SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.

Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.

1. ☐ Show to whom delivered, date, and addressee's address. *(Extra charge)*
2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to:
Mr. Robert H. Herndon
Star Enterprise
P.O. Box 5140
Maitland, FL 32751

4. Article Number
P 256 396 244

Type of Service:
- ☐ Registered
- ☐ Insured
- ☒ Certified
- ☐ COD
- ☐ Express Mail
- ☐ Return Receipt for Merchandise

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature – Addressee
X

6. Signature – Agent
X

7. Date of Delivery
3-15-91

8. Addressee's Address *(ONLY if requested and fee paid)*

PS Form **3811**, Apr. 1989 ★U.S.G.P.O. 1989-238-815 **DOMESTIC RETURN RECEIPT**

P 256 396 244

RECEIPT FOR CERTIFIED MAIL

NO INSURANCE COVERAGE PROVIDED
NOT FOR INTERNATIONAL MAIL
(See Reverse)

Sent to Robert H. Herndon
Street and No. Star Enterprise
P.O., State and ZIP Code Maitland, FL

Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt showing to whom and Date Delivered	
Return Receipt showing to whom, Date, and Address of Delivery	
TOTAL Postage and Fees	$
Postmark or Date 3-13-91 AC 29-188372	

PS Form 3800, June 1985 ☆U.S.G.P.O. 1989-234-555

Florida Department of Environmental Regulation

Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400

Lawton Chiles, Governor

Carol M. Browner, Secretary

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
NOTICE OF PERMIT

Mr. Robert H. Herndon, Environmental Coordinator
Star Enterprise
P. O. Box 5140
Maitland, Florida 32751

March 12, 1991

Enclosed is construction permit AC 29-188372 for an air stripper tower system to treat contaminated water from fuel storage tanks at your petroleum products terminal located at 519 19th Street, Tampa, Hillsborough County, Florida. This permit is issued pursuant to Section 403, Florida Statutes.

Any party to this permit has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this permit is filed with the Clerk of the Department.

Executed in Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION

Barry D. Andrews

for C. H. Fancy, P.E.
Chief
Bureau of Air Regulation

Copy furnished to:

Bill Thomas, SW District
Jerry Campbell, EPCHC
John Reese, P.E.

Recycled Paper

CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this NOTICE OF PERMIT and all copies were mailed before the close of buisness on 3-13-91.

FILING AND ACKNOWLEDGEMENT FILED, on this date, pursuant to §120.52(9), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Kim Daber — Clerk

3-13-91 — Date

Final Determination

Star Enterprise
Hillsborough County
Tampa, Florida

Air Stripper Tower System for
Contaminated Water from Fuel Storage Tanks

Permit No. AC 29-188372

Department of Environmental Regulation
Division of Air Resources Management
Bureau of Air Regulation

February 28, 1991

Final Determination

The Technical Evaluation and Preliminary Determination for the permit to construct an air stripper tower system to treat contaminated water from fuel storage tanks at Star Enterprise's petroleum products terminal located at 519 19th Street, Tampa, Hillsborough County, Florida 33605, was distributed on January 11, 1991. The Notice of Intent to Issue was published in the Tampa Tribune on January 28, 1991. Copies of the evaluation were available for public inspection at the Environmental Protection Commission of Hillsborough County office in Tampa and the Department's offices in Tallahassee and Tampa.

No comments were submitted on the Department's Intent to Issue the permit. The final action of the Department will be to issue construction permit AC 29-188372 as proposed in the Technical Evaluation and Preliminary Determination.

Florida Department of Environmental Regulation

Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400

Lawton Chiles, Governor · Carol M. Browner, Secretary

PERMITTEE:
Star Enterprise
P. O. Box 5140
Maitland, Florida 32751

Permit Number: AC 29-188372
Expiration Date: July 1, 1991
County: Hillsborough
Latitude/Longitude: 27°54'00"N
82°26'24"W
Project: Air Stripper Tower System

This permit is issued under the provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Chapters 17-2 and 17-4. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawings, plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

For the construction of a 98.7% efficient air stripper system to treat 10 GPM of contaminated water from petroleum fuel storage tanks. The air stripper system consists of two Nepcco Model 120-20 towers that are 1 foot in diameter by 20 feet high columns and contains 15 feet of packing and a demister, 200 CFM air blowers, 10 GPM water pumps, along with oil-water separator, carbon adsorption canisters (for water treatment), 25,000 gallon holding tank, and other associated pump/piping, etc. The air stripping system will be located at the permittee's existing petroleum storage and transfer terminal at 519 19th Street, Tampa, Hillsborough County, Florida 33605.

The UTM coordinates of this site are Zone 17, 358.3 km E and 3086.8 km N.

The source shall be constructed in accordance with the permit application, plans, documents, amendments and drawings, except as otherwise noted in the General and Specific Conditions.

Attachments are listed below:

1. Application received October 12, 1990
2. DER letter dated November 7, 1990
3. Star Enterprise letter dated November 13, 1990

Recycled Paper

PERMITTEE:
Star Enterprise

Permit Number: AC 29-188372
Expiration Date: July 1, 1991

GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "Permit Conditions" and are binding and enforceable pursuant to Sections 403.161, 403.727, or 403.859 through 403.861, Florida Statutes. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

4. This permit conveys no title to land or water, does not constitute State recognition or acknowledgement of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

GENERAL CONDITIONS:

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at a reasonable time, access to the premises, where the permitted activity is located or conducted to:

a. Have access to and copy any records that must be kept under the conditions of the permit;

b. Inspect the facility, equipment, practices, or operations regulated or required under this permit; and

c. Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

a. a description of and cause of non-compliance; and

b. the period of noncompliance, including dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

GENERAL CONDITIONS:

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.73 and 403.111, Florida Statutes. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 17-4.120 and 17-30.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. The permittee shall comply with the following:

a. Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and

GENERAL CONDITIONS:

records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

c. Records of monitoring information shall include:

- the date, exact place, and time of sampling or measurements;
- the person responsible for performing the sampling or measurements;
- the dates analyses were performed;
- the person responsible for performing the analyses;
- the analytical techniques or methods used; and
- the results of such analyses.

14. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

SPECIFIC CONDITIONS:

1. The contaminated water flow to the air stripper system shall not exceed 10 GPM. The permittee shall check and record the flow rate to the columns at least once during each day that the system is in operation.

2. The concentration of pollutants in the contaminated tank water shall not exceed the following:

Pollutant	Maximum Water Concentration PPM
Benzene	11.2
Toluene	2840
Ethylbenzene	1640
Xylene	1640

Each batch of storage tank water shall be analyzed prior to treatment by methods approved by the Department and these lab results shall be available for Department inspection for a minimum of 3 years.

SPECIFIC CONDITIONS:

3. Based on the procedures described in the Department's October 20, 1987, memorandum titled Final Air Stripper Review Procedure or other methods with prior approval of the Department, the emissions from the air stripper system shall not exceed 100 lbs/yr VOC (total) and the following:

Pollutant	Max. Allowable Emissions (lbs/hr - 24 hr avg)
Benzene	0.056
Toluene	14.2
Ethylbenzene	8.2
Xylene	8.2

4. The air stripper system shall not operate more than 300 hrs/yr without prior approval from the Department.

5. The air stripper system shall not discharge air pollutants in quantities that cause or contribute to objectionable odors.

6. The permittee, for good cause, may request that this construction permit be extended. Such a request shall be submitted to the Bureau of Air Regulation prior to 60 days before the expiration of the permit (F.A.C. Rule 17-4.090).

7. An application for an operation permit must be submitted to the Environmental Protection Commission of Hillsborough County office at least 90 days prior to the expiration date of this construction permit or within 45 days after completion of compliance testing, whichever occurs first. To properly apply for an operation permit, the applicant shall submit the appropriate application form, fee, certification that construction was completed noting any deviations from the conditions in the construction permit, and compliance test reports as required by this permit (F.A.C. Rule 17-4.220).

Issued this 8 day
of March, 1991

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION

Carol M. Browner
Secretary

State of Florida
DEPARTMENT OF ENVIRONMENTAL REGULATION

For Routing To Other Than The Addressee	
To:	Location:
To:	Location:
To:	Location:
From:	Date:

Interoffice Memorandum

TO: Carol M. Browner

for FROM: Steve Smallwood

PAT502 yolata
3/8/91 RAR

DATE: February 28, 1991

SUBJ: Approval of Construction Permit AC 29-188372
Star Enterprise

Attached for your approval and signature is a permit prepared by the Bureau of Air Regulation for the above mentioned company to construct an air stripper tower system to treat contaminated water from fuel storage tanks at their petroleum products terminal in Tampa, Hillsborough County, Florida.

No comments were received during the public notice period.

Day 90, after which this permit will be issued by default, is March 29, 1991.

I recommend your approval and signature.

