is present above the top. Use the cap or pipet to add the few last drops to produce the meniscus. The meniscus will help in sealing the vial without producing an air bubble.
- Carefully close the vial with the teflon-lined screw cap putting the cap perpendicularly on the vial. Avoid any contact with underside of the septum. Make sure the cap is tightly screwed on.
- Invert the vial and tap the screw cap to check for air bubbles. Any air bubbles would be seen rising to the top of the vial. If air bubbles are present, repeat steps 2 through 4 (throw vial away).
- Make sure the vial is correctly labeled, place vial in styrofoam cup and place in the appropriate cooler after labeling the vials.
- 9. Repeat steps 1 through 6 for second sample.
- 10.Fill out sample sheets

- 11.Estimate the total flow through the plant and calculate the detention time to the effluent channel sampling location.
- 12. This detention time added to the time from step 2 is when the VOA effluent grab sample should be taken.
- 13.At the effluent channel sampling location, use the grab sample device with a 1 liter amber bottle attached to take a sample just below the water surface
- 14.Repeat steps 2 to 11 above.

7.2.4 H₂S Air Monitoring

- H₂S will be continuous monitoring, calibration will be bi-monthly.
- 2. Change record
- 3. If scheduled, calibrate meter

- a. Connect 25 ppm calibration gas cylinder to sensor/sampler
- b. Adjust recorded speed from slow to high
- c. Open calibration gas cylinder, read recorder, adjust to 25 ppm as necessary
- 4. Change the pen or the chart if required
- 5. Fill out the appropriate forms.

7.3 Description of the Automatic Sampling Equipment

7.3.1 ISCO Model 2100 Time Composite Sampler

The ISCO Model 2100 sampler is priority pollutant rated, contains 24 glass sample bottles, and is refrigerated by placing a bag of ice in its insulated housing. This portable sampler will automatically fill a sample bottle once per hour. (Refer to Figure 7.1 for a flow schematic).

7.4 Description of Other Sampling Equipment and Supplies

7.4.1 Grab Sampling Device

The grab sampling device is simply a mechanism as shown in Figure 7.2 that will guide the grab sampling container to a prespecified location in the channel and hold it there against the current while the container fills.

7.5 Field Notes

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Careful documentation of both expected and unexpected events through field notes is as important as the actual collection of samples. Each sample location will have a loose leaf notebook that contains all the necessary instructions and forms required at that location.

7.5.1 Sampling Procedure Checklist

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Each day, the sampling crew will receive a work plan outline of the day's events. These outlines will refer to various sampling procedure checklists made from the sample procedures in Section 7.2. The outlines will also include any deviations from the procedures found in these checklists as well as special instructions required. After each item is completed, it should be checked off. At the end of the crew shift, the person in charge should also include the time of the shift and his signature.



Figure 1.2-1 View of the Model 2100 Sampler Suspended from the Optional Suspension Harness

Figure 1.2-2 Exploded View of the Model 2100 Sampler

F167-1

8.0 SAMPLE CUSTODY PROCEDURES

8.1 Chain of Custody

Each sample is considered to be physical evidence from the Facility. The chain of custody procedures will provide documentation of the handling of each sample from the time it is collected until it is destroyed. This documentation will assure that each sample collected is of known and ascertainable quality.

A "Chain of Custody Record" will be filled out for each sample type at each sampling location to maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory which will analyze the sample (which will then continue the chain of custody within their laboratory records). Each time the samples are transferred to another custodian, signatures of both the person relinquishing the sample and the person receiving the sample, as well as the time and date, will be collected to document the transfer.

A sample Chain of Custody Record is shown in Figure 8-1. Actual field forms will include two to three copies so that forms are filled out simultaneously. The sampling team leader retains the original and his own copy, one copy remains with the samples until they are received by the laboratory. If samples are split to different labs, a copy will go to each lab. Care must be taken that all copies are legible. If additional duplicate sheets are required, the person relinquishing the samples is responsible for filling out additional copies, or making reproductions. The original must be returned by the sampling team to CDM for the New Bedford project records and the sampling team will retain their copy.

The Chain of Custody Record will be placed in a ziplock bag and be included with each sample delivery. All samples will be hand delivered to the CDM Boston laboratory. If a sample is to be analyzed by a subcontracted laboratory, that sample will be shipped via overnight delivery in compliance with chain of custody procedures.

8.2 Laboratory Custody Procedures

- a. The CDM laboratory has designated a sample custodian (Mr. O'Herron). In addition, the laboratory has set aside a secured sample storage area. This is a clean, dry, isolated room with sufficient refrigerator space that is securely locked from the outside.
- b. Samples will be handled by the minimum possible number of persons.
- c. Incoming samples will be received by the custodian who will indicate receipt by signing the chain-of-custody record sheet accompanying the samples and retaining the sheet as a permanent record.

CHAIN OF CUSTODY RECORD

PROJECT NAME___

mp Dresser & McKee Inc.

PROJECT NUMBER_

Field Log Box Reference No...

SAMPLE NUMBER	1	DATE	TIME	SAM	LE LOCATION	SAMPLE TYPE	15	/8/ \$/\$/						NUMBER OF CONTAINER	LOG BOOK S PG HO	REMARKS
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FIG 8.1

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- d. Immediately upon receipt, the custodian places the samples in the sample room, which will be locked at all times expect when samples are removed or replaced by the custodian. To the maximum extent possible, only the custodian shall be permitted in the sample room.
- e. The custodian shall insure that all samples are properly stored, preserved and maintained.
- f. Samples will be distributed to personnel who are to perform tests by the sample custodian under the direction of the laboratory supervisor.
- g. The analyst records in his laboratory notebook or analytical worksheet, identifying information describing the sample, the procedures performed, and the results of the testing. The notes are dated, indicating who performed the tests, and include any abnormalities that occurred during the testing procedure. The notes are retained as a permanent record by the laboratory.
- h. Only approved methods of laboratory analyses shall be used.
- i. Laboratory personnel are responsible for the care and custody of a sample once it is released to them.
 - j. The laboratory area is maintained as a secured area and is restricted to the authorized personnel.
 - k. Once the sample analyses are completed, the unused portion of the sample together with identifying labels and other documentation, is returned to the custodian. The returned sample is then retained in the custody room until permission to destroy the sample is received by the custodian.
 - 1. Samples are destroyed only upon the order of the laboratory supervisor. The same destruction procedure is true for tags.

For samples which are delivered to the laboratory without applicable or with incomplete chain-of-custody documentation, the sample custodian will acknowledge receipt of samples and initiate the chain-of-custody. Sampling results for such samples will be reported with the following disclaimer:

Samples were received:

- without proper chain-of-custody
- deficient chain-of-custody

9.0 SAMPLE BOTTLE PREPARATION AND SAMPLE PRESERVATION

9.1 Bottle Cleaning Procedures

Depending on the analyses to be performed and the nature of the samples

being collected, the sample container must be treated according to specific procedures. For environmental samples, bottles should be washed as described in 'general bottle washing' if: 1) they will be stored for later (not specified) usage, 2) they will be used for composite samples for a variety of routine analyses, 3) they will be used for routine analyses not requiring special preparation.

9.2 General Bottle Cleaning

Bottle Material: plastic or glass

Bottle Size: Dependent upon determinations required

Cleaning Reagents: 1. Phosphate-free detergent 2. Distilled water

Procedure:

- 1. Rinse bottles with tap water
- Soak bottles in detergent solution for approximately thirty (30) minutes
- 3. Scrub bottles with a brush
- 4. Rinse bottles several times with tap water to remove the detergent
- 5. Rinse bottles thoroughly, several times, with distilled water

9.3 Bottle Cleaning for Metals Determination

Bottle Material: Usually polypropylene

Bottle Size: Usually 500 ml

Cleaning Reagents: 1. Detergents 2. 1.1 nitric acid 3. Distilled water

Procedure:

- 1. Follow general bottle cleaning procedure
- 2. Add 1:1 nitric acid to bottles, cap, and shake briefly
- 3. Allow bottles to stand for approximately 30 minutes, shaking them intermittently
- 4. Pour acid from bottles and rinse them with tap water
- 5. Rinse bottles thoroughly, several times, with distilled water

9.4 Bottle Cleaning for Oil & Grease Determinations

Bottle Material: Glass with teflon-lined cap

Bottle Size: One (1) liter

Cleaning Reagents: 1. Acid solution of 1+1 nitric acid 2. Detergent

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- 3. Distilled water
- 4. Freon-113

Procedure:

- 1. Follow general bottle cleaning procedure
- 2. Rinse bottles (excluding caps) with acid solution
- 3. Pour acid from bottles and rinse them with tap water
- 4. Rinse bottles thoroughly, several times, with distilled water
- 5. Rinse bottles with Freon-113

9.5 Bottle Cleaning for Extractable Organics

Bottle Material: Glass with teflon-lined cap

Bottle Size: Usually one(1) gallon

Cleaning Reagents: 1. Detergent

2. Chromic acid cleaning solution

- 3. Distilled water
 - 4. Pesticide-grade hexane

Procedure:

- 1. Follow general bottle cleaning procedure
- 2. Fill bottles with chromic acid cleaning solution allow to stand for a minimum of 1/2 hour
- 3. Pour chromic acid cleaning solution from bottles and rinse them thoroughly with tap water
- 4. Rinse bottles several times with distilled water
- 5. Rinse bottles and caps two times with pesticide-quality hexane

9.6 Bottle Cleaning for Hazardous Samples

Bottle Material: Glass with teflon-lined cap

Bottle Size: 40 ml for tank for high hazard samples, up to 500 ml (wide mouth) for others

Cleaning Reagents: 1. Detergent 2. Distilled water 3. Reagent-grade methanol

Procedure:

1. Follow general bottle cleaning procedure

- 2. Rinse bottle with methanol
- 3. Bake for one hour at 300

9.7 Preservation Techniques

9.8 Preservation Technique for Total Metals

Chemical Preservative: Ultrex concentrated HNO3

Procedure:

- 1. Use bottle specifically cleaned for metal determinations
- 2. Add 5 ml of Ultrex concentrated HNO per liter of sample.
- This should reduce the pH to less than 2.

9.9 Preservation Technique for Oil and Grease

Chemical Preservatives: Conc. H_2SO_4 or HCL

Procedure:

- Use bottle specifically cleaned for oil and grease determinations
- 2. To avoid corrosion of oil-lined caps, preservative (Conc. H_2SO_4) should not be added to empty bottles prior to sampling, but should be added to samples as soon as possible after collection.
- 3. All 5 ml of concentrated H_2SO_4 or HCL to one (1) liter of liquid sample. This should reduce the pH to less than 2.
- 4. Add 1 ml concentrated H_2SO_4 per 80 g of solid sample

9.10 Preservation Technique for Cyanide

Chemical Preservative: NaOH

Procedure:

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Add 2 ml of 10 N NaOH per liter of sample. This should increase the pH to greater than 12.4

9.11 Preservation Technique for Phenols

Chemical Preservative: $CuSO_4$, H_2SO_4 and H_3PO_4

Procedure:

- 1. Add 10 ml of a 100 g/l $CuSO_4$ solution per liter of sample in order to attain a concentration of 1 g/l $CuSO_4$, and acidify with H_2SO_4 to a pH less than 4.
- with H_2SO_4 to a pH less than 4. 2. Add a Sufficient volume (usually 5 ml per liter of sample) of 1:9 H_3PO_4 to lower the pH of the sample to less than 4

9.12 H_SO_ Preservation Technique for COD and All Forms of Nitrogen and Phosphorus

Chemical Preservative: H_2SO_4

Procedure:

Add 2 ml of concentrated $\rm H_2SO_4$ per liter of sample. This should reduce the pH to less than 2.

References:

- U.S. EPA, 1979. Methods for the Chemical analysis of water and wastes. Revised March 1983. EPA-600/4-79-020.
- 2. A.P.H.A. 1975. Standard methods for the examination of water and wastewater. 14th ed.

9.13 Laboratory Sample Hold Times

The preservation requirements and hold times are summarized in Table 9-1.

10.0 DOCUMENTATION, DATA REDUCTION, AND REPORTING

- o provide setup of field notes
- o describe calculation procedures to the extent possible
- o provide data forms
- o data entry and transfer procedures

11.0 DATA VALIDATION

Validation of New Bedford's analytical data will be performed on two separate levels: Internal Laboratory Data Validation and External Program Data Validation.

11.1 Internal Laboratory Data Validation

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All analytical data produced by the CDM Boston laboratory is validated prior to its release. This validation is conducted routinely as part of the laboratory's internal quality control program, using the guidelines established in the CDM Laboratory QA/QC Plan.

Performance goals and quality control evaluation procedures are documented individually for each analytical procedure used. This information is located within the individual CDM analytical procedures, specific to each parameter analyzed.

In general, all laboratory data is reviewed as it pertains to calibration, instrument performance, blank analysis, replicate analysis, and matrix and surrogate recovery. Also, the data is reviewed for the reasonableness of the analytical result (for example, suspended solids result greater than the total solids result of a sample), calculation and transcription errors. Of greatest importance is the elimination of false positive and false negative results. This validation process is complete when the sample analyst and laboratory supervisor sign off on the analytical report.
TABLE 9-1

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Sample Preservation and Hold Times

Title	Preservative	Hold Time
Ammonia	Cool 4°C	28 days
BOD	Cool, 4°C	48 hours
COD	Cool, 4°C H ₂ SO ₄ to pH<2	28 days
Chloride	None required	28 days
Cyanide, Total	NaOH to pH>12	14 days
Kjeldahl Nitrogen	Cool, 4°C H_2SO_4 to pH<2	28 days
Trace Metals	HNO ₃ to pH<2	6 months
Oil and Grease	Cool, 4°C H_2SO_4 to pH<2	28 days
Volatile Organics	Cool, 4°C	14 days
Acid/Base-Neutral Extractables	Cool, 4°C	7 days until extraction 30 days after extraction
Pesticide/PCB	Cool, 4°C	7 days until extraction 30 days after extraction
Total Organic Carbon	Cool, 4° C, H_2 SO ₄ to pH<2	28 days
Total Phosphorus	Cool, 4°C, H_2SO_4 to pH<2	28 days
Total Suspended Solids	Cool, 4°C	7 days
Total Settleable Solids	Cool, 4°C	7 days

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11.2 External Program Data Validation

The sampling and analytical plan for the New Bedford project has its own QA/QC plan, which is independent of the laboratory's. This plan covers both the sampling and analytical component of the total measurement system. As such, the QA/QC information generated by following the plan will reflect both laboratory and field sampling performance.

This sampling and analytical plan specifies the inclusion of blind blanks and duplicate samples into the analytical system. These QC samples are prepared by the sampling team so that their true identity is unknown to laboratory personnel and are submitted for analysis at a frequency of 20% for blanks and 20% for duplicate samples.

These external QC samples provide the majority of the information used to review the data from a program perspective. The precision of the field duplicates is assessed and compared to the performance goals stated in Section 6.0 of this document. Field blank data and reported detection limits are also reviewed. Also, the laboratory QA/QC information reported with the analytical data is evaluated at this time.

The output of this program data validation is a usability report which attests to the suitability of the data or its intended use. Recommendations are included in this report which qualify specific pieces of data (if required) so that the information is not used incorrectly by project engineers. These recommendations are usually in the form of qualifying a reported value as an estimate rather than an absolute value or the rejection of some reported values because of field blank contamination.

12.0 PERFORMANCE AND SYSTEM AUDIT

Performance and systems audits are an essential part of every quality assurance/quality control (QA/QC) plan. A performance audit independently collects measurement data using performance evaluation samples. A system audit consists of systematic, comprehensive review of the total data production process which includes on-site reviews of a field and laboratory's operational systems and physical facilities for sampling, calibration and measurement protocols.

The audits conducted in support of the New Bedford project serve three general purposes:

- 1. to determine if a particular group has the capability to conduct the monitoring before the project is initiated;
- 2. to verify that the QA Project Plan and associated standard operating procedures (SOPs) are being implemented; and
- 3. to detect and define problems so that immediate corrective action can begin.

The CDM Boston laboratory participates in the U.S. EPA Water Supply (WS) and Water Pollution (WP) ongoing performance evalutions, which will serve as performance audits for this project.

Systems audits of the sampling and analytical portion of this project are the responsibility of the Quality Assurance Officer The Quality Assurance Officer will present a schedule of when audits will be conducted and what each audit will cover. All audits will be conducted by individuals who are not directly involved in the measurement process and who are competent in the fields they are auditing.

A preliminary meeting will be conducted prior to initiating any system audit. During this meeting, the auditor will identify key personnel, define scope of audit, establish communication with Field and laboratory staff, describe auditing plan and schedule, and set a date for completion along with a final briefing. The documentation required for audits include a Quality Assurance Notice form and a Nonconformance Report.

13.0 CORRECTIVE ACTION PROGRAM

13.0 Corrective Action Program

The corrective action program in place during this phase of the New Bedford project has the capability to discern errors or defects in the project implementation process.

The Quality Assurance Officer has the authority to make appropriate corrections and improvements as may be necessary in techniques and methods used by field and laboratory personnel.

Field and laboratory personnel are required to report to project management and the QA Officer any statistical data or other information that reflects the need for corrective action that should be implemented on a particular procedure or process.

Inspection steps taken during sampling, calibration and measurements should detect defects, malfunctions, or other problems which could jeopardize the sampling and analytical process and will trigger corrective actions to rectify the causes and stabilize the system.

TABLE 6 ____ QUALITY ASSURANCE OBJECTIVES

neter	Accuracy	Precision	Q	C Sample Fre	quency
	(% recovery of lab matrix spike or lab control sample)	Field Replicate RPD (1)	Blanks	Field Replicates	Collocated Samples
			5%	5%	
	-70 - 130% NA	15	2021	202 \	Min. 1/loc.
	85 - 115	15	20	20	Min. 1/loc.
	85 - 115	15	20	20	Min. 1/loc.
Solids	Not Applicable	15	20	/20 /	Min. 1/loc.
Suspended Solids	Not Applicable	15	20	20	Min. 1/loc.
Volatile Suspended Sol	. Not Applicable	15	20	20	Min. 1/loc.
Settleable Solids	Not Applicable	15	20	20 1	Min. 1/loc.
ʻide	80 - 120	15	2þ	20	Min. 1/loc.
Kjeldahl-N	80 - 120	20	20	20	Min. 1/loc.
nia – N	80 - 120	20	20 I	20	Min. 1/loc.
de	85 - 115	15	20 I	20	Min. 1/loc.
Phosphorus	80 - 120	20	20 I	2Þ (Min. 1/loc.
Grease	85 - 115	15	20	20	Min. 1/loc.
ity Pollutant Metals	80 - 120	25	20 I	20	Min. 1/loc.
ity Pollutant Volatiles	60 - 130	35	2 0	2 0	Min. 1/loc.
ional HSL Volatiles	40 - 135	40	201/	20	Min. 1/loc.
Volatiles	20 - 120	60	20 V	20 J	Min. 1/loc.
SC/PCBS	45 - 125	40	2 b	2b V	Min. 1/loc.

elative Percent Difference (RPD) is defined by the following equation:

RPD = $\frac{|D_1 - D_2|}{(D_1 - D_2)/2} \times 100$

nere D₁ = First Sample Result
nd D₂ = Second Sample Result (Duplicate)

itrol limit of + the detection limit will be used for sample values less than three times reported detection limit.

REPORTED LEVELS OF DETECTION

CONVENTIONAL PARAMETERS

Parameter	(mg/l) Detection Limit
BOD 5-day Total Solids Total Suspended Solids Total Volatile Suspended Solids Settleable Solids Chemical Oxygen Demand Total Organic Carbon Chloride Total Kjeldahl Nitrogen Ammonia Sulfide	2 . 5 5 0.1 1(0.1 0.5 0.1 0.1 0.1 0.1
Cyanide	5. 0.02

METALS ANALYSIS

· · · ·	(ug/1)
Element	Detection Limit
Antimony	25
Arsenic	· 5
Beryllium	20
Cadmium	5
Chromium	5
Copper	5
Lead	.5
Mercury	1
Nickel	5
Selenium	10
Silver	5
Thallium	10
Zinc	1
Boron	. 200
Molybdenum	50

REPORTED LEVELS OF DETECTION

(CONT'D.)

PCB/PESTICIDE ANALYSIS

Compound	(ug/1) Detection Limit
Aldrin	0.050
Aloba_BHC	0.050
Beta-BHC	0.050
Gamma-BHC	0.050
	0.050
Technical Chlordane	0.50
	0.10
4,4-001 4 4_00F	0.10
4,4-DDD	0.10
Dieldrin	0.10
Endosulfan I	0.050
Endosulfan II	0.10
Endosulfan Sulfate	0.10
Endrin	0.10
Endrin Aldehyde	0.10
Endrin Ketone	0.10
Heptachlor	0.050
Heptachlor Epoxide	0.050
Methoxychlor	0.50
Arochlor 1016	0.50
Arochlor 1221	0.50
Arochlor 1232	0.50
Arochlor 1242	0.50
Arochlor 1248	0.50
Arochlor 1254	1.0
Arochlor 1260	1.0
Toxaphene	1.0

REPORTED LEVELS OF DETECTION

(CONT'D)

VOLATILE ORGANICS ANALYSIS

Compound	(ug/1) Detection Limit
Priority Pollutants	
Chloromethane Bromomethane Vinyl Chloride Chloroethane Methylene Chloride Trichlorofluoromethane 1.1-Dichloroethylene 1.1-Dichloroethane Trans-1.2-Dichloroethylene Chloroform 1.2-Dichloroethane 1.1.1-Trichloroethane Carbon Tetrachloride Bromodichloromethane 1.2-Dichloropropane Trans-1.3-Dichloropropene Trichloroethylene Dibromochloromethane CIS-1.3-Dichloropropene 1.1.2-Trichloroethane Benzene 2-Chloroethylvinylether Bromoform Tetrachloroethylene 1.1.2.2-Tetrachloroethane Toluene Chlorobenzene Ethylbenzene	10 10 10 5 10 5 5 5 5 5 5 5 5 5 5 5 5 5
Additional HSL Compounds	r.
Styrene Total Xylenes Carbon Disulfide Vinyl Acetate 2-Butanone Acetone 2-Hexanone 4-Methyl-2-Pentanone	5 5 15 15 15 15 15

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REPORTED LEVELS OF DETECTION

(CONT'D.)

HSL ACID BASE/NEUTRAL EXTRACTABLE COMPOUNDS

	(ug/l)
Compound	Detection Limit
N-Nitrosodimethylamine	20
Phenol	20
Aniline	20
Bis(2-Chloroethyl)Ether	20
2-Chlorophenol	20
1,3-Dichlorobenzene	20
1,4-Dichlorobenzene	20
Benzyl Alcohol	20
1,2-Dichlorobenzene	20
2-Methylphenol	20
Bis(2-Chloroisopropyl)Ether	20
4-Methylphenol	20
N-Nitroso-Di-N-Propylamine	20
Hexachloroethane	20
Nitrobenzene	20
Isophorone	20
2-Nitrophenol	20
2,4-Dimethylphenol	20
Benxoic Acid	100
Bis(2-Chloroethoxy)Methane	20
2,4-Dichlorophenol	20
1,2,4-Trichlorobenzene	20
Naphthalene	20
4-Chloroaniline	20
Hexachlorobutadiene	20
P-Chloro-M-Cresol	20
2-Methylnaphthalene	20
Hexachlorocyclopentadiene	20
2,4,6-Trichlorophenol	20
2,4,5-Trichlorophenol	200
2-Chloronaphthalene	20
2-Nitroaniline	100
Dimethyl Phthalate	20
Acenaphthylene	20
3-Nitroaniline	100
Acenaphthene	20
2,4-Dinitrophenol	100
4-Nitrophenol	100
Dibenzofuran	20
Z,4-Dinitrotoluene	20
2,6-Dinitrotoluene	20

REPORTED LEVELS OF DETECTION

(CONT'D.)

HSL ACID BASE/NEUTRAL EXTRACTABLE COMPOUNDS (CONT'D.)

Diethyl Phthalate	20
4-Chlorophenyl Phenyl Ether	20
Fluorene	20
4-Nitroaniline	100
4,6-Dinitro-2-Methylphenol	100
N-Nitrosodiphenylamine	20
4-Bromophenyl Phenyl Ether	20
Hexachlorobenzene	20
Phenanthrene	20
Anthracene	20
Di-N-Butyl Phthalate	20
Fluoranthene	20
Benzidine	100
Pyrene	20
Butylbenzyl Phthalate	20
3,3-Dichlorobenzidine	40
Benzo(A)Anthracene	20
Bis(2-Ethylhexyl)Phthalate	20
Chrysene	20
Di-N-Octyl Phthalate	20
Benzo(B)Fluoranthene	20
Benzo(K)Fluoranthene	. 20
Benzo(A)Pyrene	20
Indeno(1,2,3-C,D)Pyrene	20
Dibenzo(A,H)Anthracene	20
Benzo(G,H,I)Perylene	20
1,2-Diphenyl-Hydrazine	20
P-Chloro-M-Cresol	20
4,6-Dinitro-O-Cresol	20



VOLUME III

APPENDIX C

GUIDELINES FOR COST EFFECTIVENESS ANALYSES

1.0 INTRODUCTION

In order to use a cost-effectiveness analysis for the selection of treatment alternatives, these guidelines and procedures for determining present worth costs have been developed based on EPA cost-effectiveness guidelines. Common parameters to be used in all cost effectiveness analyses include life expectancies, replacement costs, discount rate, salvage values, and planning period for analysis.

2.0 PARAMETERS

2.1 DISCOUNT RATE

At the start of each fiscal year, EPA establishes the discount rate to be used for present worth cost analyses. The rate to be used for this analysis is 8.63 percent, the rate established by the Water Resources Council as of October 1, 1985.

2.2 PLANNING PERIOD FOR ANALYSIS

The planning period for the analysis is 20 years.

2.3 CONSTRUCTION COST INDEX

The estimated construction costs are based on November 1988 prices. The Construction Cost Index, as presented in the Engineering News Record (ENR-CCI) for November 1988 is 4,565.

2.4 COST ESCALATION FACTORS FOR ENERGY USE AND WASTEWATER FLOW INCREASES

There will be no escalation of energy or chemical costs for the purposes of the cost-effectiveness analysis. None of the costs will be weighted according to flow. It is unlikely that one alternative would have an appreciably higher flow-dependent cost than another. In addition, the average flow in 1987 is approximately 88 percent of the ultimate average flow. This difference in flow is not enough to warrant a major difference in the energy and chemical requirements.

2.5 LIFE EXPECTANCIES

The life expectancies of cost items are important for use in determining future replacement costs and salvage values at the end of the planning period. The life expectancies to be used for these projects are 15 years for all equipment, and 30 years for buildings, structures, and pipelines.

2.6 REPLACEMENT COSTS

For those cost items whose life expectancies are less than the planning period of the analysis, the items must be replaced, and the costs associated with the replacement incorporated into the present worth cost. There will be no escalation of the present costs of those items requiring replacement. The present day costs will be used as the replacement value. The replacement cost must be converted to an equivalent present worth cost to be included in the cost analysis.

2.7 SALVAGE VALUES

For those items which are replaced after 15 years, the salvage value has been calculated based on a straight line depreciation for a period equal to its life expectancy, assuming no salvage value after its life expectancy. The salvage value is equal to the replacement cost minus 5 years of depreciation.

For the buildings, structures, and pipelines, whose life expectancies are 30 years, an assumption has been made that they have no measurable salvage value at the end of 20 years.

The estimated salvage values must be converted to a present worth cost for inclusion in the cost analysis.

3.0 COSTS

3.1 LAND COSTS

The cost of land is not expected to become a part of the present worth cost analysis. In accordance with the cost effectiveness guidelines, the land values must be salvaged at the end of the planning period. and therefore would be negligible in the final cost effectiveness analysis. Thus, there is no need to consider land costs in the present worth cost analysis.

3.2 CAPITAL COSTS

The term "capital cost" is used throughout the discussion of cost factors. This cost consists of the estimated construction cost plus contingencies. The engineering and project contingency costs have not been included.

3.3 ANNUAL COST

Annual costs are those costs paid each year to keep the facilities in good operating order and to preserve the lives of structures and equipment. The following items, among others, are included:

- o Wages and salaries
- o Maintenance items
- o Energy consumption
- o Chemicals

The labor cost for the plant's operation and maintenance staff, including fringe benefits, averages \$26,000 per employee per year. The annual maintenance cost which includes lubrication oils, replacement parts, and

other maintenance items, is estimated as a percentage of the equipment capital costs. The cost of electric power is \$0.05227/kwh. Chemical costs for the biological treatment alternatives include a supply of liquid oxygen which costs \$70 per ton.

3.4 PRESENT WORTH COSTS

The present worth costs represent the summation of the equivalent present worth costs of the expenditures for the initial construction and installation of treatment process, the replacement of equipment, and the annual operation and maintenance costs minus the present worth of the estimated salvage values at the end of the planning period. The equivalent present worth cost is determined by applying factors based on the type of expenditure single or series, the interest rate which is the discount rate, and timing of the expenditure.

4.0 BASIS OF COST COMPARISON

All cost comparisons have been made in terms of present worth costs instead of equivalent annual costs. This has been done to avoid confusion between equivalent annual costs and annual operating and maintenance costs. Present worth costs provide a convenient method for evaluating one-time capital costs and the annual costs of the alternatives on an equivalent basis. Relative rankings of alternatives will not change regardless of whether present worth or equivalent annual cost is the method of comparison.

Appendix D

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VOLUME III

APPENDIX D

ASSESSMENT OF SLUDGE INCINERATION

1.0 INTRODUCTION

The sludge incineration option is comparative in cost to landfilling of stabilized sludge, but non-economic factors made sludge incineration a less desirable long-term disposal option.

The Massachusetts Department of Environmental Quality Engineering (DEQE) and the U.S. EPA have proposed limits on trace metals and organic compounds that are emitted from sludge incinerators. Because the proposed limits are still subject to public comment and review by the regulatory agencies, compliance with the limits in their final form is uncertain. The air pollution control equipment to be installed is also uncertain. The regulatory agencies have made it clear that the particulate control limitations will be more stringent than currently required in the New Source Performance Standards for sludge incinerators, but how much more stringent is not known. Even if the permitting process could be completed under current standards, and operation begun, it is uncertain whether sludge incineration is a less desirable long-term disposal option. Several communities that invested in sludge incineration as their principal disposal option have found their system shut down because of changing environmental concerns.

This technical memorandum addresses the environmental and other noneconomic factors related to the sludge incineration disposal alternative.

2.0 ASSESSMENT CRITERIA

Draft ambient limitations on the allowable levels for compounds emitted from the incineration of sewage sludge have been set by the DEQE and EPA. The DEQE guidelines are in the form of annual-average allowable ambient levels (AALs) and 24-hour-average threshold effects exposure limits (TELs) which were developed as part of the Commonwealth's air toxics program. At

the federal level, the U.S. EPA has proposed the establishment of a methodology to calculate permissible emission levels of metals and hydrocarbons from sewage sludge incinerators (54 FR 5746, February 6, 1989), under authority of Sections 405(d) and (e) of the Clean Water Act (CWA).

Both state and federal rules may be amended during comment periods and before final promulgation. Presently, they are the most applicable limitations from which the viability of sewage sludge incineration in New Bedford can be determined. This assessment of the incineration option as part of the New Bedford wastewater treatment plant (WWTP) upgrade is based on a preliminary or screening-level air quality analysis using approximate incinerator operating parameters. A Pass/Fail test is used to determine compliance with the proposed inhalation limits. While a more detailed assessment of the incinerator operating parameters and air quality impacts may change these results, sludge incineration is considered less desirable than other disposal alternatives.

2.1 U.S. EPA/CRUMPLER METHODOLOGY

Section 405(d) of the CWA mandates the development and assessment of disposal options for sewage sludge which protect human health and the environment. Incineration is technically a treatment method. However, it reduces sludge (residuals) volume and may be categorized as a disposal option; therefore, it qualifies as one of five major disposal options for which technical regulations have been developed. The inhalation exposure assessment method was developed by Dr. Eugene Crumpler (U.S. EPA) and others. The "Crumpler Method" defines a maximum concentration of seven elemental metals (including arsenic, beryllium, cadmium, chromium, lead, mercury, and nickel) and total hydrocarbons (THCs) in sludge which can be incinerated and still guarantee that human health and the environment will be protected. These allowable contaminant concentrations are computed using parameters from the sludge, the proposed air pollution control technology, and estimates of typical atmospheric dispersion rates for incinerator plumes.

The Crumpler Method is a multi-tier assessment that begins with a generic and conservative compliance analysis and can progress to a more sitespecific analysis. Tier I is a screening method that uses empirical data collected by U.S. EPA. Tiers II and III incorporate more site-specific and refined data. Meeting the proposed standards at the Tier I level would satisfy proposed U.S. EPA (federal) public health maintenance criteria necessary for approval of a sludge incinerator.

2.1.1 Modeling Parameters

The derivation of the sludge contaminant loading formulae for metals and THCs (54 FR 5746) is contained in the Draft U.S. EPA manual <u>Technical</u> <u>Support Document: Incineration of Sewage Sludge</u>. In its simplest form, the maximum allowable concentration of metals in incinerable sludge is a function of several parameters including a risk-specific concentration (RSC), a dispersion factor (DF) typical of operating incinerators, a control efficiency for metals (CE), and the sludge feed rate (SF).

The risk-specific concentration (RSC) is the minimum incremental ambient air concentration of a carcinogen (in micrograms per cubic meter) that has the potential for adverse effects on human health. It is based on an incremental carcinogenic risk of one per one-hundred thousand, an EPA cancer potency value for the metal, inhalation rate (20 cubic meters per day), and the body weight (70 kg) for an average adult. It is assumed that 100 percent of the inhaled particulate is retained in the lungs.

The dispersion factor (DF) for the Maximum Exposed Individual (MEI) can be chosen from the Crumpler data or site-specific data. The present analysis used the empirical Crumpler DF which was estimated from dispersion modeling sensitivity tests conducted by U.S. EPA. In the U.S. EPA tests it was determined that: (1) the stack height is the single most important factor affecting the magnitude of plume dispersion, and (2) the highest groundlevel concentrations typically result from aerodynamic downwash of sludge incinerator plumes because the stacks are short. Thus, the Tier I dispersion factor was developed solely as a function of incinerator stack height and downwash influenced dispersion simulated with ISCLT.

A first-level, or Tier I, analysis of potential plume impacts uses an empirical dispersion factor based on the proposed stack height and modeling results conducted by U.S. EPA for ten "representative" facilities modeled with the Industrial Source Complex Long-Term model (ISCLT). It is presumed that a sludge incinerator that passes a Tier I analysis will not result in chronic impairment of human health or the environment. A second-level, or Tier II, analysis is performed if the maximum allowable sludge feed rate calculated with the U.S. EPA prescribed dispersion factor is exceeded. A Tier II and III analysis involves developing a site-specific dispersion factor. Site-representative terrain elevations and plume wake (i.e., building dimensions) parameters are input to U.S. EPA guideline models to predict the highest ground-level exposure for the MEI. In both analyses, the RSC is calculated for the MEI who is assumed to be continuously exposed to the highest ground-level concentration over a 70-year lifetime.

Control efficiencies (CE) for metals were calculated by the U.S. EPA based on values collected from the literature for the period 1972 to 1985, and on the 1987 test reports for four incinerators. The values selected for arsenic, cadmium, chromium, and nickel correspond to the 10th-percentile control efficiency listed in 54 FR 5035, Table IX-G.1, and are reproduced in this document in the modeling results tables. The CEs for beryllium and mercury were based on assumptions used in developing the National Emission Standards for Hazardous Pollutants (NESHAPs) for these pollutants. The Tier III analysis allows control efficiencies to be developed from stack tests performed on the existing incinerators. However, the existing incinerators would not be used to incinerate sludge from the proposed facility. Therefore, any data collected from the existing units would not be useful.

A **sludge feed rate** (SF) for the present study was set equal to the average mass of dry sludge processed each day at the New Bedford WWTP as a function of the wastewater flow rate and solids percentage.

2.1.2 Allowable Contaminant Concentrations in Sludge

The allowable sludge concentrations for arsenic, cadmium, chromium, and nickel are calculated from the forementioned parameters RSC, DF, and CE. The three other metals -- mercury, beryllium and lead -- are calculated differently because mercury and beryllium have promulgated NESHAPs, and lead has a National Ambient Air Quality Standard (NAAQS). The proposed sludge standards do not attempt to redefine acceptable emission rates for these elements. The fact that there are pre-existing emission standards for beryllium and mercury precluded development of allowable sludge concentrations using RSCs and DFs. In the case of lead, the RSC was set equal to 25 percent (0.38 ug/m³) of the 1.5 ug/m³ NAAQS. There is some speculation that it may be lowered by one-third to 0.25 ug/m³, based on recent toxicological data. The modeled lead impact is compared to both numbers for thoroughness.

Besides allowable sludge concentrations for metals, the U.S. EPA has proposed limiting concentrations of organic pollutants (expressed as total hydrocarbons, THCs) in the incinerator flue gas. U.S. EPA testing of four incinerators for organics destruction efficiencies and PIC formation demonstrated that no reasonable worst-case destruction efficiencies could be calculated. However, a good correlation between the relative concentration of organics and THCs detected in the flue gas permitted the estimation of a risk-specific concentration for THCs. A site-specific in-stack THC limitation can be calculated if a dispersion factor (DF) and gas flow rate are known. Thus, compliance with the THC limitation is possible without the input of highly variable destruction efficiency data for organics.

The Crumpler Method, Tier I and Tier II, was used to compute allowable concentrations of metals and THC in the sludge feed to the incinerator. Parameters input to the formulae are listed in the modeling results tables.

2.2 DEQE ALLOWABLE AMBIENT LEVELS METHODOLOGY

The Commonwealth of Massachusetts DEQE requires that all water treatment projects for which 310 CMR 7.02 approvals are required shall "... perform an air toxics analysis which demonstrates compliance with Allowable Ambient Limits" (Maillet, 1988). Since the issuance of the Maillet memorandum, an additional set of threshold effects exposure limits (TELs) have been developed by the Office of Research and Standards (ORS) to regulate short-term (24-hour) exposures to air toxics (West, 1989). The Office of Research and Standards (ORS) of the DEQE has established AALs and TELs for 106 chemical compounds (including trace metals) which are suspected carcinogens, mutagens, or acute toxins.

The AALs are not-to-be-exceeded annual average concentrations based on an "acceptable" additional incremental cancer incidence of one per one-million population or a fraction of the most appropriate occupational limit adjusted according to the CHEM scoring system (DEQE, 1989b). This risk level is one order of magnitude more stringent than that proposed by U.S. EPA. The TELs are based on the most appropriate occupational limit adjusted by a factor of 5 to 50 to account for developmental and reproductive effects and multimedia exposures not otherwise accounted for in the occupational exposure levels. If the calculation of the TEL results in a lower limit than the calculation for the AAL, the AAL is set equal to the TEL. An emissions source with an ambient air impact exceeding one-tenth of an AAL must address cumulative impacts of that compound from local sources (DEQE, 1989a).

The DEQE has proposed AALs and TELs for 10 compounds for which sludge testing was performed at the New Bedford WWTP: beryllium, cadmium, total chromium, chromium VI, lead, nickel, PCBs, selenium, toluene, and total xylenes. Screening modeling was performed to identify the maximum annual and 24-hour ground-level impacts for each of the above mentioned compounds in accordance with guidelines set by the DEQE (DEQE, 1988a). Model inputs and results are discussed in the next section.

3.0 INCINERATION TECHNOLOGY

The combustion of sewage sludge is one of the treatment/disposal alternatives being studied for New Bedford. The New Bedford incinerator would incorporate fluidized-bed technology which has been been used for numerous industrial applications since the early 1960s. The fluidized-bed incinerator (FBI) would be cylindrically shaped with a vertical orientation; the steel exterior shell covers an interior refractory material. Partially dewatered sludge would be fed into the lower portion of a single chamber furnace where it would be simultaneously fluidized with hot sand by air jets emanating at a system of tuyeres. Fine particulate ash would be carried out through the top of the furance and collected in an air pollution control system.

The combustion process occurs in two stages. First, evaporation of water and pyrolysis of organics occur as the sludge temperature rises rapidly in the fluidized sand bed. Secondly, the freeboard area above the sandbed acts like an afterburner because most of the remaining carbon and combustible gases are burned there. Compared to multiple hearth incinerators and electric furnaces, the FBI is a preferred technology because it reduces the amount of excess air required for complete combustion to 20 to 50 percent. In a well-operated FBI, the remaining ash is completely burned out.

3.1 INCINERATOR OPERATING ASSUMPTIONS

The following reasonable worst-case operating conditions were used to assess ambient air emissions of heavy-metals and VOCs from a fluidized bed incinerator, based on designs currently under consideration:

- The facility would process a maximum-month design year quantity of 87,000 dry pounds per day of sewage sludge at 30% solids.
- o Three incinerators, each with a capacity of 43,000 dry pounds per day at 30% solids, would be constructed at the preferred treatment site. One would be in continuous operation.

Another would operate for 3 to 4 days at a time to process excess sludge. The third would be held in reserve.

- No additional fuel would be added during normal steady-state operation of the FBI. (Fuel oil or natural gas would be utilized during start-up and stand-by modes, or when the furnace combustion temperature drops below acceptable levels.)
- o The combustion chamber would have a "hot wind box" design, and operate at temperatures in excess of 1,500°F.
- o Projected design year (i.e., 2014) New Bedford sludge quality for dry-weather and average-load conditions (primary and secondary production) is used to estimate the percent composition of arsenic, beryllium, cadmium, chromium, lead, nickel and, PCBs for which concentration limits have been proposed under amendments to Section (d) and (e) of the Clean Water Act. (Projected sludge quality is based on Phase 2 Facilities Plan sludge quality testing.)
- o Hexavalent chromium is assumed to be 1% of the total chromium content in the sludge, a contention supported by the U.S. EPA amendments.
- Particulate emissions would be controlled to an outlet loading of 0.015 grains per dry standard cubic foot corrected to 12 percent CO₂.
- Heavy-metal control efficiencies of the employed control technology are assumed to be equal to the values cited in 54 FR 5746, February 6, 1989.
- o Good combustion management practices will be used to control NOx and CO emissions.

3.2 AIR POLLUTION CONTROL SYSTEM

The New Source Performance Standard (NSPS) for particulate matter from sewage sludge incinerators is 1.3 pounds per ton of dry solids fired. To achieve this standards, most facilities have used a high pressure drop venturi and wet tray scrubber. For systems that can achieve an emission rate of 0.67 pounds of particulate per ton of dry solids, certain monitoring and reporting of incinerator operating parameters are waived. A venturi/wet tray scrubber operating at a pressure drop across the system of 35 to 40 inches of water column has been able to achieve the lower limit. However, the relationship between pressure drop and particulate control efficiency is not direct and depends on other factors, including the type of incinerator, particle size distribution, and sludge quality.

The venturi/wet tray scrubber system for the sewage sludge incinerator not only is capable of meeting the NSPS but is desirable for other reasons. The flue gases from a sewage sludge incinerator are relatively humid and are more suitable to a wet scrubbing system. The availability of water and water treatment systems for the scrubber effluent make it an economical system to operate.

In order to meet the more stringent emission limitations that may be required under the proposed federal and state guidelines, alternative air pollution control systems may need to be considered. The air pollution control system considered in this analysis includes:

- o A combustion air preheater
- o A secondary heater or flue gas conditioner
- A dry electro-static precipitator (ESP)
- o A wet tray or packed tower scrubber
- o An induced draft fan

The dry ESP will be designed to achieve an outlet loading of 0.015 grains per dry standard cubic foot corrected to 12 percent CO₂. The wet scrubbing system will be designed to remove 70 percent of sulfur dioxide emissions and 90 percent of the acid gas emissions.

To operate a dry ESP on a fluidized bed incinerator firing sewage sludge that is 30 percent solids, several design and operational conditions must be met. First, the flue gas passing through the dry ESP must be less than $500^{\circ}F$. This is achieved through the use of heat exchangers or boilers which cool the flue gases exiting the incinerator at temperatures in excess of 1,500°F to a temperature of about 475°F. The waste heat is used to preheat the combustion air and/or reheat the flue gas at the stack.

To avoid corrosion within the dry ESP, the incinerator must be run continuously. Units operated on an intermittent basis must be equipped

with auxiliary burners to ensure that the temperature of the ESP is maintained above the acid gas dew point through an extended startup and shutdown procedure to avoid potential corrosion problems.

Sewage sludge is not considered a high sulfur fuel. The concentration of acids in the flue gas is also lower than for other fuels. However, a wet tray or packed tower scrubber was included in the air pollution control train. If wastewater effluent is used in the wet scrubber, the alkalinity of the effluent may be sufficient to meet the emission limitations without the use of additional lime.

Although this air pollution control system will be more efficient at controlling particulate emissions than the venturi/wet tray scrubber, it is uncertain whether the collection efficiency for selected metals is sufficient to meet the federal or state guidelines. To meet the guideline values for trace metals through the air pollution controls alone, even more stringent particulate limits may be necessary. This may require more expensive air pollution control technologies or multiple systems operated in series.