CF/WH/plm

Attachments

Check Sheet

Company Name: Star Enterprise
Permit Number: AC29-188377
PSD Number:
Permit Engineer:

Application:

- [x] Initial Application
  - [x] Incompleteness Letters
  - [x] Responses
  - [ ] Waiver of Department Action
  - [ ] Department Response
  - [ ] Other

Cross References:
- [x] AC06-188031
- [x] IC29-185327
- [ ]

Intent:

- [x] Intent to Issue
- [x] Notice of Intent to Issue
- [x] Technical Evaluation
- [ ] BACT or LAER Determination
- [x] Unsigned Permit

  Correspondence with:
  - [ ] EPA
  - [ ] Park Services
  - [ ] Other
- [x] Proof of Publication
  - [ ] Petitions - (Related to extensions, hearings, etc.)
  - [ ] Waiver of Department Action
  - [ ] Other

Final **Determination:**

- [x] Final Determination
- [x] Signed Permit
- [ ] BACT or LAER Determination
  - [ ] Other

Post Permit Correspondence:

- [x] Extensions/Amendments/Modifications
- [ ] Other

State of Florida
Department of Environmental Regulation

District Routing Slip

To: Harry Kuns Date: 9-2-92

C.C. To:

	Pensacola	**Northwest District**
	Panama City	Northwest District Branch Office
	Tallahassee	Northwest District Branch Office
	Apalachicola	Northwest District Satellite Office
✓	**Tampa**	**Southwest District**
	Punta Gorda	Southwest District Branch Office
	Bartow	Southwest District Satellite Office
	Orlando	**Central District**
	Melbourne	Central District Satellite Office
	Jacksonville	**Northeast District**
	Gainesville	Northeast District Branch Office
	Fort Myers	**South District**
	Marathon	South District Branch Office
	West Palm Beach	**Southeast District**
	Port St. Lucie	Southeast District Branch Office

Reply Optional ☐ Reply Required ☐ Info Only ☐
Date Due _____ Date Due _____

Comments:

I transferred PATS record to you. Please send us a copy of extension D.E.R. letter - thanks

SEP 4 1992

SOUTHWEST DISTRICT
TAMPA

From: Patty Adams Tel.: 279-1344

10-31-90

Florida Department of Environmental Regulation

Southwest District • 4520 Oak Fair Boulevard • Tampa, Florida 33610-7347

Lawton Chiles, Governor 813-620-6100 Carol M. Browner, Secretary

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
NOTICE OF PERMIT AMENDMENT

CERTIFIED MAIL

Mr. Robert H. Herndon
Environmental Coordinator
Star Enterprises
P.O. Box 5140
Maitland, FL 32751

Dear Mr. Herndon:

Re: Hillsborough County - AP
AC29-188372

On July 29, 1992, the Department received your request to amend permit AC29-188372. As requested, the expiration date is changed as follows:

CHANGE FROM: July 31, 1992

CHANGE TO: June 30, 1993

A person whose substantial interests are affected by this permit amendment may petition for an administrative proceeding (hearing) in accordance with Section 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400 within 14 days of receipt of this permit amendment. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. Failure to file a petition within this time period shall constitute a waiver of any right such person may have to request an administrative determination (hearing) under Section 120.57, Florida Statutes.

The Petition shall contain the following information:

(a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;
(b) A statement of how and when each petitioner received notice of the Department's action or proposed action;
(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;
(d) A statement of the material facts disputed by Petitioner, if any;

(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;

(f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action; and

(g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

If a petition is filed, the administrative hearing process is designed to formulate agency action. Accordingly, the Department's final action may be different from the position taken by it in this permit amendment. Persons whose substantial interests will be affected by any decision of the Department with regard to the application have the right to petition to become a party to the proceeding. The petition must conform to the requirements specified above and be filed (received) within 14 days of receipt of this notice in the Office of General Counsel of the Department at the above address of the Department. Failure to petition within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, F.S., and to participate as a party to this proceeding. Any subsequent intervention will only be at the approval of the presiding officer upon motion filed pursuant to Rule 28-5.207, F.A.C.

This permit amendment is final and effective on the date filed with the Clerk of the Department unless a petition is filed in accordance with the above paragraphs or unless a request for extension of time in which to file a petition is filed within the time specified for filing a petition and conforms to Rule 17-103.070, F.A.C. Upon timely filing of a petition or a request for an extension of time this permit amendment will not be effective until further Order of the Department.

When the Order (permit amendment) is final, any party to the Order has the right to seek judicial review of the Order pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date the Final Order is filed with the Clerk of the Department.

This letter must be attached to and becomes a part of permit number AC29-188372. If you have any questions, please call Mr. Harry Kerns of my staff at (813) 620-6100, Extension 419.

Sincerely,

for Richard D. Garrity, Ph.D.
Director of District Management

RDG/BK/bm

cc: Environmental Protection Commission
of Hillsborough County

CERTIFICATE OF SERVICE

This is to certify that this NOTICE OF PERMIT AMENDMENT and all copies were mailed by certified mail before the close of business on SEP 04 1992 to the listed persons.

FILING AND ACKNOWLEDGEMENT
FILED, on this date, pursuant to Section 120.52(10), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Marilyn Quispe SEP 04 1992
Clerk Date

P 832 538 737

Certified Mail Receipt

No Insurance Coverage Provided
Do not use for International Mail
(See Reverse)

UNITED STATES POSTAL SERVICE

Sent to Mr. Robert H. Herndon, Star Enterprise	
Street & No. P. O. Box 945140	
P.O., State & ZIP Code Maitland, FL 32794-5140	
Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, & Address of Delivery	
TOTAL Postage & Fees	$
Postmark or Date Mailed: 10-21-91 Permit: AC 29-199372	

PS Form **3800**, June 1990

Florida Department of Environmental Regulation

Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400

Lawton Chiles, Governor

Carol M. Browner, Secretary

October 15, 1991

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Robert H. Herndon
Environmental Coordinator
Star Enterprise
P. O. Box 945140
Maitland, Florida 32794-5140

Dear Mr. Herndon:

Re: AC 29-188372, Air Stripper Tower System

The Department is in receipt of your September 30, 1991, letter requesting another extension to the referenced construction permit. The extension is needed to give Star Enterprise more time to obtain other permits for the system. This request is acceptable and the expiration date of permit No. AC 29-188372 is extended from October 1, 1991 to January 31, 1992.

A copy of this letter must be filed with the referenced construction permit and shall become a part of that permit.

Sincerely,

Carol M. Browner
Secretary

CB/kt

attachment: Star Enterprise September 30, 1991 letter

cc: P. Houmere, BAMA
B. Thomas, SW District
B. Kabra, EPCHC

Recycled Paper

BM: Pl. Mail this to
MR. CLARE FANCY
DER, TPA.

StarEnterprise

P O Box 945140 (32794-5140)
555 Winderley Pl (32751)
Maitland FL
407 875 7600

Certified Mail
Return Receipt Requested

RECEIVED
OCT 0 4 1991
Division of Air
Resources Management

September 30, 1991

TO: CLARE FANCY

Mr. Ben Kalra
Air Permit Engineer
Hillsborough Environmental Protection Commission
1900 9th Avenue
Tampa, Fla. 33605

Re: Permit AC29-188372 GPM Air Stripper

Reference is made to your September 19, 1991 letter regarding the above subject. We have encountered some delays in finalizing the operating permit of the above facility through the FDER and are requesting a 90 day extension in this permit to allow time for finalization of other related permits to the treatment system.

Sincerely yours,
Star Enterprise

Robert H. Herndon/aw

Robert H. Herndon
Environmental Coordinator

cc Tampa Terminal Permit File
Bill Buda-Tampa Terminal
Env. File
GTI-Larson-Tampa
R. Hanks
B. Thomas, SWD Lab.

ENV. PROT. COMM.
OCT 01 1991
RECD

ENVIRONMENTAL PROTECTION COMMISSION
OF
HILLSBOROUGH COUNTY

CONVERSATION RECORD

DATE 10.02.91 TIME 10.15 AM SUBJECT AC24 - 188372

MR/~~MS~~ ROBERT H. HERNDON TELEPHONE NO. (407) 875-7600

REPRESENTING SAR ENTERPRISES

TELEPHONED [ ] WAS CALLED [X] SCHEDULED/UNSCHEDULED MEETING [ ]

OTHER INDIVIDUALS INVOLVED IN CONVERSATION/MEETING

MEETING/CONVERSATION SUMMARY LEFT MESSAGE ON HIS VOICE MAIL. FOR EXTENSION OF THE ABOVE PERMIT HE NEED TO CONTACT DER TALLAHASSEE SINCE 'AC' PERMIT WAS ISSUED BY THEM.

CONTINUE ON BACK

SIGNATURE BEN KALRA

TITLE AIR PERMIT ENGINEER

State of Florida
DEPARTMENT OF ENVIRONMENTAL REGULATION

For Routing To Other Than The Addressee

To: _____ Location: _____

To: _____ Location: _____

To: _____ Location: _____

From: _____ Date: _____

Interoffice Memorandum

TO: Carol Browner

FROM: Steve Smallwood CHD

DATE: October 15, 1991

SUBJ: Amendment of Permit AC 29-188372 - Star Enterprise

Attached for your approval and signature is a letter that will extend the expiration date of a construction permit issued to Star Enterprise for an air stripper tower system at their Tampa petroleum terminal. The extension is needed to give the permittee more this to obtain other permits needed for the system.

I recommend your approval and signature.

SS/WH/t

attachment

BM: Pl. Mail this to
MR. CLARE FANCY
DER, TAL.

StarEnterprise

P O Box 945140 (32794-5140)
555 Winderley Pl (32751)
Maitland FL
407 875 7600

Certified Mail
Return Receipt Requested

RECEIVED
OCT 0 4 1991
Division of Air
Resources Management

September 30, 1991

TO: CLARE FANCY

Mr. Ben Kalra
Air Permit Engineer
Hillsborough Environmental Protection Commission
1900 9th Avenue
Tampa, Fla. 33605

Re: Permit AC29-188372 GPM Air Stripper

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Sincerely yours,
Star Enterprise

Robert H. Herndon/aw

Robert H. Herndon
Environmental Coordinator

cc Tampa Terminal Permit File
Bill Buda-Tampa Terminal
Env. File
GTI-Larson-Tampa
R. Hanks
B. Thomas, SWD ist.

RECD
OCT 01 1991
ENV. PROT. COMM.
OF H.C.

ENVIRONMENTAL PROTECTION COMMISSION
OF
HILLSBOROUGH COUNTY

CONVERSATION RECORD

DATE 10.02.91 TIME 10:15 AM SUBJECT AC24 - 188372

MR/~~MS~~ ROBERT H. HERNDON TELEPHONE NO. (407) 875-7600

REPRESENTING SAR ENTERPRISES

TELEPHONED [ ] WAS CALLED [X] SCHEDULED/UNSCHEDULED MEETING [ ]

OTHER INDIVIDUALS INVOLVED IN CONVERSATION/MEETING

MEETING/CONVERSATION SUMMARY LEFT MESSAGE ON HIS VOICE MAIL. FOR EXTENSION OF THE ABOVE PERMIT HE NEED TO CONTACT DER TALLAHASSEE SINCE 'AC' PERMIT WAS ISSUED BY THEM.

CONTINUE ON BACK

SIGNATURE BEN KALRA

TITLE AIR PERMIT ENGINEER

SENDER:
- Complete items 1 and/or 2 for additional services.
- Complete items 3, and 4a & b.
- Print your name and address on the reverse of this form so that we can return this card to you.
- Attach this form to the front of the mailpiece, or on the back if space does not permit.
- Write "Return Receipt Requested" on the mailpiece next to the article number.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Mr. Robert H. Herndon
Env. Coordinator
Star Enterprise
P.O. Box 5140
Maitland, Fl

4a. Article Number
P 832 539 835

4b. Service Type
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery
8-2-91

5. Signature (Addressee)

8. Addressee's Address (Only if requested and fee is paid)

6. Signature (Agent)

PS Form 3811, October 1990 ☆U.S. GPO: 1990—273-861 **DOMESTIC RETURN RECEIPT**

P 832 539 835

Certified Mail Receipt
No Insurance Coverage Provided
Do not use for International Mail
(See Reverse)

UNITED STATES POSTAL SERVICE

Sent to: Robert Herndon	
Street & No.: Star Enterprise	
P.O., State & ZIP Code: Maitland, Fl	
Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, & Address of Delivery	
TOTAL Postage & Fees	$
Postmark or Date	

PS Form 3800, June 1990

Florida Department of Environmental Regulation
Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400
Lawton Chiles, Governor
Carol M. Browner, Secretary

July 19, 1991

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Robert H. Herndon
Environmental Coordinator
Star Enterprise
P.O. Box 5140
Maitland, Florida

RE: AC 29-188372, Air Stripper Tower System

Dear Mr. Herndon:

The Department is in receipt of your June 24, 1991, letter requesting the referenced construction permit be extended. The extension is needed to give Star Enterprise more time to obtain the NPDES surface water discharge permit for the system. This request is acceptable and the expiration date of permit no. AC 29-188372 is extended from July 1, 1991 to October 1, 1991.

A copy of this letter must be filed with the referenced construction permit and shall become a part of that permit.

Sincerely,

Carol M. Browner
Secretary

CB/ms

Attachment: Star Enterprise June 24, 1991 letter

cc: Pam Houmere, BAR
Bill Thomas, SW District
Darrel Graziana, EPC HC

State of Florida
DEPARTMENT OF ENVIRONMENTAL REGULATION

For Routing To Other Than The Addressee	
To:	Location:
To:	Location:
To:	Location:
From:	Date:

Interoffice Memorandum

TO: Carol Browner

FROM: Steve Smallwood

DATE: July 18, 1991

SUBJ: Amendment of Construction Permit No. AC 29-188372
Star Enterprise

Attached for your approval and signature is a letter that will extend the expiration date of a permit to construct an air stripper tower system for contaminated water from fuel storage tanks at Star Enterprise's bulk terminal in Tampa, Hillsborough County, Florida. The extension is needed to give the applicant time to obtain a NPDES surface water discharge permit for the system.

This request is not controversial

I recommend your approval and signature.

SS/ms

Attachment

StarEnterprise

P O Box 945140 (32794-5140)
555 Winderley Pl (32751)
Maitland FL
407 875 7600

RECEIVED
JUN 24 1991
Division of Air
Resources Management

Certified Mail
Return Receipt Requested

6-24-91

Mr. C. H. Fancy
Cheif Bureau of Regulation
Florida Dept. of Env. Regulations
2600 Blair Stone Road
Tallahassee, Florida 32399

Re: DER File No. AC 29-188372
DER File No. IC 29-185327
Star Enterprise Bulk Storage Facility
519 19th Street
Hillsborough County
Tampa, Florida 33605

Dear Mr. Fancy

Star Enterprise is requesting a 90 day extension to the above referenced permits. The extension time is required due to the NPDES surface water discharge permit has not yet been issued and is requiring an additional public notification period. The water treatment system has been installed and operational but cannot be operated until the NPDES permit is issued.

Should you have any questions or need any additional information please contact me at 407-875-7616.

Sincerely,

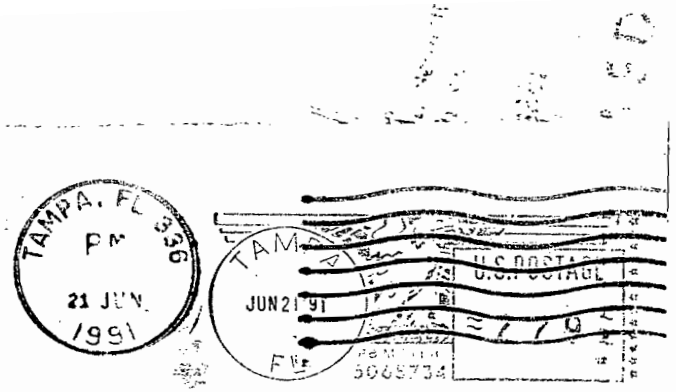
STAR ENTERPRISE

Robert H. Herndon
Environmental Coordinator

cc: Darrel Graziana, HCEPC
JSL, Northborough, AR
GTI, Tampa- Larson
ENV File
Read File
N. Franks
B. Thomas, SW Dist.

GROUNDWATER TECHNOLOGY

Groundwater Technology, Inc.
3110 Cherry Palm Drive, Suite 390, Tampa, FL 33619



MR. C. H. FANCY
CHIEF BUREAU OF REGULATION
FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATIONS
2600 BLAIR STONE ROAD
TALLAHASSEE, FL 32399

PM
2-8-91
Maitland, FL

File Copy

StarEnterprise

P O Box 945140 (32794-5140)
555 Winderley Pl (32751)
Maitland FL
407 875 7600

February 8, 1991

Department of Environmental Regulation
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Re: Public Notification
Port of Tampa Terminal
519 19th Street, Tampa

Please find enclosed permit of public notification. Permit number is AC 29-188372.

If you have any questions please contact me at (407) 875-7620.

Sincerely,

David M. Killingsworth/aw

David M. Killingsworth
Environmental Coordinator

DMK/ARW/aw

enclosure

cc:
Willard Hanks
Bill Thomas SW Dist. } 2-13-91 RAR
Jerry Campbell HCEPC

RECEIVED
FEB 11 1991
DER - BAQM

THE TAMPA TRIBUNE

Published Daily
Tampa, Hillsborough County, Florida

State of Florida
County of Hillsborough } ss.

Before the undersigned authority personally appeared R. Putney, who on oath says that he is Accounting Manager of The Tampa Tribune, a daily newspaper published at Tampa in Hillsborough County, Florida; that the attached copy of advertisement being a

LEGAL NOTICE

in the matter of

STAR ENTERPRISE

was published in said newspaper in the issues of

January 28, 1991

Affiant further says that the said The Tampa Tribune is a newspaper published at Tampa, in said Hillsborough County, Florida, and that the said newspaper has heretofore been continuously published in said Hillsborough County, Florida, each day and has been entered as second class mail matter at the post office in Tampa, in said Hillsborough County, Florida, for a period of one year next preceding the first publication of the attached copy of advertisement; and affiant further says that he has neither paid nor promised any person, firm, or corporation any discount, rebate, commission or refund for the purpose of securing this advertisement for publication in the said newspaper.

R Putney

Notary Public, State of Florida
My Commission Expires Sept. 3, 1994
Bonded Thru Troy Fain - Insurance Inc.

Sworn to and subscribed before me, this 29 *day of* January *A.D. 19* 91

Scott D. Williams

(SEAL)

SCOTT D. WILLIAMS NOTARY

State of Florida
Department of Environmental Regulation Notice of Intent to Issue

The Department of Environmental Regulation hereby gives notice of its intent to issue a permit (AC 29-188372) to Star Enterprise, P. O. Box 5140, Maitland, Florida 32751. The permit will authorize the construction of an air stripper tower system to treat contaminated water from fuel storage tanks at the terminal located at 519 19th Street, Tampa, Hillsborough County, Florida 33605. The system will emit less than 100 pounds per year of volatile organic compounds. Best Available Control Technology (BACT) and Lowest Achievable Emission Rate (LAER) determinations were not required. These emissions will not interfere with reasonable further progress toward attainment of the ambient air standard for ozone or endanger the health of the public. The Department is issuing this intent to issue for the reasons stated in the Technical Evaluation and Preliminary Determination.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) in accordance with Section 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400, within fourteen (14) days of publication of this notice. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. Failure to file a petition within this time period shall constitute a waiver of any right such person may have to request an administrative determination (hearing) under Section 120.57, Florida Statutes.

The Petition shall contain the following information:

(a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;

(b) A statement of how and when each petitioner received notice of the Department's action or proposed action;

(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;

(d) A statement of the material facts disputed by Petitioner, if any;

(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;

(f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action; and

(g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

If a petition is filed, the administrative hearing process is designed to formulate agency action. Accordingly, the Department's final action may be different from the position taken by it in this Notice. Persons whose substantial interests will be affected by any decision of the Department with regard to the application have the right to petition to become a party to the proceeding. The petition must conform to the requirements specified above and be filed (received) within 14 days of publication of this notice in the Office of General Counsel at the above address of the Department. Failure to petition within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, F.S., and to participate as a party to this proceeding. Any subsequent intervention will only be at the approval of the presiding officer upon motion filed pursuant to Rule 28-5.207, F.A.C.