3.3 SLUDGE/SOURCE CHARACTERISTICS

Proposed incinerator stack and flue gas parameters were obtained from a study of data from presently operating FBIs and from CDM's proprietary mathematical model for the analysis of combustion systems, BURN (Version 3.0). Pertinent values are listed in Table D-1.

The proposed U.S. EPA and Massachusetts DEQE ambient impact criteria for contaminants emitted from the combustion of sludge are not-to-be exceeded annual-average concentrations. Thus, the dry-weather average-load sludge quality data for the design year were used to estimate contaminant concentrations in the sludge and average daily sludge production (Table 1). The fraction emitted (mg of contaminant per mg of sludge) for each compound was calculated using the 90th percentile of a log-normal probability distribution, and is listed in **Table D-2**. Daily sludge incineration rates were based on these loadings.

TABLE D-1

SLUDGE PRODUCTION RATES AND INCINERATOR OPERATION PARAMETERS

Stack Parameters

Height	= 100 ft	(30.48 m)
Diameter	= 1.0 ft	(0.305 m)
Velocity	= 67.7 ft/s	(20.64 m/s)
Gas Temp.	= 104°F	(313.4 K)

Sludge Feed Rates⁽¹⁾

Average Design Year⁽²⁾: 52,290 dry-lbs/day @ 30% solid Maximum Design Year: 86,895 dry-lbs/day @ 30% solid Volatile Solids: 65%

Design Yea	
Pollutant	Sludge Loadings
Arsenic (As)	0.34 lbs/day
Berylliun (Be)	1.20 lbs/day
Cadmium (Cd)	0.27 lbs/day
Chromium (Cr)	20.73 lbs/day
Lead (Pb)	5.10 lbs/day
Mercury (Hg)	0.10 lbs/day
Nickel (Ni)	6.93 lbs/day
PCBs	0.16 lbs/day
Selenium (Se)	0.61 lbs/day
Toluene	0.43 lbs/day
Total Xylene	0.78 lbs/day

(2) Design year is 2014.

Source: CDM, 1989

⁽¹⁾ Feed rates for dry-weather average-load conditions consistent with the long-term nature of the proposed DEQE and Federal health-based standards.

TABLE D-2

Pollutant	Fraction Emitted(2) (mg/mg)	Controlled Emission Rate (g/s)
Arsenic	4.00E-02	7.12E-05
Beryllium	1.00E-02	6.30E-05
Cadmium	1.11E-01	1.58E-04
Chromium VI	9.31E-03	1.01E-05
Chromium (total)	9.31E-03	9.59E-06
Lead	5.08E-03	1.36E-04
Mercury		5.25E-04
Nickel	2.59E-02	9.43E-04
PCBs	5.0E-02	4.20E-05
Selenium	·	3.20E-03
Toluene		2.26E-03
Total Xylene		4.09E-03

SLUDGE INCINERATOR EMISSION PARAMETERS⁽¹⁾

Source: CDM, 1989

⁽¹⁾ Rates listed for compounds with proposed AALs or U.S EPA in-sludge concentration limits.

<sup>(2)
 (1-</sup>CE) = (1-control efficiency) = fraction emitted
 Based on the top 10 percent of a log-normal probability distribution

The term for fraction emitted is a very simplistic approach to estimating pollutant emissions. It assumes homogeneity in both the quality of the sludge and concentration in the stack, and that sludge and stack sampling has taken place concurrently. This approach does not account for the uncertainties associated with the distribution of the trace metals among the particulate size fractions. To determine the relationship between particulate collection efficiencies and trace metal collection efficiencies, the particle size distribution and concentration of metal on each size fraction would have to be understood. This would require detailed stack testing which is beyond the scope of this analysis.

4.0 DISPERSION MODELING ANALYSES

4.1 MODEL SELECTION

A Crumpler Method Tier I analysis was performed using the tabulated U.S. EPA UNAMAP (Version 6) ISCLT dispersion factors which are site-independent and a function of stack height only. No site-specific modeling was performed for the Tier I analysis.

A modified Crumpler Tier II analysis and a comparison of annual impacts to DEQE AALs was accomplished with a more site-specific approach. Three U.S. EPA guideline (EPA, 1986a) dispersion models -- PTPLU, ISCST and COMPLEX I -- were used in screening mode to estimate the maximum annual average groundlevel concentration for Sites 1A, 4A, and 47 for a single worst-case downwind radial. The modeling included ISCST modified to include "Letter Change 7 to UNAMAP (Version 6)" as presented in a D. B. Turner (EPA-EOB) letter dated July 27, 1988. The preliminary 100-ft incinerator stack is good engineering practice height so that the downwash algorithms were not invoked.

A preliminary estimate of distance to maximum impact for the various wind speed and atmospheric stability classes was obtained with PTPLU. Three sets of modeling results were obtained from which the MEI RSC was selected. These were: (1) ISCST impacts for terrain elevations below stack top, (2) ISCST and COMPLEX I impacts for terrain elevations between stack top and

plume elevation, and (3) COMPLEX I impacts for terrain elevations above plume height. In each instance, COMPLEX I was run in VALLEY screening mode.

4.2 METEOROLOGICAL DATA

The Crumpler Tier I dispersion factor was calculated using Atlanta, Georgia STAR tabulated data. It was decided that these wind conditions produced the highest ground-level concentrations of all meteorological data sets from approved data collection agencies closest to the database incinerators.

Twenty-one meteorological conditions specified by DEQE (1988a) (i.e., pairings of wind speed and stability classes) were used in the modeling for compliance with AALs and TELs. These conditions are presented in **Table D-3.** A "plume trapping" condition (i.e., C-stability and 2.5 m/s wind speed with a 100m mixing height) was included in the analysis. The models estimated 1-hour average ground-level concentrations for each condition and for each site-specific set of downwind receptors.

DEQE modeling guidance (DEQE, 1984) states that hourly concentrations predicted under stability classes A and B should not be scaled to equivalent impacts for averaging times exceeding 3 hours because Massachusetts climatological records indicate that these regimes do not occur for more than 3 hours at a time during each day. Thus, no annual average concentrations were calculated for these conditions.

Screening modeling with COMPLEX-I was performed with one meteorological condition: F-stability with a 2.5 m/s wind speed.

4.3 RECEPTORS

The Crumpler Tier I dispersion factor was developed by U.S. EPA with all receptor terrain heights set equal to stack base elevation.

TABLE D-3

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METEOROLOGICAL CONDITIONS FOR ISCST SCREENING MODELING

Meteorological Condition Number	Wind Speed (m/s)	Mixing Height (m)	Atmospheric Stability Class
1	1.0	5000.	А
2	3.0	5000.	А
3	1.0	5000.	В
4	3.0	5000.	В
5	5.0	5000.	В
6	1.0	5000.	С
7	2.5	100.	С
8	3.0	5000.	С
9	5.0	5000.	С
10	10.0	5000.	С
11	1.0	5000.	D
12	3.0	5000.	D
13	5.0	5000.	D
14	10.0	5000.	D
15	15.0	5000.	D
16	1.0	10000.	E
17	3.0	10000.	Е
18	5.0	10000.	E
19	1.0	10000.	F
20	3.0	10000.	F
21	5.0	10000.	F

NOTE: Default ambient temperature is 293K for all meteorological conditions.

Source: DEQE, 1988

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A worst-case radial was developed for each site as part of the comparison to DEQE AALs. The receptors extended radially outward from the proposed site of the incinerator stack at the following spacings: 100 m increments between 100 m and 2,000 m, 200 m increments between 2,200 m and 4,000 m, 1,000 m increments between 5,000 m and 10,000 m. Worst-case terrain elevations were selected from a U.S.G.S. 7.5-minute topographic map and assigned to each downwind distance along the single radial.

The ISCST model automatically truncates terrain elevations above stack top elevation to the value at stack top. COMPLEX I was used to model impacts at receptors with elevations above stack top. For the F-stability and 2.5 m/s wind speed condition, COMPLEX I was run with the terrain height set equal to the plume centerline height minus 10 meters at the receptor closest to the incinerator at which the terrain elevation equaled or exceeded this elevation. Actual receptor elevations for each site are listed in Table D-4.

4.4 MODELING METHODOLOGY

The Crumpler Tier I modeling assumed a 311K incinerator flue gas temperature. Building-induced downwash was based on an input 5.5 m (i.e., 18 ft.) building height and a 39.5 m effective diameter characteristic of operating facilities in the U.S. EPA study.

The ISCST and COMPLEX I models were run in screening mode with inputs (listed in **Table D-5**) that are in accordance with U.S. EPA and DEQE guidance. The area within a 3 kilometer radius of Sites 1A, 4A, and 47 is non-urban as determined using the Auer classification system (Auer, 1979), and as documented in Section 7 of the <u>Draft Site Evaluation For Wastewater</u> <u>Treatment Facilities</u> (CDM, 1989). Rural dispersion coefficients were input to the models. Rural-default wind profile exponents and potential temperature gradients were specified. An ambient temperature of 293K, a 10m anemometer height, and default (5,000 m) mixing ceilings were used as inputs. Stability class E and F mixing heights default to 10,000 m.

TABLE D-4

Downwind Distance (m)	Site la ⁽¹⁾ <u>(ft msl)</u>	Site 4a ⁽²⁾ (ft msl)	Site 47 ⁽³⁾ (ft msl)		
100	20	10	80		
200	20	10	90		
300	40	10	100		
400	40	10	110		
500	30	20	110		
600	30	20	120		
700	30	30	120		
800	30	30	120		
900	30	30	120		
1000	30	40	130		
1100	30	40	130		
1200	30	40	140		
1300	30	50	130		
1400	40	60	130		
1500	40	80	140		
1600	40	90	160		
1700	40	100	170*		
1800	40	100	190*		
1900	40	100,	180*		
2000	40	110	170*		
2200	50	110*	180*		
2400	50	110	210*		
2600	60	110*	200*		
2800	80	110	170*		
3000	90	110*	170*		
3200	90	110	180*		
3400	80	120	200*		
3600	70	130*	220*		
3800	70	130	220*		
4000	80	150*	200*		
5000	110	180	280*		
6000	160*	180	250*		
7000	160	110	250*		
8000	180	200	384*		
9000	160	200	310*		
10000	170	210	250*		

GROUNDLEVEL ELEVATIONS FOR DOWNWIND RECEPTORS AT PROPOSED NEW BEDFORD SLUDGE INCINERATION SITES

(1) Base elevation 12 feet msl. (2) Base elevation 6 feet msl. (3)

(3) Base elevation 62 feet msl. *

Terrian elevation above stack top for a 100 ft-stack.

Source: CDM, 1989

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TABLE D-5

ISCST/COMPLEX I DISPERSION MODELING OPTIONS

Option	Selection				
Urban/Rural Dispersion Coefficients	Rural				
Wind Profile Exponents	(.07,.07,.10,.15,.35,.55)				
Potential Temperature Gradients	0.02 K/m (E-Stability) 0.035 K/m (F-Stability)				
Final Plume Rise Only	No				
Stack Tip Downwash	Yes				
Buoyancy Induced Dispersion	Yes				
Chemical Transformation	No				
EPA De-Calm Option	No				
Anemometer Height (m)	10 m				
Terrain Adjustment Factors	0.5,0.5,0.5,0.5,0,0 (A-to-F stability classes)				
Minimum Miss Distance(Zmin)	10 m				
Entrainment Coefficient	0.6				

Source: DEQE, 1988

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5.0 COMPARISON OF IMPACTS TO AIR QUALITY CRITERIA

Three different analyses were performed to assess compliance of the proposed New Bedford sludge incinerator with the Draft CWA Section 405(d) amendments and the DEQE's AALs. Crumpler Tier I and modified Tier II analyses were performed. The former analysis compared the actual average-weather metals loading for New Bedford sludge to the calculated Crumpler allowable sludge concentrations, whereas the latter analysis used worst-case meteorological conditions and site-specific terrain in a dispersion model (ISCST) to present a more reasonable estimate of potential impacts.

5.1 MODELING RESULTS

The Crumpler Tier I analysis was performed assuming a 100-ft stack. A dispersion factor of 10.12 ug/m3(s/g) was chosen from 54 FR 5890, Table 9, and entered into the formulae for calculating allowable sludge concentrations. Table D-6 presents a comparison of the design year (2014) metals loading to the calculated Crumpler Tier I allowable loading for each compound in New Bedford. The modeling results suggest that the projected average-weather loadings of metals for New Bedford sludge consume only a fraction of the Crumpler Tier I allowable metal concentrations. The percent of allowable concentrations consumed are: arsenic (29%), beryllium (51%), cadmium (82%), total chromium (48%), lead (22%), and mercury (1%). Nickel (assumed to be emitted as 100-percent nickel subsulfide) is present at 119 mg per kilogram of dry sludge which is 519 percent of the 23 mg per kilogram of dry sludge allowed under the Crumpler Tier I. Thus, projected nickel concentration in the sludge for the new New Bedford WWTP at the design year (2014) fails the Crumpler Tier I analysis.

A modified Crumpler Tier II analysis was performed incorporating the maximum annual ground-level concentration from screening modeling. In this way, the use of a generic dispersion factor was avoided. The 12.43 ug/m3 (s/g) normalized annual ground-level concentration was predicted by ISCST for the Site 47 worst-case terrain radial. The maximum impact occurred 1,600 m downwind from the incinerator stack for F-stability and a 1 m/s

TABLE D-6

U.S. EPA / CRUMPLER TIER I COMPLIANCE RESULTS FOR THE PROPOSED NEW BEDFORD SLUDGE INCINERATOR $^{(1)}$

M. A. J	(q*) Potency Factor	RSC Risk-Specific Concentration	CE Control Efficiency	C Allowable Concentration	(2) Loa	L -Weather ding ⁽²⁾	L/C Percent	Crumpler Tier I	0
Metal	(mg/kg/dy)	(µg/m)/(g/s)	(%)	(mg/kg)	(1D/dy)	(mg/kg)	(%)	Pass/Fall	Comments
Arsenic	15.0	2.3E-03	96	20.0	0.34	5.85	29	PASS	
Beryllium	8.4	NA	99	40.8	1.20	20.65	51	PASS	
Cadmium	6.1	5.7E-03	65	5.68	0.27	4.65	82	PASS	
Chromium(Total) 41.0	8.5E-02	96	741	20.73	357	48	PASS	
Lead	NA	3.8E-01	67	401	5.10	87.8	22	PASS	Present NAAQS
	NA	2.5E-01	67	267	5.10	87.8	39	PASS	Proposed NAAQS
Mercury	NA	NA	0	131	0.10	1.68	1	PASS	-
Nickel	1.05	3.3E-03	95	23.0	6.93	119	519	FAIL	100% nickel as nickel subsulfide

⁽¹⁾ Assessment uses formulae introduced in 54 FR 5746; Parameter values: $DF = 10.12 \ \mu g/m^3 (g/s)^{-1}$, $SF = 24.5 \ Mg/dy$, and stack height = 100 ft.

(2) Units are mg contaniment per kg dry sludge.

NA = Not Applicable

Source: CDM, 1989

wind speed. This dispersion factor is 23 percent larger than the generic Tier I dispersion factor. Consequently, the allowable concentrations of arsenic, cadmium, chromium, and nickel are lower, because the allowable sludge concentration is inversely proportional to the dispersion factor. This is reflected (**Table D-7**) in the percent of allowable metals concentration for sludge consumed by the New Bedford average-weather sludge loadings: arsenic (35%), cadmium (101%), total chromium (59%), and nickel (638%). The allowable concentrations of beryllium, lead, and mercury are unchanged so that the percent of the allowable concentrations consumed are the same as cited above for the Crumpler Tier I analysis. Nickel and cadmium contents in the New Bedford WWTP design-year sludge fail the Crumpler modified Tier II analysis.

Sludge loadings for 18 compounds in the New Bedford sludge are estimated and listed in **Table D-8**. DEQE AALs and TELs exist for 10 of these compounds including beryllium, cadmium, total chromium, chromium VI, lead, nickel, PCBs, selenium, toluene, and total xylenes. The ISCST maximum annual ground-level concentration of each compound resulting from the combustion of New Bedford sludge is compared to the DEQE AALs and TELs in Table D-8. The 12.43 ug/m3 (s/g) dispersion factor for the MEI described in the modified Tier II analysis was multiplied by the 90th-percentile control efficiencies (1-CE) and the uncontrolled sludge concentration of each compound to estimate the MEI inhalation concentration. The maximum annual concentrations exceed the AALs for cadmium, chromium VI, and PCBs. The maximum 24-hour concentrations exceed the TELs for beryllium and cadmium.

The exceedances of AALs are quite small for PCBs, considering the inherent conservativism of the screening modeling methodology. But the exceedances of AALs and TELs for beryllium, cadmium, and chromium VI are larger and may not be completely resolved by more detailed modeling analyses.
TABLE D-7

U.S. EPA / CRUMPLER MODIFIED TIER II COMPLIANCE RESULTS FOR THE PROPOSED NEW BEDFORD SLUDGE INCINERATOR⁽¹⁾

	(q*)	RSC	CE	C		L			
	Potency	Risk-Specific	Control	Allowable	Average	e-Weather	L/C	Crumpler	
	Factor 1	Concentration	Efficiency	Concentration	$1^{(2)}$ Loa	ading ⁽²⁾	Percent	Tier II	
Metal	$(mg/kg/dy)^{-1}$	(µg/m ⁾)/(g/s)	(%)	(mg/kg)	(lb/dy)) (mg/kg)	(%)	Pass/Fail	Comments
Arconio	15 0	1 35 03	06	16.0	0.24	5 05	26	DACC	
Alsenic	15.0	2.36-03	90	10.5	0.54	7.07	20	PASS	
Beryllium	8.4	NA	99	40.8	1.20	20.65	51	PASS	
Cadmium	6.1	5.7E-03	65	4.62	0.27	4.65	101	FAIL	
Chromium(Total	.) 41.0	8.5E-02	96	602	20.73	357	59	PASS	
Lead	NA	3.8E-01	67	401	5.10	87.8	22	PASS	Present NAAQS
	NA	2.5E-01	67	267	5.10	87.8	39	PASS	Proposed NAAQS
Mercury	NA	NA	0	131	0.10	1.68	1	PASS	
Nickel	1.05	3.3E-03	95	18.7	6.93	119	638	FAIL	100% nickel as nickel subsulfide

(1) Assessment uses formulae introduced in 54 FR 5746; Parameter values: DF = 12.43 µg/m³(g/s)⁻¹, SF = 24.5 Mg/dy, and stack height = 100 ft.

(2) Units are mg contaminent per kg dry sludge.

NA = Not Applicable

Source: CDM, 1989

TABLE D-8

COMPLIANCE WITH DEQE'S AALS and TELS FOR THE PROPOSED NEW BEDFORD SLUDGE INCINERATOR

	$Normalized_{\downarrow}$	DEQE	DEQE				
	Annual GLC	AAL	TEL	Annual	24-Hour	Pass/Fail	Pass/Fail
Compound	(µg/m ³)(g/s)	(µg/m ³)	(µg/m ³)	GLC/AAL	GLC/TEL	AALs	TELs
Antimony	124.3	NA	NA	NA	NA	NA	NA
Arsenic	124.3	NA	NA	NA	NA	NA	NA
Beryllium	124.3	4.00E-04	1.00E-03	1.96E+00	3.13E+00	Pass	Pass
Boron	124.3	NA	NA	NA	NA	NA	NA
Cadmium	124.3	6.00E-04	3.00E-03	3.26E+00	2.61E+00	Fail	Fail
Chromium(tota	1) 124.3	6.80E-01	1.36E+00	1.90E-02	3.70E-02	Pass	Pass
(VI)	124.3	8.00E-05	3.00E-03	0.00	0.00	Fail	Fail
Copper	124.3	NA	NA	NA	NA	NA	NA
Cyanide	124.3	NA	NA	NA	NA	NA	NA
Lead	124.3	7.00E-02	1.40E-01	2.40E-02	4.80E-02	Pass	Pass
Mercury	124.3	NA	NA	NA	NA	NA	NA
Molybdenum	124.3	NA	NA	NA	NA	NA	NA
Nickel	124.3	1.80E-01	2.70E-01	6.50E-02	1.74E-01	Pass	Pass
PCBs	124.3	5.00E-04	3.00E-03	1.04E+00	6.96E-01	Fail	Pass
Selenium	124.3	5.40E-01	5.40E-01	7.40E-02	2.95E-01	Pass	Pass
Thallium	124.3	NA	NA	NA	NA	NA	NA
Toluene	124.3	1.02E+01	1.02E+01	3.00E-03	1.10E-02	Pass	Pass
Total Xylenes	124.3	1.18E+01	1.18E+01	4.00E-03	1.70E-02	Pass	Pass

* Modeled with ISCST for F-stability, 1 m/s; maximum impact for site 47. Emission rates presented in Table D-2.

Source: CDM, 1989

5.2 SUMMARY OF AIR QUALITY ANALYSIS

Preliminary results from the Crumpler Tier I and modified Tier II analyses suggest that several compounds may be emitted in sufficient amounts from the combustion of sewage sludge to exceed proposed federal and state limits. The U.S. EPA methodology indicates that nickel (assumed to be emitted in total as nickel subsulfide) may exceed recommended in-sludge concentrations by a factor of five to seven. Cadmium may also exceed the proposed limits. A detailed dispersion modeling effort may change these results; however, the magnitude of any change cannot be accurately resolved at this time. In addition, the requirements of the CWA Section 504(d) amendments may change during the official 120-day comment period ending August 7, 1989. The apparent failure of the proposed New Bedford incinerator to satisfy the U.S. EPA criteria should be considered conditional given the preliminary nature of the Section 504(d) amendments.

The Massachusetts DEQE air toxics program is continually evolving, with several changes to the AALs within the last six months. The proposed combustion of New Bedford sludge may result in exceedences of the current AALs or TELs for beryllium, cadmium, chromium (total and hexavalent), and PCB; however, the exceedances are quite small for several of these compounds. A detailed dispersion modeling effort may change this result. Nickel impacts pass the AALs because nickel is not assumed to be emitted in the nickel subsulfide form.

6.0 IMPLEMENTABILITY

In order to implement sludge incineration as a disposal alternative, federal, state, and local approvals must be received. At each of these levels, the requirements for receiving approval are continually changing and increasing, making implementation less certain.

At the federal level, the recommended sludge management alternative must be included in the facility plan. For sludge incineration, a backup disposal option would be required. Depending on the backup disposal option

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selected, or the conditions imposed on the backup alternative, the sludge incineration alternative may become less economical.

State permitting requirements include an evaluation of the best available control technology. In accordance with recent guidance from EPA, a top down approach would be used. This methodology could result in a more extensive air pollution control system than is currently standard practice. Because there is no clear guidance on the threshold for determining when BACT has been meet, the air pollution control systems that could be imposed may become less economical.