The application is available for public inspection during business hours, 8:00 a.m. to 5:00 p.m., Monday through Friday, except legal holidays, at:
Department of Environment Regulation
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, Florida
32399-2400
Department of Environmental Regulation
Environmental Protection Commission of
Hillsborough County
1410 North 21st Street
Tampa, Florida 33605
Department of
Environmental Regulation
Southwest District
4520 Oak Fair Boulevard
Tampa, Florida 33610-7347

Any person may send written comments on the proposed action to Mr. Barry Andrews at the Department's Tallahassee address. All comments mailed within 14 days of the publication of this notice will be considered in the Department's final determination.

1272 1/28/91

SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.

Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.

1. ☐ Show to whom delivered, date, and addressee's address. *(Extra charge)*
2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to:

Mr. Robert H. Herndon
Environmental Coordinator
Star Enterprise
P. O. Box 5140
Maitland, FL 32751

JAN 18 1991

RECEIVED

4. Article Number
P 407 852 915

Type of Service:
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature — Addressee
X

6. Signature — Agent
X

7. Date of Delivery
1-15-91

8. Addressee's Address *(ONLY if requested and fee paid)*

MAITLAND, FL JAN 15 1991 USPS

PS Form **3811**, Apr. 1989 ★U.S.G.P.O. 1989-238-815 DOMESTIC RETURN RECEIPT

P 407 852 915

RECEIPT FOR CERTIFIED MAIL

NO INSURANCE COVERAGE PROVIDED
NOT FOR INTERNATIONAL MAIL

(See Reverse)

Sent to Mr. Robert Herndon, Star Enterprise	
Street and No. P. O. Box 5140	
P.O. State and ZIP Code Maitland, FL 32751	
Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt showing to whom and Date Delivered	
Return Receipt showing to whom, Date, and Address of Delivery	
TOTAL Postage and Fees	$
Postmark or Date Mailed: 1-11-91 Permit: AC 29-188372	

PS Form 3800, June 1985 ☆U.S.G.P.O. 1989-234-555

Florida Department of Environmental Regulation

Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400

~~Bob Martinez, Governor~~ ~~Dale Twachtmann, Secretary~~ ~~John Shearer, Assistant Secretary~~

Lawton Chiles, Governor Carol M. Browner, Sec.

January 10, 1991

CERTIFIED MAIL-RETURN RECEIPT REQUESTED

Mr. Robert H. Herndon, Environmental Coordinator
Star Enterprise
P. O. Box 5140
Maitland, Florida 32751

Dear Mr. Herndon:

Attached is one copy of the Technical Evaluation and Preliminary Determination and proposed permit to construct an air stripper tower system to treat contaminated water from fuel storage tanks at your existing terminal in Tampa, Hillsborough County, Florida.

Please submit any written comments you wish to have considered concerning the Department's proposed action to Mr. Barry Andrews of the Bureau of Air Regulation.

Sincerely,

C. H. Fancy, P.E.
Chief
Bureau of Air Regulation

CHF/WH/plm

Attachments

c: Bill Thomas, SW Dist.
Jerry Campbell, EPCHC
John Reese, P.E.

BEFORE THE STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

In the Matter of
Application for Permit by:

Star Enterprise
P. O. Box 5140
Maitland, Florida 32751

DER File No. AC 29-188372

INTENT TO ISSUE

The Department of Environmental Regulation hereby gives notice of its intent to issue an air construction permit (copy attached) for the proposed project as detailed in the application specified above. The Department is issuing this Intent to Issue for the reasons stated in the attached Technical Evaluation and Preliminary Determination.

The applicant, Star Enterprise, applied on October 12, 1990, to the Department of Environmental Regulation for a permit to construct an air stripper tower system to treat contaminated water from fuel storage tanks at the existing terminal in Tampa, Hillsborough County, Florida.

The Department has permitting jurisdiction under Chapter 403, Florida Statutes, and Florida Administrative Code Chapters 17-2 and 17-4. The project is not exempt from permitting procedures. The Department has determined that an air construction permit is required for the proposed work.

Pursuant to Section 403.815, F.S. and DER Rule 17-103.150, F.A.C., you (the applicant) are required to publish at your own expense the enclosed Notice of Intent to Issue Permit. The notice shall be published one time only within 30 days, in the legal ad section of a newspaper of general circulation in the area affected. For the purpose of this rule, "publication in a newspaper of general circulation in the area affected" means publication in a newspaper meeting the requirements of Sections 50.011 and 50.031, F.S., in the county where the activity is to take place. The applicant shall provide proof of publication to the Department, at the address specified within seven days of publication. Failure to publish the notice and provide proof of publication within the allotted time may result in the denial of the permit.

The Department will issue the permit with the attached conditions unless a petition for an administrative proceeding (hearing) is filed pursuant to the provisions of Section 120.57, F.S.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) in accordance with Section 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400. Petitions filed by the permit applicant and the parties listed below must be filed within 14 days of receipt of this intent. Petitions filed by other persons must be filed within 14 days of publication of the public notice or within 14 days of receipt of this intent, whichever first occurs. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. Failure to file a petition within this time period shall constitute a waiver of any right such person may have to request an administrative determination (hearing) under Section 120.57, Florida Statutes.

The Petition shall contain the following information:

(a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;
(b) A statement of how and when each petitioner received notice of the Department's action or proposed action;
(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;
(d) A statement of the material facts disputed by Petitioner, if any;
(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;
(f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action; and
(g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

If a petition is filed, the administrative hearing process is designed to formulate agency action. Accordingly, the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any decision of the Department with regard to the application(s) have the right to petition to become a party to the proceeding. The petition must conform to the requirements

specified above and be filed (received) within 14 days of publication of this notice in the Office in General Counsel at the above address of the Department. Failure to petition within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, F.S., and to participate as a party to this proceeding. Any subsequent intervention will only be at the approval of the presiding officer upon motion filed pursuant to Rule 28-5.207, F.A.C.

Executed in Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION

C. H. Fancy, P.E.
Chief
Bureau of Air Regulation

Copies furnished to:

Bill Thomas, SW Dist.
Jerry Campbell, EPCHC
John Reese, P.E.

CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this NOTICE OF INTENT to ISSUE and all copies were mailed before the close of business on 1-11-91.

FILING AND ACKNOWLEDGEMENT FILED, on this date, pursuant to §120.52(9), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Kyra Doberl
Clerk

1-11-91
Date

State of Florida
Department of Environmental Regulation
Notice of Intent to Issue

The Department of Environmental Regulation hereby gives notice of its intent to issue a permit (AC 29-188372) to Star Enterprise, P. O. Box 5140, Maitland, Florida 32751. The permit will authorize the construction of an air stripper tower system to treat contaminated water from fuel storage tanks at the terminal located at 519 19th Street, Tampa, Hillsborough County, Florida 33605. The system will emit less than 100 pounds per year of volatile organic compounds. Best Available Control Technology (BACT) and Lowest Achievable Emission Rate (LAER) determinations were not required. These emissions will not interfere with reasonable further progress toward attainment of the ambient air standard for ozone or endanger the health of the public. The Department is issuing this Intent to Issue for the reasons stated in the Technical Evaluation and Preliminary Determination.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) in accordance with Section 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400, within fourteen (14) days of publication of this notice. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. Failure to file a petition within this time period shall constitute a waiver of any right such person may have to request an administrative determination (hearing) under Section 120.57, Florida Statutes.

The Petition shall contain the following information:

(a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;
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(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;
(d) A statement of the material facts disputed by Petitioner, if any;
(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;
(f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action; and
(g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

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The application is available for public inspection during business hours, 8:00 a.m. to 5:00 p.m., Monday through Friday, except legal holidays, at:

Department of Environmental Regulation
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Department of Environmental Regulation
Environmental Protection Commission
of Hillsborough County
1410 North 21st Street
Tampa, Florida 33605

Department of Environmental Regulation
Southwest District
4520 Oak Fair Boulevard
Tampa, Florida 33610-7347

Any person may send written comments on the proposed action to Mr. Barry Andrews at the Department's Tallahassee address. All comments mailed within 14 days of the publication of this notice will be considered in the Department's final determination.

Technical Evaluation
and
Preliminary Determination

Star Enterprise
Hillsborough County
Tampa, Florida

Air Stripper Tower System for
Contaminated Water from Fuel Storage Tanks

File No. AC 29-188372

Department of Environmental Regulation
Division of Air Resources Management
Bureau of Air Regulation

January 10, 1991

I. General Information

A. Applicant

Star Enterprise
P. O. Box 5140
Maitland, Florida 32751

B. Request

On October 10, 1990, Star Enterprise submitted an application for a permit to construct an air stripper tower system to treat contaminated water from fuel storage tanks at their existing terminal (SIC 5171) located at 519 19th Street, Tampa, Hillsborough County, Florida 33605. The UTM coordinates of this terminal are Zone 17, 358.3 km E and 3086.8 km N. The application was considered complete on receipt of Star Enterprises November 13, 1990, letter (November 16, 1990).

C. Process

The air stripper will be used to treat accumulated bottom water from petroleum fuel storage tanks prior to discharging the water through a carbon adsorption system to the drainage system. The applicant expects benzene, toluene, ethylbenzene, xylene, and M-tert butyl ether to be present in the air emissions from the stripper. Based on the applicant's knowledge of the process, other air pollutants are not expected to be present in the air emissions.

Ten gallons per minute (GPM) of contaminated water will be passed through an oil/water separator and then to two Nepcco Model 120-20 air stripper towers in series. Each tower will be 1 foot in diameter, 20 feet high, contain 15 feet of packing followed by a demister, and use a 200 cubic feet per minute (CFM) air blower to obtain the design volumetric air/water ratio of 150. The contaminated air will be discharged through a 0.5 foot diameter stack at an elevation of 25 feet. The water from the stripping towers will pass through a granular activated carbon adsorption system to a 25,000 gallon holding tank. After analysis, the water will be either discharged to the surface drainage system or retreated by the air stripper tower system.

The system will be operated approximately 1 day per month.