Local opposition to siting a sludge incinerator at the wastewater treatment plant site has been made clear. The CAC and mayor have also expressed concern that using an incinerator to dispose of the sludge is less desirable than other sludge disposal alternatives.

In a similar situation in Boston, Massachusetts, the Massachusetts Water Resources Authority decided that, based on the associated uncertainties, incineration was not a feasible alternative for disposing of sludge from its Deer Island facility. This decision was accepted by most agencies reviewing the project, except for EPA which raised the concern that composting of sewage sludge may not be reliable over the long term, and required a back up disposal alternative. With this precedent established, sludge incineration is considered to be a less desirable alternative.

7.0 RELIABILITY

Installing a sewage sludge incinerator constitutes a significant investment in sludge treatment and disposal technology. Before incineration can be selected as a likely disposal alternative, a reasonable expectation must be made that equipment will be available throughout its design life without significant modifications. The factors which make sludge incineration a less desirable alternative are equipment reliability and changes in law.

The multiple hearth and fluidized bed combustion systems are fairly well established units for the combustion of sewage sludge. The air pollution

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control equipment typically used on these units consist of a venturi/wet tray scrubber. When the venturi is operated at pressure drops of 25 to 30 inches of water, the units are able to meet the New Source Performance Standard of 1.3 pounds of particulate matter per ton of dry solids input. To meet more stringent air pollution control requirements, a dry ESP and wet scrubber may be required. The practical experience of alternate air pollution control systems on sewage sludge incinerators does not exist, making estimates of long term reliability uncertain compared to other disposal alternatives.

Future requirements for upgrade or modification of installed systems can also make sludge incineration undesirable. Both state and federal regulations governing sludge incineration and the emission of toxic air pollutants are undergoing revision. Even if the facility were to be permitted under the proposed regulations, changes to the regulations may require significant modification to the incinerator performance or sludge disposal practices. Possible changes in law could include:

- o Decreasing the NSPS particulate emission limit
- o Increasing the monitoring or reporting requirements
- o Decreasing the draft AALs or TELs
- Identifying the ash from a sewage sludge incinerator as hazardous waste, and requiring that it be disposed of in a hazardous waste landfill

These changes could make sludge disposal more expensive and less reliable than other treatment alternatives.



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VOLUME III APPENDIX E AIR EMISSION ESTIMATES

1.0 DESCRIPTION OF REMOVAL MECHANISMS

Several mechanisms contribute to a loss of volatile compounds from wastewater treatment systems. The two major removal mechanisms, volatilization and biodegradation, were considered in this assessment. Volatilization is the only removal mechanism that leads to atmospheric emissions, and occurs when a molecule of a substance dissolved in the wastewater escapes from the liquid phase to an adjacent gas phase. The adjacent gas phase can be an air bubble within the liquid or the atmosphere above the liquid. As such, emissions due to volatilization can occur from quiescent liquids such as those found in holding tanks or clarifiers, and from turbulent liquids such as those found at bar racks, weir overflows, and in aeration tanks. Biodegradation occurs when microbes decompose organic compounds for use in their metabolic processes. The rate of this decomposition varies by compound, depending on the compound's structure and the need of the microbe for the compound. At a wastewater treatment plant, biodegradation occurs in the aeration tanks. Here, biodegradation competes with volatilization as a removal mechanism. Thus, lower air emissions are produced from the secondary treatment processes when biodegradation occurs.

Other removal mechanisms which exist in a treatment plant include chemical oxidation and sludge partitioning. These mechanisms tend to lower the amount of volatile material released from the plant. Omission of these mechanisms maximizes the calculated emission rates for all compounds considered and were therefore not considered in this assessment.

The emission calculations assumed a temperature of 20°C. This is the temperature for which most kinetic data were collected, and it is higher than the wastewater temperature most of the year. Using 20°C overestimates emissions because VOCs are more volatile at higher temperatures. Air quality modeling used actual meteorological data for temperatures.

Emissions from sludge handling facilities are dealt with in Appendix G.

1.1 THEORY

The equations used throughout the assessment of emissions are based on the concepts of equilibrium conditions and transfer rates. The approach is based on procedures developed for the MWRA Secondary Treatment Facilities Plan, with appropriate modifications.

Equilibrium

Henry's law describes the relationship of the equilibrium or saturation concentration of a gas dissolved in a liquid as a function of the partial pressure of the gas adjacent to the liquid and is given by:

$$p = K_H \times C_L$$

where: p = partial pressure of compound (atm)

 K_{H} = Henry's law constant of the compound (atm-m/mole)

CL = equilibrium liquid-phase concentration of the compound (mole/m³)

At atmospheric pressures, the gas phase approaches ideal behavior, and a dimensionless form of the Henry's law constant can be defined as:

$$H_c = K_H / (RxT) = C_G / C_L$$

where: H_c = the Henry's law coefficient expressed as a dimensionless ratio R = the universal gas constant (atm-m³/mole-K) T = absolute temperature (K) C_G = concentration of the compound in gas phase at equilibrium

Transfer Rates

The transfer of the constituent is a function of the mass transfer coefficient, the interface area, the saturation concentration, the

interface area, the saturation concentration, and the concentration in the liquid and can be defined as:

$$N = K_{I_{c}} \times A \times [C_{I_{c}} - (C_{G}/H_{c})]$$

where: N = rate at which constituent is transferred (mg/hr) K_L = overall mass transfer coefficient (L/m²-hr) A = area of interface (m²) C_L = equilibrium concentration in liquid (mg/l) C_G = equilibrium concentration in gas (mg/l)

The equilibrium concentration in gas is set at zero when the gas phase is the atmosphere.

Measurements of the mass transfer coefficients for most VOCs are not available. One alternative is to use the ratio of the relative diffusion coefficients in water of the volatile organic or other gas, with the ratio raised to a power ranging from 0.5 to 0.7.⁽¹⁾ This analysis used 0.66.

1.2 VOLATILIZATION FROM CLARIFIER SURFACES

Volatilization from quiescent surfaces increases with wind velocity. Therefore, tanks with covered, quiescent surfaces were not considered in this assessment. Furthermore, estimation of emissions after secondary clarification was not included since the amount of VOCs remaining in the liquid train is considered to be negligible. Consequently, the secondary clarifiers are the only quiescent tank surfaces assessed. The following equation (Lunney, et al, 1985)⁽²⁾ estimates emissions from the secondary clarifiers:

$$k_{I} = (1.87 \times 10^{-7} u^2 - 1.3 \times 10^{-6}) \times (D_V/D_{ether})^{2/3} : u \ge 5.5 m/s$$

where: D_V = diffusivity in water of VOC in question (m²/s) D_{ether} = wind speed, m/s Neglecting adsorption, the emissions from a clarifier surface can be estimated by developing a mass balance including VOCs in the flow into the clarifier, VOCs in the flow just before it goes over the weir, and VOCs emitted from the surface. The mass balance is:

$$Q_L C_o = Q_L C_L + K_L A C_L$$

where: Q_L = liquid flow rate C_o = influent VOC concentration in liquid C_L = concentration of VOC in liquid (and in effluent) K_p = partition coefficient (L/gm)

This mass balance assumes that the concentration of VOC in the liquid is uniform. This assumption is valid for a completely mixed system or, in the case of a clarifier, for the situation where changes in concentration in the system are small.

Solving for the effluent concentration yields:

$$\frac{C_{L}}{C_{O}} = \frac{1}{\left[1 + \frac{K_{L}A}{Q_{L}} + \frac{w^{K}P}{Q_{L}}\right]}$$

1.3 VOLATILIZATION AT WEIRS AND HYDRAULIC STRUCTURES

Volatilization is strongly influenced by turbulence. Thus, weirs used for flow control throughout the treatment plant are potential emission sources for the volatile constituents considered in this assessment. There were no reports found pertaining to the magnitude of volatile emissions due to turbulence at weirs and hydraulic structures, but there is information available about oxygen transfer at these structures. (A great deal of the procedures for estimating volatile releases from treatment systems are founded on the principles and mechanics of oxygen mass transfer.) For estimates of volatile releases from wastewater flowing over weirs, the mass-transfer coefficients for oxygen were calculated and corrected by the ratio of the volatility of the constituent in question to oxygen.

The change in concentration of oxygen relative to saturation concentration as a liquid flows over a weir can be shown to be: (3)

$$1/r = (C_{c}-C)/(C_{c}-C_{c}) = \exp(-K_{L}a_{c}t)$$

where: r = deficit ratio $K_L a_0 = mass-transfer coefficient, 1/s$ $C_s = saturation concentration$ $C_0 = upstream concentration$ C = downstream concentrationt = time

For a volatile constituent with a low concentration in the atmosphere, C_s becomes equal to zero and the equation reduces to:

$$1/r = C/C_0 = \exp(-K_L a_v t)$$

This equation can be rewritten as:

$$\ln r = K_{L}a_{v}t$$

This means that ratios of the logarithm of r for different gases over the same weir (same value of t) are related by the ratios of their values of $K_{L}a$.

Nakasone⁽⁴⁾ presented equations relating the values of the deficit ratio for oxygen over weirs with varying hydraulic conditions. He reports four equations for varying conditions which were applied in this analysis to the weirs located in the aerated grit chambers, the primary distribution box, the aeration tanks, and the secondary distribution box. Nakasone's formulas are as follows:

o ln
$$r_o = 0.0785 (D + 1.5 Z_c)^{-1.31} q^{0.428} H^{0.31}$$

for (D + 1.5 Z_c) ≤ 1.2 m and q ≤ 235 m³/h m

where:
$$r_{o}^{} = deficit ratio (ratio of upstream deficit to downstream deficit)$$

 $D = drop height, m$
 $Z_{c}^{} = critical water depth on the weir, m$
 $q = discharge per width of weir, m^{3}/h m$
 $H = tail water depth, m$
 $o \ln r_{o}^{} = 0.0861 (D + 1.5 Z_{c})^{0.816} q^{0.428} H^{0.31}$
for $(D + 1.5 Z_{c}) > 1.2 m$ and $q \le 235 m^{3}/h m$
 $o \ln r_{o}^{} = 5.39 (D + 1.5 Z_{c})^{1.31} q^{-0.363} H^{0.31}$
for $(D + 1.5 Z_{c}) \le 1.2 m$ and $q > 235 m^{3}/h m$
 $o \ln r_{o}^{} = 5.92 (D + 1.5 Z_{c})^{0.816} q^{0.363} H^{0.31}$
for $(D + 1.5 Z_{c}) > 1.2 m$ and $q > 235 m^{3}/h m$

For simplification purposes, and as suggested by Nakasone, the term D + 1.5 Z_{c} was assumed to be equal to the change in elevations of the liquid surfaces before and after the weir.

CDM further refined the weir equations specifically for the primary and secondary clarifier weirs. Dissolved oxygen readings were taken before and after the primary and secondary clarifier weirs at seven plants. From the data, the deficit ratios were calculated and the following equations were generated for use in this analysis:

Primary clarifier weir:

$$\ln r_{o} = 0.1135 (D + 1.5 Z_{c})^{1.304} q^{0.336}$$

Secondary clarifier weir equation:

$$\ln r_{0} = 0.1573 (D + 1.5 Z_{c})^{1.073} q^{0.511}$$

In order to determine the fraction of an organic constitutent emitted through weir turbulence, the deficit ratio for the constituent was calculated for substitution into the appropriate equation above in terms of the deficit ratio for oxygen, as follows:

$$\ln r_v = \ln r_o (K_L a_v / K_L a_o)$$

The fraction of volatiles emitted during flow over weirs is $f = \frac{1}{r_v}$

1.4 VOLATILIZATION FROM AERATED SYSTEMS

Volatile constituents entering an aeration tank are removed from the liquid stream primarily by volatilization and biodegradation. (As noted previously, the effects of other mechanisms on removal were reglected.) Volatilization occurs as the constituent is transferred from the liquid phase to the gas phase represented by the air or oxygen bubble fed to the system. Biodegradation occurs as the activated sludge consumes organic matter for reduction of the BOD content of the wastewater. The rate of removal by both of these mechanisms in an aeration tank is highly dependent on the oxygen mass transfer rate (or diffusivity constants) to the liquid.

The gas concentration (C_{G}) in a bubble leaving the surface of an aeration tank can be related to the liquid concentration (C) by Henry's law. For bubble aeration, some VOCs will be virtually at saturation in bubbles exiting from the surface of an aeration tank. For these, the concentration can be estimated by Henry's law as $H_{c}C_{L}$, and the emissions as $Q_{G}H_{c}C_{L}$. Saturation is not reached for some VOCs, however.

Matter-Muller⁽⁵⁾ and Roberts⁽⁶⁾ have investigated the removal of volatiles from liquids by bubble aeration. Their work has shown that the degree of saturation of an air bubble leaving the surface of an aeration basin (i.e.,

the percent of equilibrium between the air bubble and the liquid) is a function of the mass-transfer rate and the Henry's Law constant. The fraction of saturation reached is:⁽⁷⁾

$$S = 1 - \exp \left(\frac{-(K_L a)_v V_L}{H_c Q_G}\right)$$

where: S = fraction of saturation reached $(K_LA)_V$ = volumetric mass transfer coefficient (1/day) V_L = volume of liquid Q_G = flow rate of gas

The term S tends toward 1 for large values of K_La/H_c (high ratio of overall gas transfer coefficient to Henry's Law constant) and for low gas flows (e.g., pure-oxygen aeration). S can be less for small values of K_La/H_c and for inefficient aerators, such as coarse-bubble aerators.

Kinetic data on biodegradation of VOCs in activated sludge are very limited. Therefore, a simple-first order model is appropriate. The form of expression can be:

 $R = k C_{T}$

where: R = removal rate, mg/L/hr
k = first-order rate constant, 1/hr

(The term k can also be expressed as the product of k_1 X, where X is the concentration of mixed liquor volatile suspended solids.)

A mass balance can also be developed around an aeration tank:

 $Q_L C_o = Q_L C_L + Q_G C_G S + V_L k C_L$

Its solution is

$$\frac{C_{L}}{C_{o}} = \frac{1}{\left(1 + \frac{Q_{G}C_{G}S}{Q_{L}} + \frac{V_{L}k}{Q_{L}}\right)}$$

For an aerated grit chamber, where biodegradation (K) is zero, the solution is

$$\frac{C_{L}}{C_{O}} = \frac{1}{\left(1 + \frac{Q_{G} CS}{Q_{L}}\right)}$$

2.0 DATA USED FOR ESTIMATING EMISSIONS

To estimate emissions, properties of the constituents of interest and information relevant to the system design and operating parameters were compiled from the best available information sources. The derivations of the loadings for the constituents of interest are presented in Section 2.0, Wastewater Flows and Loads.

Table E-1 presents a list of each constituent considered in the asessment, along with its corresponding properties used in the calculations. Those constituents with higher Henry's Law constants will be more likely to be removed through volatilization than those with lower constants. Thus, they are especially susceptible to large releases due to weir turbulence since there are no competing mechanisms involved. Biodegradation, a competing mechanism in the aeration tanks, will tend to lower the aeration tank emission rate when the constituent has a high biorate. Those constituents with both low biorates and low Henry's Law constants will tend to pass through the system and be present in the treatment plant effluent.

Table E-2 lists both the average dry weather loadings and CSO contributions of each constituent. The preliminary physical data and operating characteristics used in calculations for the proposed plant can be found in Tables E-3 and E-4.

PHYSICAL PROPERTY CONSTANTS

	Henry's Law	Biorate(1)	Diffusivity(1)
Constituents	Constant ₃ (25°C) (atm-m /mol)	(x10 ⁻⁴ /sec)	(cm ² /sec)
Acetone	2.06×10^{-5}	67	1.14×10^{-5}
Benzene	5.59 x 10^{-3}	1	9.80 x 10^{-6}
2-Butanone	2.74×10^{-5}	67	9.80 x 10^{-6}
Chloroform	2.87×10^{-3}	1.17	1.00×10^{-5}
1,2-Dichloroethane	9.78 x 10^{-4}	0	8.13 x 10^{-6}
1,2-Dichloroethene	6.56×10^{-3}	33	8.32 x $10^{-6(3)}$
Ethylbenzene	6.48×10^{-3}	3	7.80 x 10^{-6}
Methylene Chloride	2.03×10^{-3}	0.25	1.17×10^{-5}
4-Methyl-2-Pentanone	2.91 x $10^{-5(2)}$	0	7.80 x 10^{-6}
1,1,2,2-Tetrachlorethane	3.8×10^{-4}	1.67	7.90 x 10 ⁻⁶
Tetrachloroethylene	2.59×10^{-2}	2.5	7.05 x 10 ⁻⁶⁽³⁾
Toluene	6.37×10^{-3}	72	8.60×10^{-6}
Total Xylenes	7.04×10^{-3}	42	7.80 x 10^{-6}
1,1,1-Trichloroethane	1.44×10^{-2}	3	8.8 x 10^{-6}
Trichloroethylene	9.10 x 10^{-3}	1.75	9.1 x 10^{-6}

Data taken from <u>Superfund Public Health Evaluation Manual</u> except as otherwise noted:

- (1) MWRA Secondary Treatment Facilities Plan.
- (2) Evaluation and Prediction of Henry's Law Constant and Aqueous Solubilities for Solvents and Hydrocarbon Fuel Components; Howe, Mullins, Rogers - September 1987.
- (3) Michigan Technical University Air Stripper Design Model.

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LOADINGS AND CSO CONTRIBUTIONS

	Projected Average Dry Weather Loadings	Projected Maximum Dry Weather Loadings	CSO Contributions
Constituents	(lb/day)	(lb/day)	(lb/day)
Acetone	41.36	124.33	103.99
Benzene	1.25	3.98	4.88
2-Butanone	9.10	68.69	22.89
Chloroform	2.94	5.37	4.50
1,2-Dichloroethane	1.48	4.21	1.50
1,2-Dichloroethene	1.48	3.43	1.13
Ethylbenzene	2.69	9.92	0.75
Methylene Chloride	1.56	4.98	0.00
4-Methyl-2-Pentanone	2.03	7.74	5.12
1,1,2,2-Tetrachloroethane	1.64	5.12	1.13
Tetrachloroethylene	2.41	9.49	16.14
Toluene	11.71	39.82	3.38
Total Xylenes	13.12	50.18	32.99
1,1,1-Trichloroethane	3.09	11.25	3.75
Trichloroethylene	3.67	7.96	4.50

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TREATMENT SYSTEM PHYSICAL DATA

Process	No. of <u>Units</u>	Total Tank Volume Ft ³	Total Area Ft²	Weir Length Each Ft
Aerated Grit:		26 100		
Weir	2	26,400	2,200	. 20
Primary Dist. Box: Weir	6			6
Primary Clarifier: Weir to Launder Launder to Channel	252 126			11 1
Aeration Tank: Basin Weir	4 4	1,296,000	72,000	40
Secondary Clarifier: Weir	6			880

TREATMENT SYSTEM OPERATING CHARACTERISTICS

		W		
Process	30 mgd	75 mgd	45 mgd	19 mgd
Aerated Grit Basin Aeration Oxygen diff. (cm²/sec) KLa for oxygen (1/day) Air use (cfm)	Diffused air 1.88 x 10 ⁻⁵ 67 660	Diffused air 1.88 x 10 ⁻⁵ 67 1320	Diffused air 1.88 x 10 ⁻⁵ 67 330	Diffused air 1.88 x 10 ⁻⁵ 67 660
Aerated Grit Weirs Flow per weir (m³/hr) Drop (m)	2365.63 0.73	5914.06 0.44	7096.88 0.45	1498.23 0.83
Primary Distribution Box Flow per weir (m³/hr) Drop (m)	789 0.89	1971 1.49	1183 2.57	499 0.90
Primary Clarifier Weirs (Weirs to Launders) Flow per weir (m³/hr) Drop (m) (Launders to channels) Flow per weir (m³/hr) Drop (m)	18.77 0.77 37.55 0.16	46.94 0.19 93.87 0.00	28.16 0.59 56.32 0.00	11.89 0.82 23.78 0.43
Aeration Tank Basin Aeration Oxygen diff. (cm²/sec) KLa for oxygen (1/day) Air use (cfm)	Diffused air 1.88 x 10 ⁻⁵ 67 17,740	Diffused air 1.88 x 10 ⁻⁵ 67 15,600	,	Diffused air 1.88 x 10 ⁻⁵ 67 17,740
Aeration Tank Weir Flow per weir (m³/hr) Drop (m)	1182.81 0.73	2957.03 0.23		749.11 0.75
Secondary Clarifier Weir Flow per weir (m³/hr) Drop (m)	788.54 0.58	1971.35 0.17		499.41 0.78

3.0 APPLICATION OF PROCEDURES TO NEW BEDFORD

3.1 SOURCES OF EMISSIONS

Sources of emissions are those facilities where interfaces between wastewater and air are produced. Facilities at the proposed New Bedford treatment plant which have the potential to emit VOCs in sufficient amounts to impact ambient air levels include:

- o Aerated grit chambers and weirs
- o Primary distribution box
- o Primary clarifier tank weirs
- o Aeration tanks and weirs
- o Secondary clarifier weirs

Those processes which are to be covered and under relatively quiescent conditions (primary clarifiers, bar racks, and secondary clarifiers) were not included in emission calculations. Since the concentration of VOCs will be insignificant in the effluent from the secondary clarifiers, analysis of emissions was disregarded past secondary treatment.

3.2 APPLICATION OF MODELS FOR EMISSIONS

Aerated Grit System

Formulas for volatilization from aerated systems were applied to the grit chamber surface, and weir formulas were calculated for the facilities effluent weirs.

Primary Distribution Box

Weir formulas were used to estimate emissions from the distribution box.

Primary Clarifiers

The primary clarifiers will be covered. Since they have a quiescent surface, surface calculations were disregarded. Weir formulas specific for

primary clarifier weirs as described in Subsection 1.2 were used to estimate emissions.

Aeration Tanks

Emissions from the aeration tanks were based on formulas for aerated surfaces and for weirs.

Secondary Clarifiers Weirs

The weir formulas are specific to secondary clarifier weirs as described in Subsection 1.2.

Disinfection

Emissions of VOCs from disinfection were neglected because of the small concentrations remaining.

- 4.0 SCENARIOS EVALUATED FOR EMISSION CALCULATIONS
- 4.1 AVERAGE ANNUAL VOC EMISSIONS

The evaluation of average annual emissions is needed to:

- Determine if the proposed New Bedford treatment plant should be considered a Major Stationary Source in accordance with 310 CMR 7.02.
- Evaluate, after air quality modeling, the expected ambient impacts of potentially toxic releases from the facility (i.e., compare with AALs).

An estimate of the annual emissions from the treatment system was obtained by performing calculations for two combinations of flows and loads as follows:

- Average annual dry weather flow (30 mgd) with projected non-runoff average mass loading.
- 2. Maximum hydraulic capacity of secondary treatment (75 mgd) and CSO flow through primary treatment only (45 mgd) with CSO loadings.