D. Emissions

Based on a limited number of contaminated water samples, the applicant estimates the air pollutant emission from the system as follows:

Pollutant	Emissions (lbs/hr)
Benzene	0.0026
Toulene	0.0169
Ethylbenzene	0.0029
Xylene	0.213
MTBE	0.20

II. Rule Applicability

The proposed project, construction of an air stripper tower system, is subject to preconstruction review under the provisions of Chapter 403, Florida Statutes, and Chapter 17-2, Florida Administrative Code (F.A.C.).

The source will be located at a major facility, a petroleum storage and transfer unit (SIC 5171). These units are on Table 500-1, Major Facility Categories, of Chapter 17-2, F.A.C. Allowable emissions of volatile organic compounds (VOC) from this facility exceed 100 TPY.

The proposed source will be located in an area designated nonattainment for ozone and total suspended particulate (F.A.C. Rule 17-2.410), unclassifiable for PM_{10} and sulfur dioxide (F.A.C. Rule 17-2.430), and attainment for the other criteria pollutants (F.A.C. Rule 17-2.420).

The maximum VOC emissions from the proposed source are less than the significant emission rates listed in F.A.C. Rule 17-2, Table 500-2. Therefore, the proposed project is not subject to F.A.C. Rule 17-2.510, New Source Review for Nonattainment Areas. It is subject to F.A.C. Rule 17-2.620, General Pollutant Emission Limiting Standards. The Department will require the applicant to control the operation so that the emissions of air pollutants will not cause an exceedance of the ambient air concentrations established under the air toxic policy.

III. Technical Evaluation

The air stripper column system will process 10 GPM of contaminated water for up to 24 hrs/day and emit BTEX and MTBE pollutants.

The acceptable ambient air concentrations of the BTEX air pollutants from this source for 24 hrs/day operation, based on the Department's toxic policy, are summarized in the following table. Data is not available for MTBE.

Pollutant	Max. Conc. (mg/m^3) for 24 hrs/day operated
Benzene	0.0071
Toluene	1.786
Ethylbenzene	1.036
Xylene	1.036

Calculations, using the EPA approved Screen-1.1 Model and the stack parameters listed in the application, show that an emission rate of 1 gram/sec from the proposed system will have a maximum ambient air impact 1 mg/m3 (8 hr).

The Department has calculated maximum concentration of the pollutant that can be in the contaminated water and the maximum emissions from the proposed source that can occur without exceeding the acceptable ambient air concentration for the BTEX compounds. The results of these calculations are summarized in the following table:

Pollutant	Maximum Emissions grams/second	lbs/hr	Maximum Conc. in Water PPM
Benzene	0.0071	0.056	11.2
Toluene	1.786	14.2	2840
Ethylbenzene	1.036	8.2	1640
Xylene	1.036	8.2	1640

The applicant estimates that the emissions from the air stripper column system will be below the values shown above.

IV. Ambient Air Impact

Based on the modeled impact of the estimated emissions of the BTEX compounds, the operation of the air stripper tower system will not create a health hazard or cause/contribute to an ambient air quality violation.

V. Conclusion

Based on the information provided by Star Enterprise, the Department has reasonable assurance that the proposed construction/installation of an air stripper tower system, as described in this evaluation, and subject to the conditions proposed herein, will not cause or contribute to a violation of any air quality standard, PSD increment, or any other technical provision of Chapter 17-2 of the Florida Administrative Code.

Florida Department of Environmental Regulation

Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400

~~Bob Martinez, Governor~~ ~~Dale Twachtmann, Secretary~~ ~~John Shearer, Assistant Secretary~~

Lawton Chiles, Governor Carol M. Browner, Secretary

PERMITTEE:
Star Enterprise
P. O. Box 5140
Maitland, Florida 32751

Permit Number: AC 29-188372
Expiration Date: July 1, 1991
County: Hillsborough
Latitude/Longitude: 27°54'00"N
82°26'24"W
Project: Air Stripper Tower System

This permit is issued under the provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Chapters 17-2 and 17-4. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawings, plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

For the construction of a 98.7% efficient air stripper system to treat 10 GPM of contaminated water from petroleum fuel storage tanks. The air stripper system consists of two Nepcco Model 120-20 towers that are 1 foot in diameter by 20 feet high columns and contains 15 feet of packing and a demister, 200 CFM air blowers, 10 GPM water pumps, along with oil-water separator, carbon adsorption canisters (for water treatment), 25,000 gallon holding tank, and other associated pump/piping, etc. The air stripping system will be located at the permittee's existing petroleum storage and transfer terminal at 519 19th Street, Tampa, Hillsborough County, Florida 33605.

The UTM coordinates of this site are Zone 17, 358.3 km E and 3086.8 km N.

The source shall be constructed in accordance with the permit application, plans, documents, amendments and drawings, except as otherwise noted in the General and Specific Conditions.

Attachments are listed below:

1. Application received October 12, 1990
2. DER letter dated November 7, 1990
3. Star Enterprise letter dated November 13, 1990

Recycled Paper

GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "Permit Conditions" and are binding and enforceable pursuant to Sections 403.161, 403.727, or 403.859 through 403.861, Florida Statutes. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

4. This permit conveys no title to land or water, does not constitute State recognition or acknowledgement of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

GENERAL CONDITIONS:

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at a reasonable time, access to the premises, where the permitted activity is located or conducted to:

a. Have access to and copy any records that must be kept under the conditions of the permit;

b. Inspect the facility, equipment, practices, or operations regulated or required under this permit; and

c. Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

a. a description of and cause of non-compliance; and

b. the period of noncompliance, including dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

GENERAL CONDITIONS:

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.73 and 403.111, Florida Statutes. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 17-4.120 and 17-30.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. The permittee shall comply with the following:

a. Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and

GENERAL CONDITIONS:

records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

c. Records of monitoring information shall include:

- the date, exact place, and time of sampling or measurements;
- the person responsible for performing the sampling or measurements;
- the dates analyses were performed;
- the person responsible for performing the analyses;
- the analytical techniques or methods used; and
- the results of such analyses.

14. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

SPECIFIC CONDITIONS:

1. The contaminated water flow to the air stripper system shall not exceed 10 GPM. The permittee shall check and record the flow rate to the columns at least once during each day that the system is in operation.

2. The concentration of pollutants in the contaminated tank water shall not exceed the following:

Pollutant	Maximum Soil Concentration PPM
Benzene	11.2
Toluene	2840
Ethylbenzene	1640
Xylene	1640

Each batch of storage tank water shall be analyzed prior to treatment by methods approved by the Department and these lab results shall be available for Department inspection for a minimum of 3 years.

SPECIFIC CONDITIONS:

3. Based on the procedures described in the Department's October 20, 1987, memorandum titled Final Air Stripper Review Procedure or other methods with prior approval of the Department, the emissions from the air stripper system shall not exceed 100 lbs/yr VOC (total) and the following:

Pollutant	Max. Allowable Emissions (lbs/hr - 24 hr avg)
Benzene	0.056
Toluene	14.2
Ethylbenzene	8.2
Xylene	8.2

4. The air stripper system shall not operate more than 300 hrs/yr without prior approval from the Department.

5. The air stripper system shall not discharge air pollutants in quantities that cause or contribute to objectionable odors.

6. The permittee, for good cause, may request that this construction permit be extended. Such a request shall be submitted to the Bureau of Air Regulation prior to 60 days before the expiration of the permit (F.A.C. Rule 17-4.090).

7. An application for an operation permit must be submitted to the Environmental Protection Commission of Hillsborough County office at least 90 days prior to the expiration date of this construction permit or within 45 days after completion of compliance testing, whichever occurs first. To properly apply for an operation permit, the applicant shall submit the appropriate application form, fee, certification that construction was completed noting any deviations from the conditions in the construction permit, and compliance test reports as required by this permit (F.A.C. Rule 17-4.220).

Issued this _____ day
of _____, 1991

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION

_____
STEVE SMALLWOOD, P.E., Director
Division of Air Resources
Management

StarEnterprise

P O Box 945140 (32794-5140)
555 Winderley Pl (32751)
Maitland FL
407 875 7600

RECEIVED
NOV 16 1990
DER - BAQM

November 13, 1990

C. H. Fancy, P.E.
Chief
Bureau of Air Regulation
Florida Department of Environmental Regulation
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Re: File No. AC 29-188372, Tampa Air Stripper original issue
File No. AC 06-188031, Pt. Everglades Air Stripper

Dear Mr. Fancy:

This letter is in response to your letter (attached) reflecting a preliminary review of the above applications. This communication will be formatted in a "question/response" format in the order in which the questions were posed in your letter dated November 7, 1990.

1) "The applications list emissions for benzene, toluene, ethylbenzene, xylene, and MTBE based on the analysis of one sample. Will the system be used to treat water with higher concentrations of these pollutants? If so, what will be the maximum concentrations and emissions of these pollutants?"

The analyses presented in the applications were taken from the collection tanks used in the accumulation of the waste stream. The basis for the design of this waste-water treatment system is that these are representative analyses. Dissolved hydrocarbons are not expected to vary in concentration or composition a great deal. A 25% safety factor has been used throughout the design.

However, real-time data collected with the system in operation will provide the final answer to the question. If the emissions were to approach the A.A.C., the systems operation could be adjusted to reduce the air to water ratio therefore, reducing emissions.

2) "The applications also list phenol, 2-nitrophenol, 2,4-dischloraphenol, 2-chlorophenol, and 4-chloro-3-methylphenol as being present in the bottom water. Will the air stripper systems discharge these pollutants or other air pollutants that are not listed in the applications? What are the recommended occupational exposure levels (consult Material Safety Data Sheets), acceptable ambient air concentrations, and estimated maximum concentrations in the ambient air of these pollutants resulting from these operations?"

The phenolic compounds, detected in the water samples obtained in the collection tank, are a minor component of the dissolved contaminants reflected by analysis. The attached graph shows the extent to which phenol is effected by air stripping. This reflects that the solubility of phenol in water does not lend itself to volatilization. The phenolic compounds are not removed from the water by the air strippers, but by carbon absorption after the air strippers.