CSO conditions were estimated to occur nearly 800 hours per year. These conditions were accounted for in calculating the annual emissions from the plant. See Table E-2 for a list of the loadings used.

4.2 MAXIMUM DAY EMISSIONS

The evaluation of the maximum day emissions is needed to evaluate, after air quality modeling, the maximum expected 24-hour ambient impacts of potentially toxic releases from the facility (i.e., compare with TELs).

The maximum 24-hour emissions were calculated for two different scenarios using maximum constituent mass loading rates. These two scenarios are:

- Minimum daily dry weather flow (19 mgd) with projected non-runoff maximum mass loading.
- Maximum hydraulic capacity of secondary treatment (75 mgd) and CSO flow through primary treatment only (45 mgd) with maximum CSO loadings.

The minimum wastewater flow was considered because long detentions and large drops over weirs could yield high emission rates for volatile constituents with low biodegradation rates. To ensure that the scenario representing the maximum 24-hour emission rate was analyzed, the constituent loadings added by storm runoff were also included in a calculation using normal maximum loadings at maximum normal flow plus maximum storm water flow. Identification of these two scenarios was expected to yield a larger 24-hour emission rate than any other conceivable situation. Upon reviewing the results, those expected to produce the

greatest ambient impacts were subjected to the air dispersion modeling analysis in Appendix G.

5.0 RESULTS OF EMISSION CALCULATIONS

The output generated by the computer program provided an annual emission total for each constituent by treatment unit, as well as a total emitted per constituent across the entire plant. These rates represent emissions prior to control.

The annual average uncontrolled emissions for individual constituents are presented in Table E-5. The Federal Register cites the compounds 1,1,1-Trichloroethane (Methyl chloroform) and Methylene Chloride as being exempt from the EPA's photochemical reactivity policy. It proposes that Perchloroethylene (Tetrachloroethene) also be exempt. Table E-5 presents two totals; one includes these exempt compounds, the second total does not. In determining the proposed plant's status as a Major Stationary Source, the average annual uncontrolled emission rate of 8.9 tons per year should be used. (See Subsection 2.4.)

The maximum short-term uncontrolled emission rates for each constituent are presented in Table E-6. These short-term emission rates are calculated for comparison with TELs. (See Appendix G.) Table E-6 shows that the worst case emission rates are obtained at a minimum daily flow (19 mgd) under maximum dry load conditions.

The distribution of emissions by treatment unit indicates that a majority of the releases occur prior to the aeration basin. As discussed earlier, the major reason for this is aeration (without biodegradation) in aerated grit chambers and turbulence as wastewater flows over weirs.

ANNUAL UNCONTROLLED EMISSION ESTIMATES FOR INDIVIDUAL CONSTITUENTS

Air Feed System - tons per year

Constituent	Total Inf. Load	Aerated <u>Grit Area</u>	Primary Clarifier Area	Aeration Area	Secondary Clarifier Area	Total Emitted
Acetone	9.264	1.609	2.273	0.004	0.001	3.886
Benzene	0.309	0.057	0.065	0.045	0.001	0.167
2-Butanone	2.039	0.324	0.470	0.001	0.000	0 .795
Chloroform	0.611	0.114	0.143	0.056	0.001	0.315
1,2-Dichloroethane	0.295	0.047	0.066	0.054	0.002	0.169
1,2-Dichloroethene	0.289	0.058	0.062	0.003	0.000	0.123
Ethylbenzene	0.503	0.100	0.108	0.046	0.000	0.255
Methylene Chloride*	0.285	0.061	0.076	0.043	0.002	0.182
4-Methyl-2-Pentanone	0.455	0.063	0.095	0.042	0.004	0.204
1,1,2,2-Tetrachloroethane	0.318	0.049	0.071	0.009	0.001	0.130
Tetrachloroethylene*	0.706	0.138	0.112	0.146	0.000	0.397
Toluene	2.193	0.455	0.490	0.343	0.004	1.293
Total Xylenes	2.939	0.535	0.579	0.026	0.000	1.140
1,1,1-Trichloroethane*	0.626	0.148	0.130	0.090	0.000	0.369
Trichlorœthylene	0.744	0.162	0.161	0.114	0.001	0.438
Total including exempt constituents	21.574	3.920	4.902	1.023	0.018	9.863
Total excluding exempt constituents	19.958	3.573	4.584	0.743	0.016	8.916

* Exempt constituents (see Subsection 5.0)

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MAXIMUM UNCONTROLLED SHORT-TERM EMISSION ESTIMATES FOR INDIVIDUAL CONSTITUENTS UNDER VARIOUS FLOW AND MAXIMUM LOAD CONDITIONS (Air Feed System - pounds per day)

Constituent	Minimum Flow	Maximum Storm Flow		
Acetone	74.443	49.327		
Benzene	2.893	2.879		
2-Butanone	38.637	18.141		
Chloroform	3.780	2.686		
1,2-Dichloroethane	3.057	1.417		
1,2-Dichloroethene	1.969	0.945		
Ethylbenzene	6.217	2.776		
Methylene Chloride*	3.743	1.533		
4-Methyl-2-Pentanone	4.707	2.577		
1,1,2,2-Tetrachloroethane	2.735	1.193		
Tetrachloroethylene*	7.230	10.063		
Toluene	28.025	13.534		
Total Xylenes	28.194	16.681		
1,1,1–Trichloroethane*	8.161	5.150		
Trichlorothylene	5.766	4.177		

REFERENCES FOR APPENDIX E

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- (5) Matter-Muller, C., et al. 1980. Non-Biological Elimination Mechanisms in a Biological Sewage Treatment Plant. Program Water Technology, 12, 299.
- (6) Roberts, P.V., et al. 1984. Modeling Volatile Organic Solute Removal by Surface and Bubble Aeration. <u>Journal of the Water Pollution</u> Control Federation 56,157.
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VOLUME III

APPENDIX F

Appendix F is not used in this draft.

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Appendix G

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VOLUME III

APPENDIX G

NEW BEDFORD WASTEWATER TREATMENT PLANT AIR TOXICS AND ODORS IMPACTS ANALYSIS

1.0 INTRODUCTION

The principal objectives of the air quality modeling described in this appendix are to:

- Determine off-site impacts for a set of volatile organic compounds (VOCs), and organic and inorganic odors, characteristic of wastewater treatment plants emitted from Sites 4A and 1A
- Compare modeled ground-level VOC concentrations of acute toxic compounds and carcinogens with Massachusetts allowable ambient limits (AALs) and threshold effects exposure limits (TELs)
- Compare modeled ground-level odor concentrations with their respective odor threshold levels
- o Determine the need to treat offgases from process stacks to demonstrate compliance with the AALs and TELs, and to maintain principal odor concentrations below recognition thresholds

The results of these studies will be used for assessment of potential community air quality impacts associated with proposed preliminary plant design and site layouts for Sites 4A and 1A. The New Bedford Wastewater Treatment Plant (WWTP) will be designed with all treatment processes enclosed within their respective buildings. Emissions of volatile organic compounds and odorous compounds from water treatment and sludge dewatering operations will be vented through rooftop stacks.

VOC emissions and odors from both sites will impact mixed-use areas. For example, Site 4A is bordered by residences toward the west, the Acushnet River and harbor toward the east, and industrially zoned areas toward the north and south. The nearest residences are about 100 m west of the process stacks. Site 1A will include a revitalized Taber Park which will surround the WWTP. Water extends to the east, west, and south beyond the

park. Permanent residences are located several hundred meters toward the north, buffered from the WWTP by the park. Exposure of park visitors to any WWTP air emissions will be limited to posted visiting hours.

This appendix estimates WWTP-generated VOC and odor concentrations beyond the WWTP property boundary for comparison with Massachusetts TELs and AALs, and with odor recognition thresholds. Impacts to people visiting Taber Park are unlikely to occur for a contiguous 24-hour period. However, a comparison of modeled 24-hour impacts to TELs is shown in the results section for conservatism.

This appendix is organized into three sections: this introduction, the toxic VOC analysis, and the odor impacts analysis.

2.0 AIR TOXICS IMPACT ANALYSIS

2.1 AMBIENT AIR QUALITY CRITERIA

Regulatory Background for Toxic Substances Guidelines

The Department of Environmental Quality Engineering (DEQE), Division of Air Quality Control, has adopted a set of allowable ambient limits (AALs) and threshold effects exposure limits (TELs) for more than 100 chemical compounds. These non-promulgated toxics exposure limits are not-to-beexceeded annual and 24-hour ambient concentrations, respectively. DEQE's Office of Research and Standards (ORS) has summarized the basis for AALs and TELs in <u>Chemical Health Effects Assessment Methodology and the Method to Derive Acceptable Ambient Levels</u> (or CHEM/AAL). The application of air toxics requirements for the New Bedford WWTP project was initiated by Mr. Bruce Maillet in a November 4, 1988 memorandum to regional air quality section chiefs. This memorandum cited that, "All New Bedford projects which require [310 CMR] 7.02 approval will be required to perform air toxic analysis and demonstrate compliance with AALs." The TELs are a recent addition to the draft list of impact compliance criteria, and have been included in this study for completeness.

The regulatory basis for the development of TELs and AALs is available guantitative toxicity and carcinogenicity data supplemented by "adjustment factors" in cases of "inadequate" data. The basis for the TEL and AAL is the most appropriate occupational limit (MAOL) which is an existing occupational exposure limit. An adjusted-MAOL is calculated by dividing the MAOL by a number between 73.5 and 735, depending upon the adequacy of available toxicity data. The TEL is calculated from the adjusted-MAOL by dividing the latter by a number in the range 5 to 50 to account for threshold effects, uncertainty factors, and exposure adjustments. Another exposure limit, the non-threshold effects exposure limit (NTEL), is evaluated from the adjusted-MAOL for suspected carcinogens. The NTEL corresponds to an exposure concentration resulting in one excess cancer risk per one-million population for compounds with quantitative cancer potency data. In the absence of potency data, the adjusted-MAOL is modified by CHEM factors devised by DEQE-ORS to derive the NTEL. The smaller of the TEL and NTEL is chosen as the AAL. However, DEQE is presently setting the AAL equal to the TEL if the TEL is lower than the NTEL.

The study presents modeled ground-level concentrations of 15 compounds with published AALs and TELs. These compounds represent a subset of sampled compounds characteristic of WWTP sources and which have toxic limits. The presentation of ambient impacts relative to draft AALs and TELs is in response to a request by DEQE to CDM during a November 9, 1988 meeting on air quality issues, and the subsequent issuance of 24-hour TELs in March 1989. No modeling of impacts at receptors situated within the Acushnet River (New Bedford Harbor) and Buzzards Bay was performed for comparison to AALs and TELs in accordance with DEQE guidance (DEQE, 1989a).

VOC Significant Emission Level

Massachusetts Air Pollution Control Regulations are more stringent than the federal regulations and define a "major new source" of VOC emissions to be a stationary source emitting 100 tons per year (tpy) or more of VOCs (310 CMR, Sections 7 and 8). New Bedford is in a federally designated non-attainment area for ozone (40 CFR 81.322 et.seq.). As stated in

310 CMR 7.00, Appendix A, Massachusetts regulates "major new sources" of VOCs as ozone precursors.

If the proposed New Bedford Wastewater Treatment Plant (WWTP) is determined to be a major new source for VOC emissions, then it will be required to:

- o Comply with the lowest achievable emission rate (LAER)
- Demonstrate that it will not cause or contribute to existing violations of the National Ambient Air Quality Standards (NAAQS) for ozone
- Acquire emissions offsets from existing sources in the area such that there will be a net air quality benefit

LAER is defined (310 CMR 7.00, Appendix A) as that rate of emissions which reflects the most stringent emission limitation in the state implementation plan (SIP) of any state, or a control which has been achieved in practice by comparable sources. The formula for crediting VOC emission offsets from existing sources is an inverse function of the distance of the current WWTP emissions offset (e.g., the present facility adjacent to Fort Rodman) from the proposed site, and is outlined in 310 CMR Appendix A (4).

Appendix E presents a detailed analysis of these issues.

2.2 SOURCE AND EMISSION PARAMETERS

Emissions Sources

VOCs present in New Bedford wastewater are released in the treatment process at points where the wastewater flow becomes turbulent or undergoes aeration. Quiescent water surfaces make insignificant contributions to the total mass flux. Figures 1 and 2 show approximate preliminary wastewater treatment plant layouts for Site 4A and 1A, respectively. The building numbers and functions are the same at both sites. Table G-1 lists the significant sources of VOCs and odors. All of the sources would be enclosed and vented through stacks.



KEY

- COARSE SCREENS BUILDING
- PUMP STATION
- FINE SCREEN BUILDING
- AERATED GRIT TANKS
- CSO PRIMARY TANKS
- PRIMARY TANKS
- AERATION TANKS
- FINAL SETTLING TANKS
- PARSHALL FLUME
- CHLORINE CONTACT TANKS
- CSO CHLORINE CONTACT TANKS 12
- DISINFECTION BUILDING CSO SCREEN BUILDING 13
- MAINTENANCE BUILDING
- BLOWER BUILDING
- ADMINISTRATION BUILDING
- GRAVITY THICKENERS
- SLUDGE BLENDING TANKS 18
- SLUDGE PROCESSING BUILDING
- EFFLUENT PUMP STATION 20
- 21 SURGE TOWER

Boundary Receptor Points

Emission Stacks

Controlling Structures

(0,0) Receptor Grid Origin

FIGURE 1 Site 4A **Emission Sources and Property Boundary Receptor Points**



Controlling Structures

Site 1A **Emission Sources and Property Boundary Receptor Points**

TABLE G-1

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NEW BEDFORD WWTP EMISSIONS SOURCES

Stack No.	Building Name	_Contributing Sources_	Emission Type	Control Equipment In Stack
1	Coarse Screens	Coarse Screens	Odors	Yes
3	Fine Screens	Fine Screens	Odors	Yes
4	Aerated Grit Tanks	Aerated Grit Chambers Aerated Grit Weirs	VOC Odors	Yes Yes
6	Primary Clarifiers	Primary Distribution Boy Clarifier Weirs	v VOC Odors	Yes Yes
7	Aeration Tanks	Aeration Tanks Aeration Tank Weirs	VOC Odors	No Yes
8	Final Settling Tanks (Secondary Clarifiers)	Secondary Clarifier Weirs	VOC Odors	No No
19	Sludge Processing	Sludge Dewatering	VOC Odors	No Yes

* Stack Numbers are the same as the numbers of their associated buildings. Source: CDM, 1989.
The Coarse Screens and Fine Screens Buildings (Nos. 1 and 3) will be sources of inorganic odors, but are not expected to be significant sources of VOC emissions. This is because relatively little mixing and turbulence (i.e., no hydraulic drops) would occur in the wastewater at these points. These sources, therefore, were not considered in the VOC analysis, but will be included in a subsequent odors analysis.

In the Grit Removal Building (Building No. 4), VOCs will be generated from the aerated grit chambers and the aerated grit weirs. Emissions of VOCs from the primary clarifier (Building No. 6) occur at the primary distribution box, and at the primary clarifier weir.

Emissions from Buildings No. 4 and 6 will be vented differently at the two proposed WWTP sites. For Site 4A, all gases volatilized at Buildings No. 4 and 6 will be vented through Stack No. 6, attached to the Primary Clarifier Building (see Figure 1). This stack will contain a carbon adsorption system with a collection efficiency for VOCs greater than 95 percent. At Site 1A, Stack Nos. 4 and 6 are too far apart to be combined and treated together, so they will remain as separate sources, each with a carbon adsorption system.

At the Aeration Tanks Building (No. 7), VOCs will be emitted from the turbulent water surface, as well as from wastewater cascading over the weirs (i.e., hydraulic drop). Emission rates were calculated for the bubbling of ambient air through wastewater in the aeration tanks. Wastewater cascades over the weir is the major source of VOCs at the Final Settling Tanks (Building No. 8).

Sludge in the Sludge Processing Building (Building No. 19) will emit VOCs as it is centrifuged and dewatered. It was assumed, as a worst-case estimate, that 100 percent of the VOCs contained in the sludge would be emitted into the building air and vented through Stack No. 19. In instances where specific toxic VOC compounds were not detected in the sludge sampling, they were assumed to be present at a concentration of one-half the detection limit for that compound, based on EPA guidance (EPA, January 1989, EPA 560/4-89-002).

Source Parameters

Modeling was performed in both a screening mode, and with sequential hourly meteorological data, for modeling downwind concentrations of potentially toxic VOCs emitted from the above sources. The modeling analysis is described in Section 2.3. The parameters used to represent the stacks at each site (4A and 1A) are listed in **Tables G-2** and **G-3**, respectively. The stack heights were set equal to at least 1.5 times the building height of the "controlling" structure in order to avoid increased ground-level concentrations associated with plume entrapment in the building cavity region, and to reduce building wake influences (Schulman, 1986). It was necessary to increase the height of Stack No. 7 (Aeration Tanks) at Site 1A to 32 feet above grade, in order to avoid adverse impacts within the proposed Taber Park. Exhaust exit velocities were developed to be in the 18-to-27 m/s range to maximize momentum plume rise and minimize stack and building downwash potential.

The land use within 3 kilometers of Sites 1A and 4A is classified as a non-urban dispersion environment (Auer, 1978). Support for this conclusion was presented in the <u>Draft Phase II Facilities Plan Site Evaluation for</u> <u>Wastewater Treatment Facilities</u> (CDM, 1989). Rural dispersion coefficients, default wind profile exponents, and potential temperature gradients were selected as model inputs. The ambient temperature was set equal to 284.3K, the mean New Bedford temperature for 1951 to 1980 (NOAA, 1985). The remaining modeling switches were set equal to the values listed in Table G-7.

Emission Rates

Volatile organic compound emission rates were calculated for daily and annual periods to correspond with the TEL and AAL averaging times. An estimate of the annual emissions from the treatment system was obtained by performing calculations for two combinations of flows and loads as follows:

o Average annual dry weather flow (30 mgd) with projected non-runoff average mass loadings

SOURCE PARAMETERS FOR ISCST MODELING OF VOC STACKS AT SITE 4A

	Stack No.4 Aerated	Stack No.6	Stack No.7	Stack No.8 Final	Stack No.19 Sludge
	Grit Tanks	Primary Clarifiers	Aeration Tanks	Settling Tanks	Processing Building
Stack Location ⁽¹⁾					
(x,y) (m)	_{NA} (2)	(193,111)	(94,72)	(94,55)	(279,185)
Base elevation (ft. msl)	_{NA} (2)	6	6	6	6
Stack Data					
Height (m)	_{NA} (2)	11.00	8.38	8.38	16.58
Inner Diameter	(m) NA ⁽²⁾	0.46	0.91	0.61	1.07
Volumetric Flow Rate (acfm)	_{NA} (2)	8,140	26,000	13,000	45,400
Exit Velocity (m/s)	_{NA} (2)	23.42	18.70	20.99	23.96
Exhaust Temp.(K) ⁽³⁾ NA ⁽²⁾	285.9	285.9	285.9	291.5
Nearby "Controlli	ng" Structu	re Dimension	s		-
Minimum					
Projected Width	_{NA} (2)	11.3	11.3	11.3	47.5
Height (m)	_{NA} (2)	7.25	5.49	5.49	10.97

(1) Coordinates are relative to (0,0) at the Coarse Screens Building stack. The y-axis is aligned with geographic north.

(2) Stack No. 6 includes the flow from Stack No. 4.

(3) The ambient temperature was set equal to 52°F (284.3 K), the annual average temperature for New Bedford (1951-80).

(4) Use of the minimum projected structure width will conservatively maximize resultant modeled concentration impacts at all evaluated receptors.

Source: CDM, 1989

SOURCE PARAMETERS FOR ISCST MODELING OF VOC STACKS AT SITE 1A

	Stack No.4 Aerated	Stack No.6	Stack No.7	Stack No.8 Final	Stack No.19 Sludge	
	Grit Tanks	Primary <u>Clarifiers</u>	Aeration Tanks	Settling Tanks	Processing Building	
Stack Location ⁽¹⁾)					
(x,y) (m)	(-67,181)	(55,110)	(174,-3)	(136,-32)	(0,0)	
Base elevation (ft. msl)	9.5	9.5	9.5	9.5	9.5	
Stack Data						
Height (m)	13.41	9.20	9.75	6.55	16.58	
Inner Diameter	(m) 0.15	0.46	0.76	0.61	1.07	
Volumetric Flow Rate (acfm)	7 990	7,150	26,000	12,830	45,400	
Exit Velocity (m/s)	25.75	20.57	26.91	20.72	23.96	
Exhaust Temp.(K	() ⁽²⁾ 284.3	285.9	285.9	285.9	291.5	
Nearby "Controlli	ing" Structu	ire Dimensions	5			
Minimum Projected Width (m)(3)	21.9	11.3	11.3	11.3	47.5	
Height (m)	8.84	6.04	4.27	4.27	10.97	

(1) Coordinates are relative to (0,0) at the Sludge Processing Building Stack (No. 19). The y-axis is aligned with geographic north.

- (2) The ambient temperature was set equal to 52°F (284.3 K), the annual average temperature for New Bedford (1951-80).
- (3) Use of the minimum projected structure width will conservatively maximize resultant modeled concentration impacts at all evaluated receptors.

Source: CDM, 1989

 Maximum hydraulic capacity of secondary treatment (75 mgd) and combined sewage overflow (CSO) flow through primary treatment only (45 mgd) with CSO loadings

The maximum hydraulic capacity of the secondary treatment and CSO flow was estimated to occur about 800 hours per year, or less than 10 percent of the time. These conditions were accounted for in calculated annual emissions from the proposed wastewater treatment facility.

An evaluation of the maximum daily VOC emissions was calculated based on the minimum daily dry weather flow (19 mgd) with projected non-runoff maximum mass loading. This flow allowed long detention times and large hydraulic drops over weirs which could yield high emission rates for volatile constituents with low biodegradation rates. A maximum 24-hour emission rate was projected by adding the constituent loadings from storm runoff (assuming normal maximum loadings at maximum normal flow plus maximum storm water flow).

Estimated 24-hour and annual emission rates for 15 compounds are listed in **Tables G-4** and **G-5**, respectively. These emission rates apply to both Sites 4A and 1A. Mass emission rates are listed for the five point sources. The wastewater VOCs will be emitted to the atmosphere through single stacks on the buildings containing the following: aerated grit tanks, primary clarifiers, aeration tanks, final settling tanks and the sludge processing equipment. The corresponding building numbers were used as the stack identification numbers listed in Tables G-4 and G-5.

Emissions from the Sludge Processing Building (Stack No. 19) were estimated based on six samples of New Bedford sludge (after primary treatment only) taken between February 15 and 24, 1989. Only acetone, tetrachloroethane, toluene, ethylbenzene, and xylene were consistently found above the detection limits. The average of the six samples was used to estimate the concentrations of VOCs in the sludge. Compounds not present above the detection limits were assumed to be present at half of the detection limit.

POLLUTANT EMISSION RATES^{*} MAXIMUM 24-HOUR AVERAGE

	Stack No.4	Stack No.6	Stack No.7	Stack No.8 Final	Stack No.19 Sludge
Compound	Aerated Grit Tanks (g/s)	Primary Clarifiers (g/s)	Aeration Tanks (g/s)	Settling Tanks (g/s)	Processing Building (g/s)
Acetone	1.902E-01	2.005E-01	1.553E-04	3.194E-05	2.047E-03
Benzene	6.779E-03	5.674E-03	2.698E-03	3.576E-05	1.575E-04
2-Butanone	9.659E-02	1.061E-01	9. 506E-05	1.748E-05	4.200E-04
Chloroform	8.4 8 5E-03	8.003E-03	2.147E-03	5.282E-05	2.100E-04
1,2-Dichloro-					
ethane	5.564E-03	6.041E-03	4.230E-03	2.155E-04	1.575E-04
1,2-Dichloro-					
ethene	5.601E-03	4.587E-03	1.502E-04	1.539E-06	1.575E-04
Ethylbenzene	1.571E-02	1.300E-02	3.893E-03	3.912E-05	5.250E-04
4-Methyl,					
2-Pentanone	9.561E-03	1.111E-02	3.496E-03	5.512E-04	3.150E-04
Methylene					
Chloride	8.270E-03	7.846E-03	3.410E-03	1.248E-04	1.575E-04
1,1,2,2-Tetra-			-		
chloroethane	6.480E-03	7.339E-03	4.960E-04	4.360E-05	1.575E-04
Tetrachloro-					
ethylene	1.844E-02	1.063E-02	8.858E-03	2.650E-05	3.675E-04
Toluene	6.559E-02	5.395E-02	2.730E-02	2.946E-04	4.357E-04
1,1,1-Trichloro-					
ethane	2.180E-02	1.418E-02	6.832E-03	3.530E-05	1.575E-04
Trichloroethylene	1.433E-02	1.063E-02	5.266E-03	4.215E-05	2.100E-04
Total Xylenes	8.084E-02	6.526E-02	1.900E-03	1.753E-05	4.830E-03

Source: CDM, 1989

and and

^{*} Emission rates are calculated for ambient air aeration, and with the assumption of no control. For the "controlled" case, emissions from Stack Nos. 4 and 6 were assumed to be reduced by 95% from the numbers shown.

POLLUTANT EMISSION RATES* ANNUAL AVERAGE

	Stack No.4	Stack No.6	Stack No.7	Stack No.8 Final	Stack No.19 Sludge
Compound	Aerated Grit Tanks (g/s)	Primary Clarifiers (g/s)	Aeration Tanks (g/s)	Settling Tanks (g/s)	Processing Building (g/s)
	•				
Acetone	4.630E-02	6.539E-02	1.151E-04	2.877E-05	2.047E-03
Benzene	1.604E-03	1.870E-03	1.294E-03	2.877E-05	1.575E-04
2-Butanone	9.320E-03	1.352E-02	2.877E-05	0.000E-00	4.200E-04
Chloroform	3.279E-03	4.113E-03	1.611E-03	2.877E-05	2.100E-04
1,2-Dichloro-					
ethane	1.352E-03	1.898E-03	1.553E-03	5.752E-05	1.575E-04
1,2-Dichloro-					
ethene	1.669E-03	1.784E-03	8.631E-05	0.000E-00	1.575E-04
Ethylbenzene	2.877E-03	3.107E-03	1.323E-03	0.000E-00	5.250E-04
4-Methyl,					
2-Pentanone	1.812E-03	2.733E-03	1.208E-03	1.151E-04	3.150E-04
Methylene					
Chloride	1.755E-03	2.186E-03	1.237E-03	5.752E-05	1.575E-04
1,1,2,2-Tetra-					
chloroethane	1.410E-03	2.042E-03	2.589E-04	2.877E-05	1.575E-04
Tetrachloro-					
ethylene	3.970E-03	3.222E-03	4.198E-03	0.000E-00	3.675E-04
Toluene	1.309E-02	1.410E-02	9.868E-03	1.151E-04	4.357E-04
1,1,1-Trichloro-					
ethane	4.259E-03	3.739E-03	2.589E-03	0.000E-00	1.575E-04
Trichloroethylene	4.661E-03	4.633E-03	3.279E-03	2.877E-05	2.100E-04
Total Xylenes	1.539E-02	1.666E-02	7.480E-04	0.000E-00	4.830E-03

* Emission rates are calculated for ambient air aeration, and with the assumption of no control. For the "controlled" case, emissions from Stack Nos. 4 and 6 were assumed to be reduced by 95% from the numbers shown.

Source: CDM, 1989

The average design year sludge production rate of 52,290 dry pounds per day was assumed. It was also assumed that all of the VOCs present in the sludge would volatilize.

In general, VOC emission rates from the aerated grit tanks (Stack No. 4) and the primary clarifiers (Stack No. 6) are within a factor of two of each other and greater than emissions from the aeration tanks (Stack No. 7). Emissions from the secondary clarifiers and sludge processing building (Stacks No. 8 and No. 19, respectively) are more than an order of magnitude lower than those from aerated grit and primary clarifier stacks.

2.3 AIR QUALITY MODELING ANALYSIS

Scenario Selection for Impact Assessment

Separate modeling scenarios were developed for Site 4A and Site 1A. This permitted the identification of worst-case 24-hour and annual VOC impacts in the vicinity of each site. The intent was to identify whether any air toxics emitted by the wastewater treatment plant would impact on ambient air at concentrations exceeding the AALs and TELs. Modeling methodology was discussed with the DEQE on April 24, 1989 (DEQE, 1989a).

Ground-level VOC impacts at Site 1A were separated into two types: those on city-owned land surrounding the proposed WWTP structures which will become Taber Park, and those on land extending north beyond the park. Impacts were not modeled over the water surfaces toward the east, west, and south. Impacts associated with VOC emissions from Site 4A were modeled for beyond the property boundary and sensitive locations.

A screening modeling analysis was performed to determine the distance to maximum impact for each of the emission sources for the range of 21 meteorological conditions adopted by DEQE for dispersion modeling. Receptor grids for sequential modeling were developed from these modeling results.

For modeling purposes, all wastewater treatment surfaces proposed for Sites 4A and 1A were assumed to be enclosed in buildings. Process air was vented to the atmosphere through vertical stacks. The "all-enclosed" scenario was adopted because preliminary screening modeling had demonstrated that emissions from uncovered aeration tanks might cause ambient impacts in excess of the TELs and AALs for several VOCs.

Dispersion Model Selection

Two EPA Gaussian dispersion models, the short-term Industrial Source Complex model (ISCST) and COMPLEX-I, were used to assess ground-level impacts from emission sources. These models are commonly used to estimate ground-level impacts of pollutants in permitting projects performed for DEQE and EPA Region I.

All emission point sources at Sites 4A and 1A have stack heights set at slightly more than 1.5 times the height of their controlling structure. For Stack No. 7 (Aeration Tanks) at Site 1A, it was necessary to further increase the stack height to about 2.3 times its controlling structure to avoid adverse impacts within the proposed Taber Park. All stacks, therefore, are between 1.5 and 2.5 controlling structure heights, and the emitted plume from each stack is within the structure-induced downwash regime of its controlling structure. As a result of the "Letter Change 8 to UNAMAP (Version 6)" of the U.S. EPA's ISCST, as presented in the Joseph A. Tikvart (EPA-TSD) memorandum dated December 15, 1988, ISCST is the only guideline model capable of estimating the effects of structure-induced downwash on the distribution of downwind ground-level impacts. It was initially used in "screening mode" to determine the maximum downwind extent of the receptor grid that would capture the maximum impacts for the set of emission sources. ISCST was then used for the sequential-hourly modeling on a comprehensive receptor grid for each proposed WWTP site.

Some of the terrain within 1 kilometer of Sites 4A and 1A exceeds the elevation of the VOC stacks. Impacts on these elevated terrain areas was modeled with COMPLEX-I in the VALLEY screening mode (i.e., with F-stability and a 2.5 m/s wind speed). This screening analysis was performed to

demonstrate that impacts in simple terrain predicted by ISCST exceed those predicted by COMPLEX-I, thereby supporting the decision not to perform further sequential modeling with an "elevated terrain" model.

Meteorological Data

Screening modeling was performed with a set of 21 meteorological conditions (i.e., pairings of wind speed and atmospheric stability class) in accordance with the latest DEQE guidance on modeling protocol (DEQE, 1988). These conditions are listed in **Table G-6**. A plume trapping condition (i.e., C-stability with 2.5 m/s wind speed and minimum mixing depth of 100 m) was modeled as suggested by DEQE for the modeling protocol. The five on-site emission sources were laterally moved to align directly along one wind radial, in order to identify conservatively the maximum potential extent of impacts due to plume overlap. The ISCST model used each meteorological condition to estimate the resulting 1-hour average ground-level concentration at each receptor point along the radial.

The downwind extent and density of receptor grids was developed from the results of screening modeling. ISCST was used to model maximum 24-hour and annual average ground-level concentrations for each of five years of sequential hourly meteorological data. Surface meteorological data from the Providence (T.F. Green State) Airport (WBAN No. 14765), and upper air data from the Chatham Weather Service Meteorological Observatory (WBAN No. 14684), were chosen as most representative of the site. (The Providence station does not monitor upper air mixing heights.) These data were combined into a single meteorological data file for the years 1981 to 1985, inclusive. The anemometer height at the Providence Airport for the modeling period was 20 feet above ground level.

The metdata was checked, and one hour of data was found to be missing (the 00 hour, 12:00 a.m. to 1:00 a.m., on June 2, 1985). Data from the 23rd hour of June 1 was persisted into this hour to complete the file.

Hour Number	Wind Speed (m/s)	Mixing Height (ft)	Atmospheric Stability Class
1	1.0	5000.	А
2	3.0	5000.	А
3	1.0	5000.	В
4	3.0	5000.	В
5	5.0	5000.	В
6	1.0	5000.	С
7	2.5	100.	С
8	3.0	5000.	С
9	5.0	5000.	С
10	10.0	5000.	С
11	1.0	5000.	D
12	3.0	5000.	D
13	5.0	5000.	D
14	10.0	5000.	D
15	15.0	5000.	D
16	1.0	10000.	E
17	3.0	10000.	E
18	5.0	10000.	E
19	1.0	10000.	F
20	3.0	10000.	F
21	5.0	10000.	F

METEOROLOGICAL CONDITIONS FOR ISCST SCREENING MODELING

NOTE: An average annual ambient temperature of 284.3K was assumed for all meteorological conditions.

Source: DEQE, 1988

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In addition, DEQE has specified that some of the Providence meteorological data collected in June 1984 be treated with caution (DEQE, 1989b). Previous use of this data for another project resulted in the discovery of an unusual persistence of wind direction for June 14-27, 1984. Because of this persistence, air quality modeling generated abnormally high ground-level pollutant concentrations for those days. Suspect meteorological data were not replaced for the current study. The wind persistence may contribute to very conservative 24-hour estimates of VOC impacts presented in Tables G-8, G-9, and G-10.

Receptors

For the ISCST screening analyses, receptor points were placed at the following intervals along a single wind vector:

- Every 50 m from 100 m to 400 m
- Every 100 m from 500 to 1000 m
- Every 200 m from 1200 m to 4000 m
- Every 500 m from 4500 m to 7000 m

Modeling results indicated that for all 21 combinations of wind speed and meteorological stability class shown in Table G-6, the distance to the maximum combined ground-level concentration for the five emission sources is 600 m or less. The highest ground-level concentrations occurred for the most stable meteorological conditions: atmospheric stability classes E and F.

Based on these results, cartesian receptor grids were developed for Sites 4A and 1A. The grids were set to extend out to 1 km from the plant property boundaries in each direction at both sites. Because DEQE has directed that toxic VOC concentrations need not be modeled for locations over water (DEQE, 1989a), receptor grid points occurring over water were omitted from the analysis.

For Site 4A, receptor points were placed every 50 m along the property boundaries (see Figure 1). Three off-site grids, extending west, south,

and north, respectively, were developed with 100-m spacing in all directions. In addition, two receptors were placed east of the site on the eastern shore of the Acushnet River, about 1400 m away. Attachment A contains a listing of all 272 receptor points. The origin was set at Stack No. 1 (see Figure 1). Terrain elevations from a USGS 7.5-minute topographic map were assigned to each receptor.

Site 1A abuts the proposed Taber Park. Receptor points were placed throughout the park, as shown in Figure 2. Because Site 1A is located at the southern end of a peninsula, only one grid, extending north along the peninsula beyond Taber Park, was necessary. Receptors were placed in a rectangular grid arrangement at 100-m spacing in all directions: outward from the property boundary, and at 100-m intervals parallel to that boundary. Attachment A contains a listing of all 133 receptor points. The model grid origin was located at Stack No. 19 (see Figure 2). Terrain elevations from a USGS 7.5-minute topographic map were assigned to each receptor.

Modeling Methodology

Detailed modeling with ISCST was performed with EPA- and DEQE-approved options listed in **Table G-7.** The impact of each VOC stack was modeled on the Site 4A and 1A receptor grids for each year of the 5-year (1981 to 1985) period.

Normalized ground-level concentrations (NGLC) for 24-hour and annual averaging periods were output by ISCST for each stack (see **Tables G-8, G-9** and **G-10**). The maximum NGLC for each stack was identified and multiplied by a VOC emission rate listed in Tables G-4 and G-5. Thus, for each compound, the highest 24-hour average which occurred in 5 years was selected for each stack. Then, even though these highest values did not occur on the same day (or even in the same year) or in the same location for each of the stacks, the highest 24-hour average concentrations for each stack were added together. This worst-case, unpaired-in-space-and-time, total concentration was then compared with the appropriate DEQE TEL for that compound. The procedure was similar for the annual average case. For

MODELING OPTIONS

Option Description	ISCST	COMPLEX-I
Dispersion Coefficients	Rural	Rural
Wind Profile Exponents	.07,.07,.10,.15,.35,.55	Same
Potential Temperature Gradients (K/m)	0.02 (E-Stability) 0.035 (F-Stability)	Same
Final Plume Rise Only	No	No
Stack Tip Downwash	Yes	Yes
Buoyancy Induced Dispersion	Yes	Yes
Chemical Transformation	No	No
EPA DECALM Option	Yes	NA
Anemometer Height (m)	6.1	6.1
Upper Bound Concentration	Yes	NA
Meteorology .	1981-1985 Sequential Hourly	Screening
Receptors	Cartesian Grid	Single Radial
Terrain	Yes	Yes
Terrain Adjustment Factors	NA	.5,.5,.5,.5,0,0

NA: Not Applicable.

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Source: DEQE, 1989a

SITE 4A, OFF-SITE IMPACTS MAXIMUM NORMALIZED GROUND LEVEL CONCENTRATIONS⁽¹⁾ ISCST AND COMPLEX-I MODELING RESULTS

		Uncontr	olled Norm by	alized Con Stack Num	centration ber	(ug/m³(g/s)))
	Averaging 	No. 4	<u>No. 6</u>	<u>No. 7</u>	<u>No. 8</u>	<u>No. 19</u>	
Control Efficiency ((%)	95%	95%	0%	0%	0%	
ISCST Result by Year	ts -						
1981	1-Hour 24-Hour Annual	241.47 44.24 3.664	241.47 44.24 3.664	229.29 35.56 3.334	275.76 54.49 5.478	151.82 15.10 0.957	
1982	1-Hour 24-Hour Annual	266.98 53.52 4.775	266.98 53.52 4.775	230.37 44.93 2.422	299.25 70.97 3.923	148.81 25.72 0.972	
1983	1-Hour 24-Hour Annual	225.11 53.08 7.041	225.11 53.08 7.041	248.28 57.45 3.858	320.44 64.59 5.309	155.36 32.37 1.811	
1984	1-Hour 24-Hour Annual	223.09 68.21 5.679	223.09 68.21 5.679	210.94 44.97 3.264	276.17 56.62 4.638	140.43 18.55 1.344	
1985	1-Hour 24-Hour Annual	217.40 51.24 3.950	217.40 51.24 3.950	206.10 39.39 2.403	244.38 63.98 4.610	159.03 14.81 1.251	
COMPLEX-I Re	esults ⁽²⁾						
	1-Hour 24-Hour	34.96 8.74	34.96 8.74	39.06 9.77	41.53 10.38	9.53 2.38	

(1) Location is not noted, because the maxima for each stack were totaled without regard to whether they were coincident in space.

(2) Based on VALLEY screening methodology in COMPLEX-I.

Source: CDM, 1989

SITE 1A, TABER PARK IMPACTS MAXIMUM NORMALIZED GROUND LEVEL CONCENTRATIONS⁽¹⁾ ISCST AND COMPLEX-I MODELING RESULTS

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		Uncontro	by Stack Number				-)
	Averaging Time	<u>No. 4</u>	<u>No. 6</u>	<u>No. 7</u>	<u>No. 8</u>	<u>No. 19</u>	
Control Efficiency (%)	95%	95%	0%	0%	0%	
ISCST Result by Year	S						
1981	1-Hour 24-Hour Annual	1180.5 163.9 14.21	611.4 130.4 9.352	151.1 20.24 1.921	253.2 66.36 5.566	170.3 21.20 1.731	
1982	1-Hour 24-Hour Annual	2315.9 244.6 20.88	566.8 141.0 9.832	181.3 25.84 1.920	375.2 68.45 5.269	169.2 28.10 1.727	
1983	1-Hour 24-Hour Annual	1665.1 164.0 22.64	580.1 151.8 14.19	149.8 35.11 3.698	403.5 89.93 8.840	231.9 29.84 2.046	
1984	1-Hour 24-Hour Annual	1476.9 175.6 17.69	547.6 190.8 13.44	167.3 33.62 2.270	272.1 73.65 6.200	188.2 34.97 1.741	
1985	1-Hour 24-Hour Annual	1875.1 191.6 14.77	618.5 102.4 8.087	186.0 38.48 1.807	390.3 61.97 4.388	163.9 23.95 1.433	
COMPLEX-I Res	sults ⁽²⁾						
	1-Hour 24-Hour	66.60 16.65	94.13 23.53	80.75 20.19	103.57 25.89	13.75 3.44	

(1) Location is not noted, because the maxima for each stack were totaled without regard to whether they were coincident in space.

(2) Based on VALLEY screening methodology in COMPLEX-I.

Source: CDM, 1989

SITE 1A, IMPACTS BEYOND TABER PARK MAXIMUM NORMALIZED GROUND LEVEL CONCENTRATIONS⁽¹⁾ ISCST AND COMPLEX-I MODELING RESULTS

		Uncontrolled Normalized Concentration (ug/mby Stack Number			(ug/m³(g/s)	m³(g/s) ⁻¹)	
	Averaging 	<u>No. 4</u>	<u>No. 6</u>	<u>No. 7</u>	<u>No. 8</u>	<u>No. 19</u>	
Control Efficiency (%)	95%	95%	0%	0%	0%	
ISCST Result by Year	.s						
1981	1-Hour 24-Hour Annual	598.2 88.04 7.330	357.9 77.19 5.535	132.6 24.22 1.884	363.8 43.44 3.785	120.5 16.02 1.169	
1982	1-Hour 24-Hour Annual	598.2 92.38 8.070	423.9 78.33 5.976	150.6 29.07 1.868	405.7 53.27 4.399	103.0 19.11 1.147	
1983	1-Hour 24-Hour Annual	751.8 94.06 8.757	415.3 70.58 8.320	150.8 26.35 2.548	437.6 43.38 5.818	123.5 24.05 1.588	
1984	1-Hour 24-Hour Annual	598.2 86.34 7.926	357.4 125.49 8.231	130.5 30.22 2.447	362.5 89.07 5.702	131.3 28.64 1.594	
1985	1-Hour 24-Hour Annual	661.3 74.56 8.346	305.6 49.71 4.988	130.3 22.25 1.574	390.3 45.53 3.815	123.7 14.63 1.048	
COMPLEX-I Re	esults ⁽²⁾						
	1-Hour 24-Hour	66.70 16.67	93.17 23.29	80.75 20.19	103.6 25.89	13.75 3.44	

(1) Location is not noted, because the maxima for each stack were totaled without regard to whether they were coincident in space.

(2) Based on VALLEY screening methodology in COMPLEX-I.

Source: CDM, 1989

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each compound, an annual-average concentration was computed for each stack for each of the five years modeled. The highest of the five annual averages was selected for each stack. Then, although these highest concentrations did not occur in the same year or at the same location for each stack, they were added together. This worst-case "unpaired" annual average concentration was then compared with the DEQE AAL for each compound. Results are shown in **Tables G-11**, **G-12**, and **G-13**, and are discussed in Section 2.4. (Note that results are broken out for Taber Park in Tables G-9 and G-12.) Activated carbon filters will be used to adsorb VOCs from Stack Nos. 4 and 6, with the end result of no exceedances of AALs or TELs.

Impacts on terrain above stack-top elevation were estimated for each VOC source using a single worst-case radial from source to specific terrain features surrounding each site. For each compound, the highest COMPLEX-I (VALLEY screening mode) impact for each stack (1-hour and 24-hour) was compared with its ISCST equivalent. The 24-hour average impact was based on the assumption of a 6-hour persistence of "F"-stability and a 2.5-m/s wind speed. In all cases, ISCST generated the higher NGLCs, which were then used in the analysis.

2.4 SUMMARY OF AIR QUALITY IMPACTS

Modeled VOC Impacts at Site 4A

Modeled ground-level concentrations for 15 VOCs emitted from the Site 4A wastewater treatment facility are presented in Table G-11. The impacts for 24-hour and annual periods are the sum of the "unpaired" maximum impacts for the set of six stacks operating onsite. The cumulative impacts as a percentage of the DEQE AAL or TEL are listed in the far right-hand column.

Table G-11 shows that even with this very conservative approach of totalling the highest concentration in five years for each stack, regardless of where or when each maximum stack-specific concentration occurs, none of the combined concentrations exceed the applicable AAL or TEL.