The knowledge of processes that lead to the accumulation of this waste stream have aided in the characterization of the emissions from the proposed air stripping towers. Air stripping design guidance documents, produced by the F.D.E.R, have been reviewed against the list of suspected and known compounds present in the subject stream. The maximum ambient concentrations have been presented for the compounds subject to emissions with this technology.

3) "Will the air pollutants emitted from the systems cause or contribute to objectionable odors?"

The locations of the subject air stripping towers are in the interior of large industrial parks with many bulk fuel storage facilities. The contributed odors of the air strippers will be insignificant.

Upon start up of these waste-water treatment systems, interested regulatory officials, including yourself, are invited to attend. There will be a portable G.C. on-site providing for quantification of V.O.A. compounds.

If additional information is required please contact me at (407)875-7620.

Sincerely,

Star Enterprise on behalf of
Texaco Refining and Marketing Inc.

David M. Killingsworth/aw

David M. Killingsworth
Environmental Coordinator

DMK

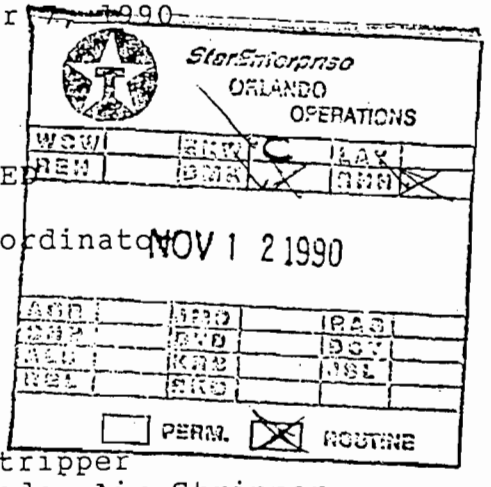
cc: REH, EKW, AGR, JMD, ROB, RHH, Star Enterprise
J. P. Bowen, IT Corporation, Deerfield Beach, FL
Env. File
Darrel Graziani, Air Permitting - HCEPC
Bill Thomas, F.D.E.R., S.W. District
Isadore Goldman, F.D.E.R., S.E. District
A. Linero, BCECQB

Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

Bob Martinez, Governor Dale Twachtmann, Secretary John Shearer, Assistant Secretary

November 7, 1990



CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Robert H. Herndon, Environmental Coordinator
Star Enterprise
P. O. Box 5140
Maitland, Florida 32751

Dear Mr. Herndon:

Re: File No. AC 29-188372, Tampa Air Stripper
File No. AC 06-188031, Port Everglades Air Stripper

The Department has made a preliminary review of your applications for permits to construct air stripper tower systems to treat contaminated water from fuel storage tanks at your existing terminals in Tampa and Port Everglades. Before these applications can be processed, we need the following information:

1. The applications list emissions for benzene, toluene, ethylbenzene, xylene, and MTBE based on the analysis of one sample. Will this system be used to treat water with higher concentrations of these pollutants? If so, what will be the maximum concentrations and emissions of these pollutants?

2. The applications also list phenol, 2-nitrophenol, 2,4-dischloraphenol, 2-chlorophenol, and 4-chloro-3-methylphenol as being present in the bottom water. Will the air stripper systems discharge these pollutants or other air pollutants that are not listed in the applications? What are the recommended occupational exposure levels (consult Material Safety Data Sheets), acceptable ambient air concentrations, and estimated maximum concentrations in the ambient air of these pollutants resulting from these operations?

3. Will the air pollutants emitted from the systems cause or contribute to objectionable odors?

Recycled Paper

The Department will resume processing these applications after we receive your reply to this letter. If you have any questions on this matter, please write to me or call Willard Hanks at 904-488-1344.

Sincerely,

C. H. Fancy, P.E.
Chief
Bureau of Air Regulation

CHF/WH/plm

c: Bill Thomas, SW Dist.
Jerry Campbell, HCEPC
Isidore Goldman, SE Dist.
Patrick Wong, DERM
John Reese, P.E.

TEXACO - PORT EVERGLADES

BATCH AIR STRIPPING OF COLLECTION TANK WATER BOTTOMS

PROJ # 585148

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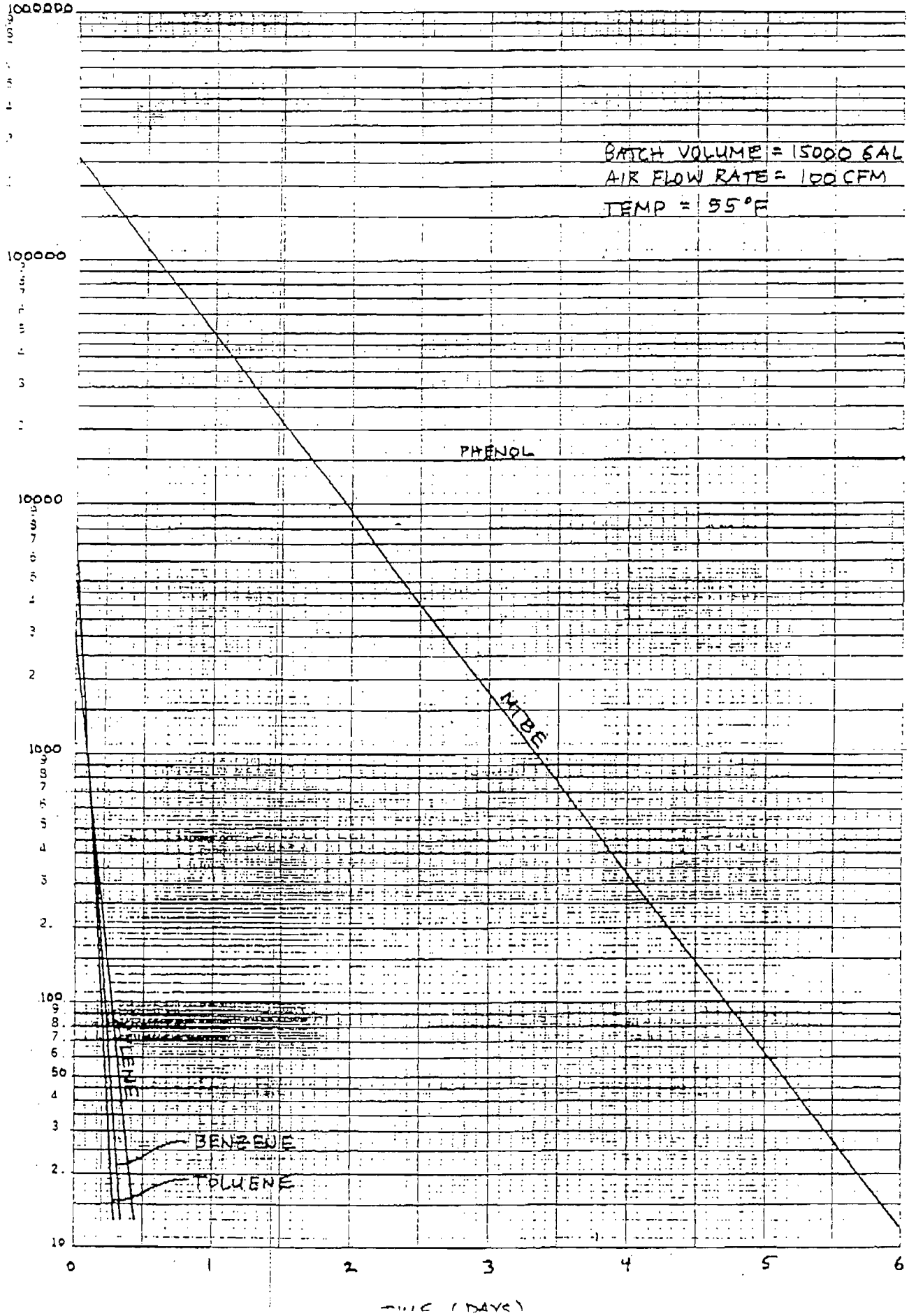
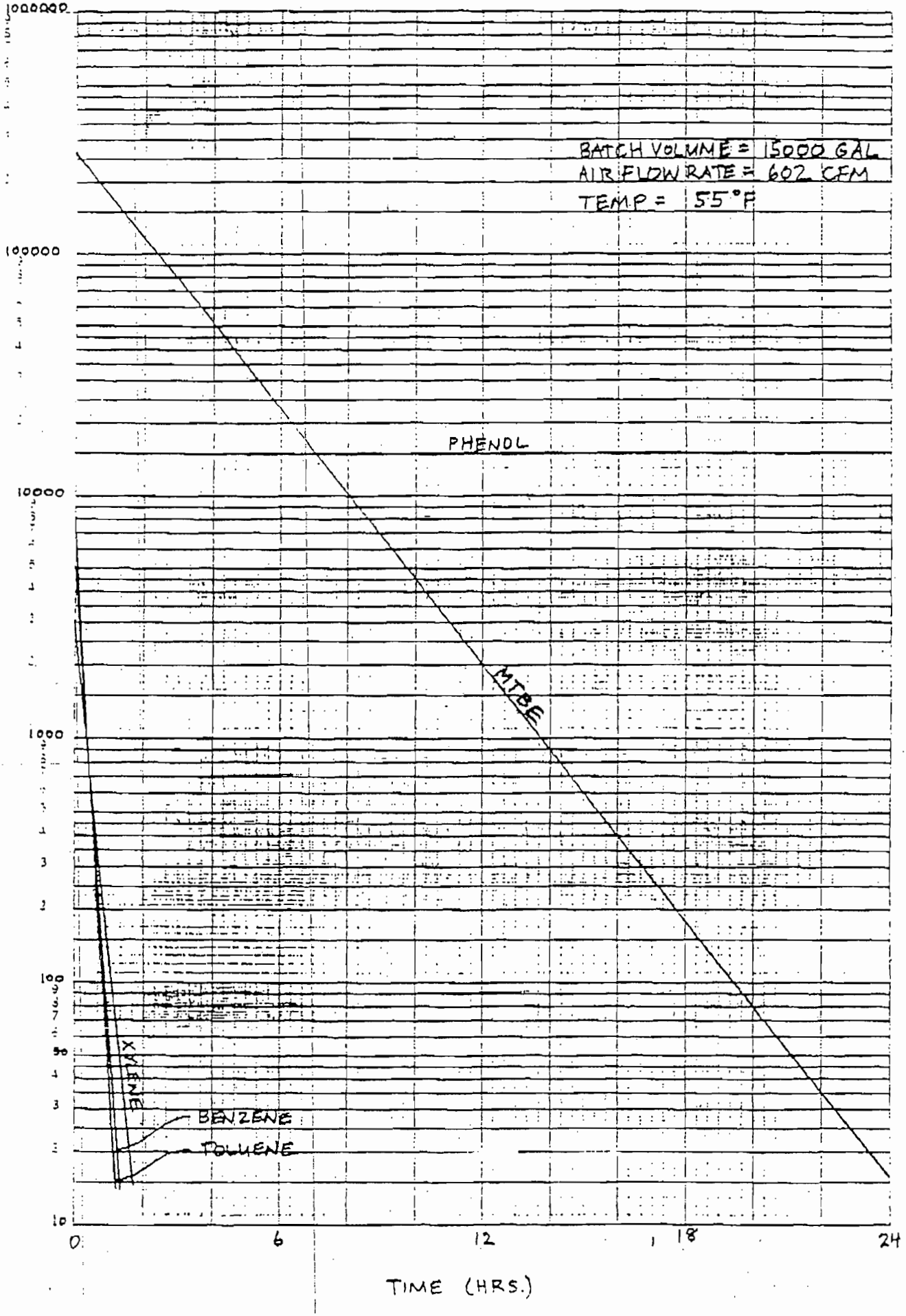