SITE 4A

COMBINED GROUND-LEVEL CONCENTRATIONS FOR ALL STACKS*

Compound	Averaging Time	Highest Combined Concentration in Five-Year Period (ug/m ³)	DEQE Guideline (24-Hour TEL) (Annual AAL) (ug/m ³)	Highest Combined Concentration as % of TEL or AAL
Acetone	24-Hour	1.38E+00	160.54	0.86%
	Annual	4.36E-02	160.54	0.03%
Benzene	24-Hour	1.95E-01	1.74	11.23%
	Annual	6.67E-03	0.12	5.55%
2-Butanone	24-Hour	7.04E-01	32.07	2.20%
	Annual	8.91E-03	32.07	0.03%
Chloroform	24-Hour	1.77E-01	132.76	0.13%
	Annual	9.35E-03	0.04	23.38%
1,2-Dichloro-	24-Hour	2.93E-01	11.01	2.66%
ethane	Annual	7.73E-03	0.04	19.32%
1,2-Dichloro-	24-Hour	4.45E-02	215.62	0.02%
ethene	Annual	1.83E-03	107.81	0.00%
Ethylbenzene	24-Hour	3.19E-01	118.04	0.27%
	Annual	8.16E-03	118.04	0.01%
4-Methyl,	24-Hour	3.02E-01	55.7	0.54%
2-Pentanone	Annual	7.44E-03	55.7	0.01%
Methylene	24-Hour	2.52E-01	9.45	2.66%
Chloride	Annual	6.75E-03	0.24	2.81%
1,1,2,2-Tetra-	24-Hour	7.48E-02	18.67	0.40%
chloroethane	Annual	2.65E-03	0.02	13.26%
Tetrachloro-	24-Hour	6.00E-01	922.18	0.07%
ethylene	Annual	1.94E-02	0.02	96.97%
Toluene	24-Hour	1.92E+00	10.24	18.74%
	Annual	4.90E-02	10.24	0.48%
1,1,1-Tri-	24-Hour	4.95E-01	1038.37	0.05%
chloroethane	Annual	1.31E-02	1038.37	0.00%
Trichloro-	24-Hour	3.80E-01	36.52	1.04%
ethylene	Annual	1.65E-02	0.61	2.70%
Total Xylenes	24-Hour	6.74E-01	11.8	5.71%
	Annual	6.13E-02	11.8	0.52%

*These concentrations are for ambient air use in aeration tanks, and for VOC emissions from Stack Nos. 4 and 6 being 95% controlled.

Source: CDM, 1989.

SITE 1A, TABER PARK COMBINED GROUND-LEVEL CONCENTRATIONS FOR ALL STACKS*

		Highest Combined	DEQE Guideline	
		Concentration in	(24-Hour TEL)	Highest Combined
	Averaging	Five-Year Period	(Annual AAL)	Concentration as
Compound	Time	(ug/m³)	(ug/m³)	% of TEL or AAL
Acetone	24-Hour	3.80E+00	160.54	2.37%
	Annual	1.04E-01	160.54	0.06%
Benzene	24-Hour	2.12E-01	1.74	12.21%
	Annual	8.55E-03	0.12	7.12%
2-Butanone	24-Hour	1.94E+00	32.07	6.06%
	Annual	2.11E-02	32.07	0.07%
Chloroform	24-Hour	2.34E-01	132.76	0.18%
	Annual	1.33E-02	0.04	33.18%
1,2-Dichloro-	24-Hour	2.70E-01	11.01	2.45%
ethane	Annual	9.45E-03	0.04	23.63%
1,2-Dichloro-	24-Hour	1.09E-01	215.62	0.05%
ethene	Annual	3.80E-03	107.81	0.00%
Ethylbenzene	24-Hour	4.14E-01	118.04	0.35%
	Annual	1.14E-02	118.04	0.01%
4-Methyl,	24-Hour	3.59E-01	55.7	0.64%
2-Pentanone	Annual	1.01E-02	55.7	0.02%
Methylene	24-Hour	2.77E-01	9.45	2.93%
Chloride	Annual	8.94E-03	0.24	3.73%
1,1,2,2-Tetra-	24-Hour	1.52E-01	18.67	0.82%
chloroethane	Annual	4.58E-03	0.02	22.89%
Tetrachloro-	24-Hour	5.82E-01	922.18	0.06%
ethylene	Annual	2.31E-02	0.02	115.28%
Toluene	24-Hour	2.05E+00	10.24	20.02%
	Annual	6.32E-02	10.24	0.62%
1,1,1-Tri-	24-Hour	5.64E-01	1038.37	0.05%
chloroethane	Annual	1.74E-02	1038.37	0.00%
Trichloro-	24-Hour	4.19E-01	36.52	1.15%
ethylene	Annual	2.14E-02	0.61	3.50%
Total Xylenes	24-Hour	1.63E+00	11.8	13.85%
	Annual	1.56E-01	11.8	1.33%

* These concentrations are for ambient air use in aeration tanks, and for VOC emissions from Stack Nos. 4 and 6 being 95% controlled.

Source: CDM, 1989.

SITE 1A, BEYOND TABER PARK COMBINED GROUND-LEVEL CONCENTRATIONS FOR ALL STACKS*

	Averaging	Highest Combined Concentration in Five-Year Period	DEQE Guideline (24-Hour TEL) (Annual AAL)	Highest Combined Concentration as
Compound	Time	(ug/m ³)	(ug/m³)	% of TEL and AAL
Acetone	24-Hour	2.15E+00	160.54	1.34%
	Annual	5.12E-02	160.54	0.03%
Benzene	24-Hour	1.54E-01	1.74	8.86%
2-Butanone	24-Hour	1.10E+00	32.07	3.43%
	Annual	1.04E-02	32.07	0.03%
Chloroform	24-Hour	1.62E-01	132.76	0.12%
	Annual	7.75E-03	0.04	19.38%
1,2-Dichloro-	24-Hour	2.13E-01	11.01	1.94%
ethane	Annual	5.92E-03	0.04	14.81%
1,2-Dichloro-	24-Hour	6.21E-02	215.62	0.03%
ethene	Annual	1.94E-03	107.81	0.00%
Ethylbenzene	24-Hour	2.86E-01	118.04	0.24%
	Annual	6.76E-03	118.04	0.01%
4-Methyl,	24-Hour	2.75E-01	55.7	0.49%
2-Pentanone	Annual	6.81E-03	55.7	0.01%
Methylene	24-Hour	2.04E-01	9.45	2.15%
Chloride	Annual	5.41E-03	0.24	2.26%
1,1,2,2-Tetra-	24-Hour	9.74E-02	18.67	0.52%
chloroethane	Annual	2.54E-03	0.02	12.72%
Tetrachloro-	24-Hour	4.27E-01	922.18	0.05%
ethylene	Annual	1.44E-02	0.02	71.79%
Toluene	24-Hour	1.49E+00	10.24	14.51%
	Annual	3.81E-02	10.24	0.37%
1,1,1-Tri-	24-Hour	397E-01	1038.37	0.04%
chloroethane	Annual	1.03E-02	1038.37	0.00%
Trichloro-	24-Hour	3.00E-01	36.52	0.82%
ethylene	Annual	1.28E-02	0.61	2.10%
Total Xylenes	24-Hour	9.56E-01	11.8	8.10%
	Annual	7.51E-02	11.8	0.64%

* These concentrations are for ambient air use in aeration tanks, and for VOC emissions from Stack Nos. 4 and 6 being 95% controlled.

Source: CDM, 1989.

Modeled VOC Impacts at Site 1A

Modeled ground-level concentrations for 15 VOCs emitted from the Site 1A wastewater treatment facility are presented in Tables G-12 and G-13. The impacts for 24-hour and annual periods are the sum of the "unpaired" maximum impacts for the set of five stacks operating onsite. The cumulative impacts as a percentage of the DEQE AAL or TEL are listed in the far right-hand column.

Impacts summarized in Table G-12 represent the highest concentrations modeled for receptors in Taber Park (shown as triangles in Figure 2). The highest impacts were modeled on historic gun emplacement bunkers which have elevations closer to the height of the VOC stacks than the remainder of the park.

The listed exceedance (115 percent) of the Tetrachloroethylene AAL in Table G-12 is an artifice of the not-paired-in-space conservative summation of annual stack impacts. A more refined breakdown of the paired-in-space annual impacts for tetrachloroethylene reveals that the actual cumulative maximum is 0.017 ug/m^3 , or 85 percent of the AAL, and occurs on the gun bunker at the southeast corner of Site 1A.

Impacts of VOCs north of Taber Park (listed in Table G-13) are lower than those modeled within the park. The cumulative unpaired maximum annual impacts from on-site stacks accounts for 83 percent of the tetrachloroethylene AAL. The paired-in-space annual impact was not evaluated, because no higher impact can occur, and the compliance with the AAL is assured.

3.0 ODOR IMPACTS ANALYSIS

3.1 INTRODUCTION

Odors are a natural by-product of wastewater transport and treatment. Anaerobic action in the wastewater may produce odors within the collection system, screens, wet well, primary and secondary clarifiers, aeration

tanks, and during sludge handling and conditioning. Although most inorganic compounds are odorless, many sulfur- and nitrogen-containing compounds impact olfactory receptors which sense common chemicals. The inorganic compound hydrogen sulfide is often the most significant odorant. It has an odor threshold much lower than most other compounds that are produced at a treatment plant and thereby can be a significant nuisance if not mitigated. The effective abatement of hydrogen sulfide gas migration from its production sources usually ensures that other sulfides are well controlled. A nitrogen-bearing odorant, ammonia, is liberated during sludge stabilization because of a rapid increase in pH. Additionally, many of the low molecular weight, toxic, and volatile organic compounds that were the focus of Section 2.0 have odor thresholds, though none is as pungent, objectionable, and easily perceived as hydrogen sulfide.

The main objectives of the air quality modeling for odorous compounds included:

- o Estimating odorous compound emission rates from the proposed wastewater treatment plant processes
- Modeling the off-site transport and dispersion of hydrogen sulfide, ammonia, and VOCs
- o Determining the extent of odor controls necessary to maintain potential ambient impacts of the principal odorants below their respective odor threshold concentrations

These analyses were conducted for the preferred Sites 4A and 1A in a manner similar to the VOC impacts analysis described in Section 2.0.

3.2 AMBIENT ODOR CRITERIA

The Commonwealth of Massachusetts DEQE requires the owner/operator of an odor generating source to control any nuisance causing emission under 310 CMR 7.09(1). However, DEQE has not established a definitive set of odor threshold concentrations for the chemical compounds emitted by the proposed WWTP. An alternate approach would have been to assemble an odor panel to determine their odor threshold for typical WWTP aggregate odors (this would be the odor concentration at which 50% of the panel detected the odor);

however, no existing WWTP has comparable influent characteristics and plant design. Using the odor environment at an existing WWTP as a model, therefore, would not likely be representative of the aggregate odor composition near the proposed New Bedford WWTP. Instead, an analysis similar to the one performed for toxic VOCs was performed: projected emissions of individual compounds were modeled, and resulting off-site concentrations were compared with the lowest odor thresholds available from a literature search. Any individual compound odor concentration found to exceed a lowest odor threshold concentration is defined to be a potential "nuisance" condition.

Odor threshold concentrations (the odor concentration at which 50% of an odor panel detected the odor) for most of the VOCs and inorganic compounds potentially emitted to the atmosphere from the WWTP were obtained from a literature search. The range of values for VOCs varied significantly, whereas the concentrations cited for hydrogen sulfide were in better agreement. The lowest concentration found in the literature was selected for use as the standard in this study. The odor threshold concentrations used in the odors analysis are listed in Table G-14.

The two most significant inorganic odorants for the WWTP, ammonia and hydrogen sulfide, were evaluated. It was assumed that the effective control of hydrogen sulfide odors would be a good indication of adequate control for other reduced sulfur compounds in the wastewater.

3.3 SOURCE AND EMISSION PARAMETERS

VOC Emission Rates

Emission rates of VOCs from each WWTP treatment process were established in Section 2.0 and summarized in Tables G-4 and G-5. Figures 1 and 2 are plan view diagrams of the location of WWTP processes at each site. These emission rates were used to demonstrate compliance with the March 29, 1989 AALs and TELs issued by the DEQE. A 95 percent VOC removal efficiency is assumed for gases passing through the activated carbon filters for Stacks No. 4 and 6 at Site 1A, and Stack No. 6 at Site 4A.

ODOR THRESHOLD CONCENTRATIONS FOR COMPOUNDS EMITTED FROM THE NEW BEDFORD WASTEWATER TREATMENT PLANT

Compound	Concentration(ug/m ³)	Reference No.
Acetone	20,700	5
Ammonia	26	3
Benzene	14,900	2
2-Butanone	350	1
Chloroform	1,000,000	4
1,2-dichloroethene	341	4
Ethylbenzene	615,000	4
Hydrogen sulfide	0.65	2
Methylene chloride	743,400	2
4-methyl 2-pentanone	410	1
1,1,2,2-tetrachloroethane	3,480	4
Tetrachloroethene	34,400	4
Toluene	640	1
Total xylenes	220	4

References:

- 1 National Academy of Sciences
- 2 Air and Waste Management Association
- 3 Journal of the Water Pollution Control Association
- 4 Final EIR for the Deer Island WWTP (CDM, 1988)
- 5 Odor Panel on Solvent Samples sponsored by PPG Industries Inc., Allison Park, Pennsylvania (February 7, 1985)

Inorganic Odors Emission Rates

Small quantities of hydrogen sulfide will be emitted at Sites 1A and 4A from each of the stacks listed in Table G-1 which are also sources of VOCs. Sources of hydrogen sulfide at the WWTP that will be controlled with odor control equipment in the stack include: the headworks (Building No. 1), Screen Building (No. 3), aerated grit tanks (No. 4), primary clarifiers (No. 6), aeration tanks (No. 7), and the Sludge Processing Building A maximum short-term hydrogen sulfide concentration was (No. 19). estimated for the flow of air arriving at the scrubber inlet for each stack. These concentrations were based on data for similar treatment processes and air flows at other operational WWTPs. Packed tower caustic scrubbers will treat the exhaust air from each of the previously indicated processes by creating a high solubility environment for the hydrogen sulfide, and either reducing the inlet hydrogen sulfide by 99.9 percent, or limiting the maximum outlet concentration to 0.1 ppmv (whichever control limit results in the lower outlet concentration). Degree of control, along with inlet and outlet hydrogen sulfide concentrations from each treated stack, are shown in Table G-15. These outlet concentrations were combined with the expected flow rates for each process stack to produce the odorant emission rates (in units of grams per second) used in the dispersion modeling analysis for both Sites 1A and 4A. For the secondary clarifiers (Stack No. 8), the only source of hydrogen sulfide in the water would be from anaerobic digestion in sludge accumulating at the bottom of the clarifier. Virtually 100% odor control can be achieved by frequent removal of the sludge; this was assumed for this analysis.

Ammonia concentrations are expected to be negligible from all on-site wastewater treatment processes except in the sludge handling building (No. 19) where the proprietary pathogen reducing process (CHEMFIX) will add portland cement and liquid silicates to the raw sludge cake, resulting in a rapid rise in pH to about 12, and the simultaneous off-gasing of ammonia. The ammonia levels within the structure will always be maintained below the ACGIH's 25 ppmv occupational exposure limit. For simplicity, the conservative assumption was made that the worst-case in-structure ammonia concentration will be 25 ppm, though under normal operating conditions with

ESTIMATED EMISSION RATES OF HYDROGEN SULFIDE AND AMMONIA FROM THE PROPOSED NEW BEDFORD WASTEWATER TREATMENT PLANT

Hydrogen Sulfide

Stack No.	<u>Site No.</u>	Inlet H2S Conc.(ppmv)	Control Effic'y.	Outlet H2S Conc.(ppmv)	Flow Ra Site la	te(cfm) Site 4a	Emission Rate(g/s)
1	1a,4a	50	99.9%	0.05	48,500	48,500	1.59E-03
3	1a,4a	50	99.9%	0.05	25 ,5 00	25,500	8.35E-04
4	1a	200	0.1 ppm	0.1	990		6.53E-05
6	4a	100	0 .1 ppm	0.1	8,140		5.34E-04
6	1a	100	0.1 ppm	0.1	7,150		4.70E-04
7	1a,4a	25 、	99.9%	0.025	26,000	26,000	4.34E-04
19	1a,4a	10	99.9%	0.01	45,400	45,400	2.98E-04

Ammonia

Stack No.	<u>Site No.</u>	Inlet NH3 Conc.(ppmv)	Control Effic'y.	Outlet NH3 Conc.(ppmv)	Flow Ra Site la	te (cfm) Site 4a	Emission Rate(g/s)
19	1a,4a	25	99%	0.25	45,400	45,400	3.72E-03

Note: Stack No. is same as the Building No. on which the stack is located. Source: CDM, Inc. a high ventilation rate the concentration will be much lower. A scrubber with a 99 percent control efficiency for ammonia will be installed for Stack No. 19 so that the scrubber outlet concentration will be less than or equal to 0.25 ppmv. This concentration was used with the stack flow rate to calculate the ammonia emission rate for Stack No. 19 listed in Table G-15.

3.4 ODOR IMPACT MODELING ANALYSIS

Dispersion modeling for ammonia, hydrogen sulfide, and odorous VOCs was performed for Site 1A and 4A sources. Impacts on ambient air from Site 1A sources were modeled on two receptor grids (i.e., within Taber Park, and beyond Taber Park, separately), whereas impacts from Site 4A sources were modeled on a single receptor grid beyond the WWTP property boundary.

Odor Perception and Model Applicability

Odor perception or olfactory stimulus can occur over very short time periods, often ranging from seconds to minutes. The highest one-hour ground-level concentrations of odorants estimated with the ISCST model can be interpreted as being representative of several-minute concentration averages, because the dispersion coefficients used in the model are based on concentration sampling periods of about several minutes. This suggests that the use of worst-case emission rates in the dispersion modeling runs adequately represents maximum impacts representative of odor perception over short-term durations.

Odorants often have molecular weights different from air. The molecular weights of most sulfur compounds are heavier than air (e.g., hydrogen sulfide has a 34 g/g-mole molecular weight compared to 29 g/g-mole for air). Ammonia (MW=17 g/g-mole), by contrast, is lighter than air. There may be instances when the atmospheric boundary layer (i.e., the air layer closest to the ground) is relatively quiescent and concentrated heavierthan-air compounds released at ground level can collect or "pool" near the ground. However, these circumstances should not apply here, since the odorants are of low ppm concentration and are well mixed prior to being

exhausted from the stacks. Furthermore, the emphasis of the dispersion modeling has been on the more frequent "well mixed" boundary layer condition. The dispersing plume is diluted in the atmosphere to be a homogeneous mixture of ambient air and odorant molecules, none of which has a preferential orientation within the plume. This type of analysis is simulated with a Gaussian-type plume dispersion model such as ISCST.

Model Selection and Implementation

Ground-level impacts of hydrogen sulfide and ammonia were modeled with the ISCST model incorporating the "Letter Change 8" modifications mandated by the EPA in December 1988. The five years (1981 to 1985) of hourly Providence/Chatham meteorological data, model options, and receptor grids used for modeling VOC impacts for Sites 1A and 4A were used in the odors analysis, as well. These parameter values are listed in Tables G-2 and G-3. The previously discussed ammonia and hydrogen sulfide emission rates from Table G-15 were input in the model.

3.5 SUMMARY OF ODOR IMPACTS

Ammonia Impacts

Modeled ground-level impacts of ammonia produced by emissions from the Sludge Handling Building (No. 19) consumed less than 4 percent of the 26 ug/m3 odor threshold for the 5-year modeling period at Sites 1A and 4A. The maximum 1-hour maximum impact near Site 1A consumes 3.3 percent of the odor threshold concentration and occurs in Taber Park. Beyond Taber Park, less than 1.9 percent of the odor threshold concentration is consumed. The maximum hourly-average concentration outside Site 4A is only 2.3 percent of the threshold concentration.

These results demonstrate that dilute ammonia vapors will not create a nuisance in ambient air beyond the property boundaries of the proposed Site 1A or Site 4A WWTP. A summary of ammonia impacts due to Stack No. 19 is presented in Table G-16.

COMPARISION OF MAXIMUM 1-HOUR INORGANIC ODOR IMPACTS FROM THE NEW BEDFORD WWTP TO ODOR THRESHOLD CONCENTRATIONS

		Site 1A				Site 4A	
Pollutant	Stack Number	In Taber Park (ug/m ³) (% of OTC)		Beyond Taber Park (ug/m ³) (% of OTC)		Beyond Property (ug/m ⁻) (% of OTC	
Hydrogen Sulfide	1	0.62	95%	0.22	34%	0.43	63%
	3	0.36	55%	0.21	32%	0.13	20%
	4	0.15	23%	0.65	7.5%	· NA	NA
	· 6	0.29	45%	0.20	31%	0.14	22%
	7	0.081	12%	0.066	10%	0.11	17%
	19	0.069	11%	0.039	6%	0.047	7%
Ammonia	19	0.86	3.3%	0.49	1.9%	0.59	2.3%

NOTES

OTC = Odor Threshold Concentration Ammonia Odor Threshold Concentration = $26 \ \mu g/m^3$ Hydrogen Sulfide Odor Threshold Concentration = $0.65 \ \mu g/m^3$

Source: CDM Inc., 1989

Hydrogen Sulfide Impacts

The highest 1-hour hydrogen sulfide impacts due to emissions from individual point sources at Sites 1A and 4A are all less than the 0.65 ug/m³ odor threshold. These impacts are also presented in Table G-16. The highest values for each stack were not totalled as they were for the VOCs analyses. This is because VOC emissions from each emission point in the treatment process were calculated to account for VOCs already volatilized from the wastewater at upstream treatment points. Adding them together was a reasonable representation of the total VOC emissions of the WWTP. The water chemistry involved with the release of hydrogen sulfide is much more complicated. Thus, a reasonable worst-case estimate of hydrogen sulfide emissions was made at each emission point independently. Therefore, summing them could have represented multiple over-counting of the potential hydrogen sulfide releases generated at any one time from the plant as a whole.

Table G-16 shows that Stacks No. 1, 3, and 6 consume high percentages of the odor threshold at both Sites 1A and 4A. The highest (worst in five years) one-hour concentration of hydrogen sulfide in Taber Park (at Site 1A), due to Stack No. 1 alone, was found to be at 95% of the odor threshold. The statistical nature of odor threshold information makes definitive conclusions impossible. Therefore, although the results indicate that worst-case concentrations of hydrogen sulfide will be below odor threshold concentrations, some fraction of the people using the park (probably less than 50%) could potentially detect this odor. Hydrogen sulfide impacts at locations outside the park are a third of the impacts predicted in the park. Therefore, residents living near Site 1A are unlikely to detect hydrogen sulfide odors from wastewater treatment plant or distinguish those odors from odors naturally generated in a coastal environment.

VOC Impacts

The sum of the modeled highest one-hour ground level VOC concentrations from stacks at Sites 1A or 4A consumes less than one percent of the most

conservative odor threshold concentration available from the literature for all compounds, excluding 2-butanone, toluene, and total xylenes. These results are summarized in **Table G-17**. Individual stack impacts for each year are presented in Attachment B. The highest impacts for 2-butanone, toluene, and total xylenes never exceed 6 percent of their respective odor threshold concentrations on the receptor grids surrounding Site 1A or Site 4A.