TEXACO - PORT EVERGLADES

BATCH AIR STRIPPING OF COLLECTION TANK WATER BOTTOMS

PROJ # 585148

BEST AVAILABLE COPY



Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

Bob Martinez, Governor | Dale Twachtmann, Secretary | John Shearer, Assistant Secretary

November 7, 1990

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Robert H. Herndon, Environmental Coordinator
Star Enterprise
P. O. Box 5140
Maitland, Florida 32751

Dear Mr. Herndon:

Re: File No. AC 29-188372, Tampa Air Stripper
File No. AC 06-188031, Port Everglades Air Stripper

see for original & cert. mail rcpts.

The Department has made a preliminary review of your applications for permits to construct air stripper tower systems to treat contaminated water from fuel storage tanks at your existing terminals in Tampa and Port Everglades. Before these applications can be processed, we need the following information:

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3. Will the air pollutants emitted from the systems cause or contribute to objectionable odors?

Recycled Paper

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Sincerely,

C. H. Fancy, P.E.
Chief
Bureau of Air Regulation

CHF/WH/plm

c: Bill Thomas, SW Dist.
Jerry Campbell, HCEPC
Isidore Goldman, SE Dist.
Patrick Wong, DERM
John Reese, P.E.

StarEnterprise

John G Curry
Regional Manager
Orlando Region

P O Box 945140 (32794-5140)
555 Winderley Pl (32751)
Maitland FL
407 875 7600

October 8, 1990

Mr. Darrel Graziani
Chief, Air Permitting
Environmental Protection Commission
Hillsborough County
1900 9th Avenue
Tampa, Florida 33605

Re: Air Permits
519 19th Street
Tampa, Terminal

Dear Mr. Graziani:

Attached are the application documents and check for air permits for the water treatment improvements at the above address.

This response is a follow up to our original inquiry letter of September 18, 1990 and your response of September 24, 1990.

Should there be any questions, please contact Mr. Rober H. Herndon at 407/875-7616.

Sincerely yours,

Star Enterprise

John G. Curry
Regional Manager

Attachment

cc REH EKW AGR ROB RHH
IT-Bowen-Deerfield Beach, Fla.
Env. File w/a
J. Harry Kerns-FDER-SW District

D.E.R.
OCT 12 1990
SOUTHWEST DISTRICT TAMPA

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Printed in U.S.A. Form G-139 9-82

PAY TO Florida Dept. of Environmental Regulation **AUTHORIZATION FOR IMMEDIATE PAYMENT**

ADDRESS 3319 Maguire Blvd Suite 232 DATE October 4, 1990
Orlando, Fl 32803-3767 SEND CHECK TO DM Killingsworth

DETAIL OF PAYMENT	AMOUNT	
Permit Review Fees - Construction Applications for Air Permits 519 19th St Tampa, Fl Tampa Terminal	$200	00

CHARGE: Star Enterprise

DEPT. Orlando Region

ACCOUNT _____

SIGNED Angie Watkins

APPROVED [signature]

APPROVED _____

IDENTIFICATION NO.	PRIMARY ACCOUNT	DATA ELEMENTS 1	2	3	4	MULTI-PURPOSE FIELD D/E	QTY/AMT	AMOUNT

A major facility
Send to BAQ
Jerry

RECEIVED
OCT 22 1990
DER - BAQM

RECEIVED
DEP - MAIL ROOM
1990 OCT 22 AM 09:54

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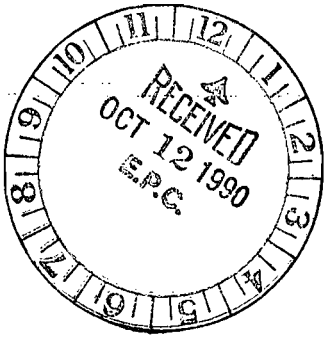
RECEIVED
OCT 12 1990
E.P.C.

October 1, 1990

INTERNATIONAL TECHNOLOGY CORPORATION

Application to
Operate/Construct
Air Pollution Sources
Star Enterprise-Port of Tampa
Bulk Storage Facility
519 19th Street
Tampa, Florida

ENVIRONMENTAL ENGINEERING
AND
SERVICES PROJECT 585-163

Prepared By _____
Randy L. Whitesell
Project Engineer

Reviewed By _____
James P. Bowen
Project Manager

IT Corporation 466 SW 12th Avenue, Deerfield Beach, Florida

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Florida Department of Environmental Regulation
Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

DER Permit #
Permit File
Effective Date
DER Application No. (Filled in by DER)

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Air Stripper [X] New[1] [ ] Existing[1]

APPLICATION TYPE: [X] Construction [ ] Operation [ ] Modification

COMPANY NAME: Star Enterprise **COUNTY:** Hillsborough

Identify the specific emission point source(s) addressed in this application (i.e. Li
Kiln No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) _____

SOURCE LOCATION: **Street** 519 19th Street **City** Tampa

UTM: **East** _____ **North** _____

Latitude 26 ° 76 ' 49 "N **Longitude** 82 ° 26 ' 24 "W

APPLICANT NAME AND TITLE: _____

APPLICANT ADDRESS: P.O. Box 5140, Maitland, FL 32751

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of STAR ENTERPRISE.

I certify that the statements made in this application for a CONSTRUCTION permit are true, correct and complete to the best of my knowledge and belief. Fur I agree to maintain and operate the pollution control source and pollution cc facilities in such a manner as to comply with the provision of Chapter 403, Fl Statutes, and all the rules and regulations of the department and revisions thereo also understand that a permit, if granted by the department, will be non-transfe and I will promptly notify the department upon sale or legal transfer of the perm establishment.

*Attach letter of authorization

Signed: Robert H Herndon

ROBERT H HERNDON ENV COOR
Name and Title (Please Type)

Date: 10-8-90 Telephone No. 407 875 7614

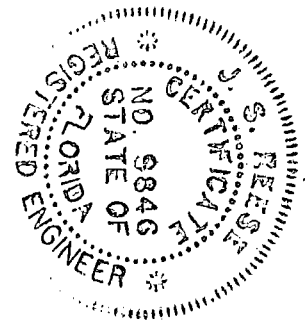
B. PROFESSIONAL ENGINEER REGISTERED IN FLORIDA (where required by Chapter 471, F.S.)

This is to certify that the engineering features of this pollution control project been designed/examined by me and found to be in conformity with modern engine principles applicable to the treatment and disposal of pollutants characterized ir permit application. There is reasonable assurance, in my professional judgment,

[1] See Florida Administrative Code Rule 17-2.100(57) and (104)

Northwest District 160 Governmental Center Pensacola, Florida 32501-5794
Northeast District 3426 Bills Rd. Jacksonville, Florida 32207
Central District 3319 Maguire Blvd. Suite 232 Orlando, Florida 32803-3767
Southwest District 4520 Oak Fair Blvd. Tampa, Florida 33610-7347
South District 2269 Bay St. Fort Myers, Florida 33901-2904
Southeast District 1900 S. Congress Ave., Suite A

the pollution control facilities, when properly maintained and operated, will discharg an effluent that complies with all applicable statutes of the State of Florida and the rules and regulations of the department. It is also agreed that the undersigned will furnish, if authorized by the owner, the applicant a set of instructions for the prope maintenance and operation of the pollution control facilities and, if applicable, pollution sources.



Signed John S Reese

JOHN S. REESE
Name (Please Type)

NEPCCO EQUIPMENT DIVISION
Company Name (Please Type)

2140-300 N.E. 36TH AVE OCALA, FL 32670
Mailing Address (Please Type)

Florida Registration No. 9846 Date: 10/5/90 Telephone No. 904 867-7482

SECTION II: GENERAL PROJECT INFORMATION

A. Describe the nature and extent of the project. Refer to pollution control equipment, and expected improvements in source performance as a result of installation. State whether the project will result in full compliance. Attach additional sheet if necessary.