In general, the VOCs have very high odor threshold concentrations, which minimize their odor production potential. The dispersion modeling supports the conclusion that there is no reason to expect detectable VOC odors beyond the property boundary at either proposed WWTP site.

5.4 ADDITIONAL ON-SITE ODOR MITIGATION MEASURES

The highest odorant production may occur for several weeks during the summer months when storm water flow into the WWTP decreases dramatically. The maximum inorganic odorant concentrations for these low flow conditions were shown not to exceed the odor threshold concentrations. However, pre-chlorination, or the addition of hydrogen peroxide upstream from the primary settling tanks, can further reduce the potential for odors during the highest odor production periods. Rigorous odor mitigation programs will need to be adopted during maximum odor production periods at the WWTP to preclude the potential for odor generation.

Maximum Cumulative 1-Hour Concentrations Site 1A Site 4A Odor Threshold In Taber Park Beyond Taber Park Concentration Beyond Property (ug/m) (% of OTC) (ug/m[']) (% of OTC) (% of OTC) Compound (ug/m~) (ug/m) 20,700 28.1 0.1% 11.6 0.1% 7.74 <0.1% Acetone 14,900 <0.1% 0.815 <0.1% 0.899 <0.1% 1.47 Benzene 1.7% 3.90 1.1% 2-Butanone 350 14.3 4.1% 5.91 Chloroform 1,000,000 1.65 <0.1% 0.858 <0.1% 0.859 <0.1% 1,2-dichloroethene 341 0.833 0.2% 0.349 0.1% 0.259 0.1% <0.1% Ethylbenzene 615,000 3.00 1.53 <0.1% 1.55 <0.1% <0.1% Methylene chloride 743,400 1.87 1.06 <0.1% 1.16 <0.1% 2.32 0.6% 0.3% 0.3% 4-methyl 2-pentanone 410 1.40 1.40 1,1,2,2-tetrachloro-0.409 3,480 <0.1% <0.1% <0.1% ethane 1.09 0.509 <0.1% 2.73 <0.1% Tetrachloroethylene 34,400 <0.1% 4.11 2.31 1.2% 8.79 14.3 2.2% 7.89 1.4% Toluene 640 220 2.4% 4.04 0.1% Total xylenes 12.4 5.6% 5.29

COMPARISION OF MAXIMUM 1-HOUR ORGANIC ODOR IMPACTS FROM THE NEW BEDFORD WWTP TO ODOR THRESHOLD CONCENTRATIONS

NOTES

Maximum cumulative impact is conservatively assumed to be the unpaired-in-space-and-time sum of the maximum 1-hour ground-level impacts for each of the VOC emitting stacks.

OTC = Odor Threshold Concentration

Source: CDM Inc., 1989

4.0 REFERENCE

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ATTACHMENT A

RECEPTOR GRIDS

Table A-1 lists the coordinates of all of the receptor points, and the elevation (in meters) at each one, for the VOC ground-level concentration modeling at Site 4A. Table A-2 contains comparable information for Site 1A. Refer to Figures 1 and 2, and to Section 2.2, for descriptions of these grids.

ATTACHMENT A

RECEPTOR GRIDS

TABLE A-1: SITE 4A DISCRETE RECEPTOR POINTS (in meters)								
- x -	- Y -	ELE.	- x -	- Y -	ELE.	- x -	- Y -	ELE
-100.0	-1200.0	9.14402	0.0	-1200.0	12.19202	100.0	-1200.0	12.1920
200.0	-1200.0	9.14402	300.0	-1200.0	3.04801	-100.0	-1100.0	9.1440
0.0	-1100.0	12.19202	100.0	-1100.0	12.19202	200.0	-1100.0	6.0960
300.0	-1100.0	3.04801	-100.0	-1000.0	9.14402	0.0	-1000.0	12.1920
100.0	-1000.0	12.19202	200.0	-1000.0	6.09601	300.0	-1000.0	3.0480
-100.0	-900.0	6.09601	0.0	-900.0	9.14402	100.0	-900.0	9.1440
200.0	-900.0	6.09601	300.0	-900.0	3.04801	-100.0	-800.0	6.0960
0.0	800.0	9.14402	100.0	-800.0	9.14402	200.0	-800.0	6.0960
300.0	-800.0	3.04801	-100.0	-700.0	6.09601	0.0	-700.0	6.0960
. 100.0	-700.0	6.09601	200.0	-700.0	6.09601	300.0	-700.0	3.0480
-100.0	-600.0	6.09601	0.0	-600.0	6.09601	100.0	-600.0	6.0960
200.0	-600.0	3.04801	300.0	-600.0	1.82880	-100.0	-500.0	3.0480
0.0	-500.0	3.04801	100.0	-500.0	3.04801	200.0	-500.0	3.0480
-100.0	-400.0	3.04801	0.0	-400.0	1.82880	100.0	-400.0	1.8288
200.0	-400.0	1.82880	-100.0	-300.0	3.04801	0.0	-300.0	1.8288
100.0	-300.0	1.82880	200.0	-300.0	1.82880	300.0	-300.0	1.8288
-100.0	-200.0	3.04801	0.0	-200.0	1.82880	100.0	-200.0	1.8288
200.0	-200.0	1.82880	0.0	-161.0	1.82880	100.0	-162.0	1.8288
200.0	-55.0	1.82880	1365.0	254.0	6.09601	1524.0	890.0	6.0960
00.0	330.0	1.82880	200.0	330.0	1.82880	300.0	330.0	1.8288
400.0	325.0	1.82880	0.0	400.0	1.82880	100.0	400.0	1.8288
							-	
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- X -	- Y -	ELE.	- x -	- Y -	ELE.	- x -	- Y -	ELE
200.0	400.0	1.82880	300.0	400.0	1.82880	400.0	400.0	1.8288
0.0	500.0	1.82880	100.0	500.0	1.82880	200.0	500.0	1.8288
300.0	500.0	1.82880	400.0	500.0	1.82880	0.0	600.0	1.8288
100.0	600.0	1.82880	200.0	600.0	1.82880	300.0	600.0	1.8288
400.0	600.0	1.82880	0.0	700.0	1.82880	100.0	700.0	1.8288
200.0	700.0	1.82880	300.0	700.0	1.82880	400.0	700.0	1.8288
0.0	800.0	1.82880	100.0	800.0	1.82880	200.0	800.0	1.8288
300.0	800.0	1.82880	400.0	800.0	1.82880	0.0	900.0	1.8288
100.0	900.0	3.04801	200.0	900.0	1.82880	0.0	1000.0	1.8288
100.0	1000.0	1.82880	200.0	1000.0	1.82880	0.0	1100.0	1.8288
100.0	1100.0	1.82880	200.0	1100.0	1.82880	0.0	1200.0	1.8288
100.0	1200.0	1.82880	0.0	1300.0	3.04801	100.0	1300.0	1.8288
0.0	1400.0	3.04801	100.0	1400.0	1.82880	-1050.0	-300.0	6.0960
-1050.0	-200.0	6.09601	-1050.0	-100.0	6.09601	-1050.0	0.0	3.0480
-1050.0	100.0	3.04801	-1050.0	200.0	3.04801	-1050.0	300.0	9.1440
-1050.0	400.0	9.14402	-1050.0	500.0	12.19202	-1050.0	600.0	12.1920
-1050.0	700.0	12.19202	-1050.0	800.0	18.28804	-1050.0	900.0	18.2880
-1050.0	1000.0	18.28804	-950.0	-300.0	3.04801	-950.0	-200.0	3.0480
-950.0	-100.0	3.04801	-950.0	0.0	3.04801	-950.0	100.0	3.0480
-950.0	200.0	3.04801	-950.0	300.0	6.09601	-950.0	400.0	6.0960
-950.0	500.0	9.14402	-950.0	600.0	9.14402	-950.0	700.0	9.1440

- x -	- X -	ELE.	- x -	- x -	ELE.	- x -	- Y -	ELE
-950.0	800.0	18.28804	-950.0	900.0	18.28804	-950.0	1000.0	18.2880
-850.0	-300.0	3.04801	-850.0	-200.0	3.04801	-850.0	-100.0	3.0480
-850.0	0.0	3.04801	-850.0	100.0	3.04801	-850.0	200.0	3.0480
-850.0	300.0	6.09601	-850.0	400.0	6.09601	-850.0	500.0	9.1440
-850.0	600.0	9.14402	-850.0	700.0	9.14402	-850.0	800.0	18.2880
-850.0	900.0	18.28804	-850.0	1000.0	18.28804	-750.0	-300.0	3.0480
-750.0	-200.0	3.04801	-750.0	-100.0	3.04801	-750.0	0.0	3.0480
-750.0	100.0	3.04801	-750.0	200.0	3.04801	-750.0	300.0	3.0480
-750.0	400.0	3.04801	-750.0	500.0	6.09601	-750.0	600.0	6.0960
-750.0	700.0	6.09601	-750.0	800.0	18.28804	-750.0	900.0	18.2880
-750.0	1000.0	18.28804	-650.0	-300.0	3.04801	-650.0	-200.0	3.0480
-650.0	-100.0	3.04801	-650.0	0.0	3.04801	-650.0	100.0	3.0480
-650.0	200.0	3.04801	-650.0	300.0	3.04801	-650.0	400.0	3.0480
-650.0	500.0	6.09601	-650.0	600.0	6.09601	-650.0	700.0	6.0960
-650.0	800.0	16.76403	-650.0	900.0	16.76403	-650.0	1000.0	16.7640
-550.0	-300.0	3.04801	-550.0	-200.0	3.04801	-550.0	-100.0	3.0480
-550.0	0.0	3.04801	-550.0	100.0	3.04801	-550.0	200.0	3.0480
-550.0	300.0	3.04801	-550.0	400.0	3.04801	-550.0	500.0	3.0480
-550.0	600.0	3.04801	-550.0	700.0	3.04801	-550.0	800.0	13.7160
-550.0	900.0	13.71603	-550.0	1000.0	13.71603	-450.0	-300.0	3.0480
-450.0	-200.0	3.04801	-450.0	-100.0	3.04801	-450.0	0.0	3.0480
-450.0	100.0	3.04801	-450.0	200.0	3.04801	-450.0	300.0	3.0480
50.0	400.0	3.04801	-450.0	500.0	3.04801	-450.0	600.0	3.0480
-450.0	700.0	3.04801	-450.0	800.0	12.19202	-450.0	900.0	12.1920

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- X -	- Y -	ELE.	- x -	– Y –	ELE.	- X -	- Y -	ELE
-450.0	1000.0	12.19202	-350.0	-300.0	3.04801	-350.0	-200.0	3.0480
-350.0	-100.0	3.04801	-350.0	0.0	3.04801	-350.0	100.0	3.0480
-350.0	200.0	3.04801	-350.0	300.0	3.04801	350.0	400.0	3.0480
-350.0	500.0	3.04801	-350.0	600.0	3.04801	-350.0	700.0	3.0480
-350.0	800.0	9.14402	-350.0	900.0	9.14402	-350.0	1000.0	9.1440
-250.0	-600.0	3.04801	-250.0	-500.0	3.04801	-250.0	-400.0	3.0480
-250.0	-300.0	3.04801	-250.0	-200.0	3.04801	-250.0	-100.0	3.0480
-250.0	0.0	3.04801	-250.0	100.0	3.04801	-250.0	200.0	3.0480
-250.0	300.0	3.04801	-250.0	400.0	3.04801	-250.0	500.0	3.0480
250.0	600.0	3.04801	-250.0	700.0	3.04801	-250.0	800.0	6.0960
-250.0	900.0	6.09601	-250.0	1000.0	6.09601	-150.0	-700.0	3.0480
-150.0	-600.0	3.04801	-150.0	-500.0	3.04801	-150.0	-400.0	3.0480
-150.0	-300.0	3.04801	-150.0	-200.0	3.04801	-150.0	-100.0	3.0480
-150.0	0.0	3.04801	-150.0	100.0	3.04801	-150.0	200.0	3.0480
-150.0	300.0	1.82880	-150.0	400.0	1.82880	-150.0	500.0	3.0480
-150.0	600.0	3.04801	-150.0	700.0	3.04801	-150.0	800.0	3.0480
-150.0	900.0	3.04801	-150.0	1000.0	3.04801	-50.0	-700.0	3.0480
-50.0	-600.0	6.09601	-50.0	-500.0	3.04801	-50.0	-400.0	3.0480
-50.0	-300.0	3.04801	-50.0	-200.0	3.04801	-50.0	-100.0	3.0480
-50.0	0.0	3.04801	-50.0	100.0	3.04801	-50.0	200.0	3.0480

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 - x -	- Y -	ELE.	- x -	- Y	ELE.	- x -	- Y -	ELE
-50.0	300.0	1.82880	-50.0	400.0	1.82880	-50.0	500.0	3.0480
-50.0	600.0	3.04801	-50.0	700.0	3.04801	-50.0	800.0	3.0480
-50.0	900.0	3.04801	-50.0	1000.0	3.04801	-81.0	-100.0	3,0480
-50.0	-100.0	3.04801	-64.0	0.0	3.04801	-8.0	100.0	3.0480
25.0	200.0	3.04801	39.0	300.0	1.8288			

		and the second						
- x -	- ¥ -	ELE.	- x -	- Y -	ELE.	- x -	- Y -	ELE
50.0	-400.0	2.74321	150.0	-400.0	2.74321	250.0	-400.0	2.4384
100.0	-300.0	1.21920	150.0	-300.0	1.21920	200.0	-250.0	1.2192
250.0	-250.0	6.09601	250.0	-200.0	1.21920	250.0	-100.0	1.2192
250.0	0.0	1.21920	250.0	50.0	1.21920	300.0	100.0	0.6096
50.0	-250.0	1.21920	0.0	-200.0	1.21920	0.0	-150.0	3.0480
-50.0	-100.0	3.04801	-100.0	-50.0	3.04801	-150.0	0.0	1.2192
-100.0	50.0	1.21920	-150.0	100.0	1.21920	-150.0	150.0	2.1336
-150.0	200.0	2.74321	-200.0	200.0	2.74321	200.0	150.0	3.0480
250.0	150.0	2.43840	50.0	200.0	5.48641	100.0	200.0	5.4864
200.0	200.0	4.57201	-150.0	250.0	5.48641	-100.0	250.0	4.5720
-50.0	250.0	5.48641	0.0	250.0	4.87681	-200.0	275.0	19.2024
-150.0	300.0	15.54483	50.0	300.0	4.26721	50.0	300.0	4.5720
150.0	300.0	4.57201	250.0	300.0	4.57201	350.0	300.0	4.5720
-500.0	400.0	6.09601	-400.0	400.0	9.14402	-300.0	400.0	9.1440
-200.0	400.0	7,62002	-100.0	400.0	7.62002	0.0	400.0	6.0960
100.0	400.0	3.04801	200.0	400.0	1.52400	-500.0	500.0	6.0960
-400.0	500.0	9.14402	-300.0	500.0	9.14402	-200.0	500.0	9.1440
-100.0	500.0	7.62002	0.0	500.0	6.09601	100.0	500.0	4.5720
200.0	500.0	1.52400	-600.0	600.0	1.52400	-500.0	600.0	6.0960
-400.0	600.0	9.14402	-300.0	600.0	9.14402	-200.0	600.0	9.1440
-100.0	600.0	9.14402	0.0	600.0	9.14402	100.0	600.0	6.0960
200.0	600.0	3.04801	-600.0	709.0	1.52400	-500.0	700.0	6.0960
-400.0	700.0	9.14402	-300.0	700.0	9.14402	-200.0	700.0	9.1440

TABLE A-2: SITE 1A DISCRETE RECEPTOR POINTS (in meters)

the second s		the second s						
- x -	- Y -	ELE.	- x -	- Y -	ELE.	- x -	- Y -	ELE
-100.0	700.0	9.14402	0.0	700.0	9.14402	100.0	700.0	6.0960
200.0	700.0	3.04801	-600.0	800.0	3.04801	-500.0	800.0	6.0960
-400.0	800.0	9.14402	-300.0	800.0	9.14402	-200.0	800.0	9.1440
-100.0	800.0	9.14402	0.0	800.0	9.14402	100.0	800.0	6.0960
200.0	800.0	3.04801	-600.0	900.0	3.04801	-500.0	900.0	9.1440
-400.0	900.0	9.14402	-300.0	900.0	9.14402	-200.0	900.0	9.1440
-100.0	900.0	9.14402	0.0	900.0	9.14402	100.0	900.0	6.0960
200.0	900.0	3.04801	-600.0	1000.0	6.09601	-500.0	1000.0	9.1440
-400.0	1000.0	9.14402	-300.0	1000.0	9.14402	-200.0	1000.0	9.1440
100.0	1000.0	9.14402	0.0	1000.0	9.14402	100.0	1000.0	6.0960
200.0	1000.0	3.04801	-600.0	1100.0	9.14402	-500.0	1100.0	9.1440
-400.0	1100.0	9.14402	-300.0	1100.0	9.14402	-200.0	1100.0	9.1440
-100.0	1100.0	9.14402	0.0	1100.0	9.14402	100.0	1100.0	6.0960
200.0	1100.0	3.04801	-600.0	1200.0	9.14402	-500.0	1200.0	9.1440
-400.0	1200.0	9.14402	-300.0	1200.0	9.14402	-200.0	1200.0	9.1440
-100.0	1200.0	9.14402	0.0	1200.0	7.62002	100.0	1200.0	4.5720
-600.0	1300.0	9.14402	-500.0	1300.0	9.14402	-400.0	1300.0	9.1440
-300.0	1300.0	9.14402	-200.0	1300.0	9.14402	-100.0	1300.0	6.0960
0.0	1300.0	7.62002	100.0	1300.0	4.57201	-600.0	1400.0	6.0960
-500.0	1400.0	6.09601	-400.0	1400.0	6.09601	-300.0	1400.0	9.1440
-200.0	1400.0	9.14402	-100.0	1400.0	6.09601	0.0	1400.0	6.0960
100.0	1400.0	4,5720						

ATTACHMENT B

MODELING RESULTS FOR INDIVIDUAL STACKS

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CDM, AIR QUALITY SERVICES TEAM			INORGANIC C	DORANT IMP					
NEW BEDFORD, MA	WWTP		IMPACTS BEY	OND FENCEL		Input by:	rts		
TASK 10.4 ODOR AN	VALYSIS		(ISCST-8, PF	ROVID/CHATH	Date:	6/27/89			
	· ·				-			Checked by:	CSH
								Date:	7/21/89
		NORMALIZED	CONCENTRA	TIONS BY STA	CK IDENTIFICA	TION			
			Stack Identif	fications					
Year	Ave. Time	No. 1	No.3	No. 4	No. 6	No. 7	No. 8	No. 19	
1981	Hi 1-hr	203.27	158.42		241.47	229.29	275.76	151.82	
	Annual	1.482	2.009		3.664	3.333	5.478	0.957	
1982	Hi 1-hr	226.10	209.30		266.98	230.37	299.25	148.81	
	Annual	1.293	2.195		4.775	2.422	3.923	0.972	
1983	Hi 1-hr	244.24	204.21		225.11	248.28	320,44	155.36	
	Annual	1.933	2.775		7.041	3.858	5.309	1.811	
1984	Hi 1-hr	259.59	146.47		223.09	210.93	276.17	140.43	
	Annual	1.628	2.021		5.679	3.264	4.638	1.344	
				·					
1985	Hi 1-hr	187.89	151.49		217.40	206.10	244.38	159.03	
	Annual	1.289	1.877		3.950	2.403	4.610	1.251	

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CDM, AIR QUALITY SERVICES TEAM			INORGANIC C	DORANT IMP					
NEW BEDFORD, MA	WWTP		IMPACTS IN	PARK				Input by:	rts
TASK 10.4 ODOR AI	VALYSIS		(ISCST-8, PROVID/CHATHAM meteo.)					Date:	6/27/89
					-			Checked by:	CSH
								Date:	7/21/89
		NORMALIZED	CONCENTRA	TIONS BY STA	CK IDENTIFIC	CATION			
			Stack Identi	fications					
Year	Ave. Time	No. 1	No.3	No. 4	No. 6	No. 7	No. 8	No. 19	
1981	Hi 1-hr	284.31	359.10	1180.46	611.38	151.06	253.20	170.33	
	Annual	3.421	4.176	14.208	9.352	1.921	5.567	1.731	
			•						
1982	Hi 1-hr	328.94	325.92	2315.91	566.83	181.28	375.24	169.18	
	Annual	3.268	4.181	20.883	9.832	1.920	5.269	1.727	
. 1983	Hi 1-hr	389.08	344.44	1665.06	580.06	148.83	403.51	231.88	
	Annual	4.368	. 5.718	22.645	14.187	3.698	8.840	2.045	
1984	Hi 1-hr	238.65	434.67	1476.88	547.63	167.25	272.13	188.19	
	Annual	2.988	5.434	17.686	13.440	2.270	6.200	1.740	
1985	Hi 1-hr	318.89	408.20	1875.10	618.48	186.00	390.27	163.89	
	Annual	2.781	4.570	14.771	8.087	1.807	4.388	1.432	

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CDM, AIR QUALITY SERVICES TEAM			INORGANIC	ODORANT IM					
NEW BEDFORD, MA	WWTP		IMPACTS BEYOND PARK				,	Input by:	rts
TASK 10.4 ODORS A	VALYSIS		(ISCST-8, PF	ROVID/CHATH	Date:	6/27/89			
					-			Checked by:	CSH
								Date:	7/21/89
		NORMALIZED	CONCENTRA	TIONS BY STA	CK IDENTIFIC	CATION			
			Stack Identi	fications					
Year	Ave. Time	No. 1	No.3	No. 4	No. 6	No. 7	No. 8	No. 19	
1981	Hi 1-hr	127.04	221.41	598.16	357.88	132.60	363.77	120.48	
	Annual	1.474	2.834	7.330	5.535	1.884	3.785	1.168	
1982	Hi 1-hr	137.08	208.28	598.16	423.85	150.59	405.67	102.96	
	Annual	1.428	2.748	8.070	5.976	1.868	4.399	1.147	
1983	Hi 1-hr	141.14	150.47	751.84	415.33	150.87	437.57	123.52	
	Annual	1.920	3.665	8.757	8.320	2.548	5.818	1.588	
									-
1984	Hi 1-hr	122.57	236.40	598.16	357.44	130.51	362.46	131.27	
	Annual	1.935	2.960	7.926	8.231	2.447	5.702	1.594	
1985	Hi 1-hr	118.91	245.77	661.30	305.58	140.29	363.23	123.70	
	Annual	1.201	2.651	8.346	4.988	1.574	3.815	1.048	

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Camp Dresser & McKee Inc.