Star Enterprise intends to treat the tank water of their operations at this facility. The water treatment has been designed to meet air pollution criteria set by the FDER. For additional details see attached report pages 1 - 3.

B. Schedule of project covered in this application (Conetruction Permit Application Only)

Start of Construction 10/10/90 Completion of Conetruction 11/10/90

C. Costs of pollution control system(s): (Note: Show breakdown of estimated costs only for individual components/units of the project serving pollution control purposes. Information on actual costs shall be furnished with the application for operation permit.)

The estimated costs for the subject system is $171,000. For breakdown, please refer to Appendix F of the attached report.

D. Indicate any previous DER permits, orders and notices associated with the emisaion point, including permit issuance and expiration dates.

This is a new source.

E. Requested permitted equipment operating time: hrs/day_____; days/wk_____; wks/yr___

if power plant, hrs/yr_____; if seasonal, describe:_____

25 hours/month - 12 months/year

F. If this is a new source or major modification, answer the following questions. (Yes or No)

1. Is this source in a non-attainment area for a particular pollutant? Yes

   a. If yes, has "offset" been applied? N/A

   b. If yes, has "Lowest Achievable Emission Rate" been applied? N/A

   c. If yes, list non-attainment pollutants. Ozone and V.O.C. regulated

2. Does best available control technology (BACT) apply to this source? If yes, see Section VI. No

3. Does the State "Prevention of Significant Deterioriation" (PSD) requirement apply to this source? If yes, see Sections VI and VII. No

4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? No

5. Do "National Emission Standards for Hazardous Air Pollutants" (NESHAP) apply to this source? No

H. Do "Reasonably Available Control Technology" (RACT) requirements apply to this source? No

   a. If yes, for what pollutants? N/A

   b. If yes, in addition to the information required in this form, any information requested in Rule 17-2.650 must be submitted.

Attach all supportive information related to any answer of "Yes". Attach any justification for any answer of "No" that might be considered questionable.

SECTION III: AIR POLLUTION SOURCES & CONTROL DEVICES (Other than Incinerators)

A. Raw Materials and Chemicals Used in your Process, if applicable:

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		
N/A				

B. Process Rate, if applicable: (See Section V, Item 1)

1. Total Process Input Rate (lbs/hr): N/A

2. Product Weight (lbs/hr): N/A

C. Airborne Contaminants Emitted: (Information in this table must be submitted for each emission point, use additional sheets as necessary)

For additional detail see attached report, Appendix C.

Name of Contsminant	Emission[1]		Allowed[2] Emission Rate per Rule 17-2	Allowable[3] Emission ~~lbs/hr~~ * mg/m^3	Potential[4] Emission		Relate to Flow Diagram
	Maximum lbs/hr	Actual lbs/yr			lbs/hr	lbs/yr	
Benzene	0.0026	0.78	N/A	0.208	0.0026	11.4	N/A
Toulene	0.0169	5.07	N/A	52.0	0.0169	74.0	N/A
Ethylbenzene	0.0029	0.87	N/A	30.2	0.0029	12.7	N/A
Xylene	0.0213	6.39	N/A	30.2	0.0213	93.3	N/A
MTBE	0.20	60.0	N/A	34.7	0.20	876.0	N/A

[1]See Section V, Item 2.

[2]Reference applicable emission standards and units (e.g. Rule 17-2.600(5)(b)2. Table II, E. (1) - 0.1 pounds per million BTU heat input)

[3]Calculated from operating rate and applicable standard.

[4]Emission, if source operated without control (See Section V, Item 3).

* The Allowable Emission (lb/hr) is the intermittent Allowable Ambient Concentration Levels (ACC in Appendix C).

D. Control Devices: (See Section V, Item 4)

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)
N/A				

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
N/A			

*Units: Natural Gas--MMCF/hr; Fuel Oils--gallons/hr; Coal, wood, refuse, other--lbs/hr.

Fuel Analysis: N/A

Percent Sulfur: N/A Percent Ash: N/A

Density: N/A lbs/gal Typical Percent Nitrogen: N/A

Heat Capacity: N/A BTU/lb N/A BTU/gal

Other Fuel Contaminants (which may cause air pollution): N/A

F. If applicable, indicate the percent of fuel used for space heating.

Annual Average N/A Maximum N/A

G. Indicate liquid or solid wastes generated and method of disposal.

N/A

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H. Emission Stack Geometry and Flow Characteristics (Provide data for each stack):

Stack Height: 25 ft. Stack Diameter: 0.5 ft.

Gas Flow Rate: 200 ACFM 190.5 DSCFM Gas Exit Temperature: 85°F °F.

Water Vapor Content: Saturated % Velocity: 17.0 FPS

SECTION IV: INCINERATOR INFORMATION

Type of Waste	Type 0 (Plastics)	Type I (Rubbish)	Type II (Refuse)	Type III (Garbage)	Type IV (Pathological)	Type V (Liq.& Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Incinerated	N/A						
Uncontrolled (lbs/hr)							

Description of Waste N/A

Total Weight Incinerated (lbs/hr) N/A Design Capacity (lbs/hr) N/A

Approximate Number of Hours of Operation per day N/A day/wk N/A wks/yr. N/A

Manufacturer N/A

Date Constructed N/A Model No. N/A

	Volume $(ft)^3$	Heat Release (BTU/hr)	Fuel		Temperature (°F)
			Type	BTU/hr	
Primary Chamber	N/A				
Secondary Chamber					

Stack Height: N/A ft. Stack Diamter: N/A Stack Temp. N/A

Gas Flow Rate: N/A ACFM N/A DSCFM* Velocity: N/A FPS

*If 50 or more tons per day design capacity, submit the emissions rate in grains per standard cubic foot dry gas corrected to 50% excess air. N/A

Type of pollution control device: [ ] Cyclone [ ] Wet Scrubber [ ] Afterburner

[ ] Other (specify)

Brief description of operating characteristics of control devices: N/A

Ultimate disposal of any effluent other than that emitted from the stack (scrubber water, ash, etc.):

N/A

NOTE: Items 2, 3, 4, 6, 7, 8, and 10 in Section V must be included where applicable.

SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]

2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made.

3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).

4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)

5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency).

6. An 8 1/2" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained.

7. An 8 1/2" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Example: Copy of relevant portion of USGS topographic map).

8. An 8 1/2" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.

9. The appropriate application fee in accordance with Rule 17-4.05. The check should be made payable to the Department of Environmental Regulation.

10. With an application for operation permit, attach a Certificate of Completion of Construction indicating that the source was constructed as shown in the construction permit.

SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY

A. Are standards of performance for new stationary sources pursuant to 40 C.F.R. Part 60 applicable to the source?

N/A

[ ] Yes [ ] No

Contaminant	Rate or Concentration
N/A	

B. Has EPA declared the best available control technology for this class of sources (If yes, attach copy)

[ ] Yes [ ] No N/A

Contaminant	Rate or Concentration
N/A	

C. What emission levels do you propose as best available control technology?

Contaminant	Rate or Concentration
N/A	

D. Describe the existing control and treatment technology (if any). N/A

1. Control Device/System:
2. Operating Principles:
3. Efficiency:*
4. Capital Costs:

*Explain method of determining

5. Useful Life:

6. Operating Costs:

7. Energy:

8. Maintenance Cost:

9. Emissions:

Contaminant	Rate or Concentration
N/A	

10. Stack Parameters N/A

a. Height: ft.

b. Diameter: ft.

c. Flow Rate: ACFM

d. Temperature: °F.

e. Velocity: FPS

E. Describe the control and treatment technology available (As many types as applicable, use additional pages if necessary).

1. N/A

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

2. N/A

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of conatruction materials and process chemicals:

[1]Explain method of determining efficiency.
[2]Energy to be reported in units of electrical power - KWH design rate.

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

3. N/A

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

4. N/A

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Costs:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

. Describe the control technology selected: N/A

1. Control Device:

2. Efficiency:[1]

3. Capital Cost:

4. Useful Life:

5. Operating Cost:

6. Energy:[2]

7. Maintenance Cost:

8. Manufacturer:

9. Other locations where employed on similar processes:

a. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

Explain method of determining efficiency.
Energy to be reported in units of electrical power - KWH design rate.

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration
N/A	

(8) Process Rate:[1]

b. (1) Company: N/A

(2) Mailing Address:

(3) City: (4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration
N/A	

(8) Process Rate:[1]

10. Reason for selection and description of systems: N/A

[1]Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION

A. Company Monitored Data N/A

1. _____no. sites _____ TSP _____( ) SO^{2}* _____ Wind spd/dir

Period of Monitoring ____/____/____ to ____/____/____
month day year month day year

Other data recorded _____

Attach all data or statistical summaries to this application.

*Specify bubbler (B) or continuous (C).

2. Instrumentation, Field and Laboratory N/A

a. Was instrumentation EPA referenced or its equivalent? [ ] Yes [ ] No

b. Was instrumentation calibrated in accordance with Department procedures?

[ ] Yes [ ] No [ ] Unknown

3. Meteorological Data Used for Air Quality Modeling N/A

1. _____ Year(s) of data from ____/____/____ to ____/____/____
month day year month day year

2. Surface data obtained from (location)_____

3. Upper air (mixing height) data obtained from (location)_____

4. Stability wind rose (STAR) data obtained from (location)_____

4. Computer Models Used N/A

1. _____ Modified? If yes, attach description.

2. _____ Modified? If yes, attach description.

3. _____ Modified? If yes, attach description.

4. _____ Modified? If yes, attach description.

Attach copies of all final model runs showing input data, receptor locations, and principle output tables.

5. Applicants Maximum Allowable Emission Data N/A

Pollutant	Emission Rate
TSP	_____ grams/sec
SO^2	_____ grams/sec

6. Emission Data Used in Modeling N/A

Attach list of emission sources. Emission data required is source name, description of point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

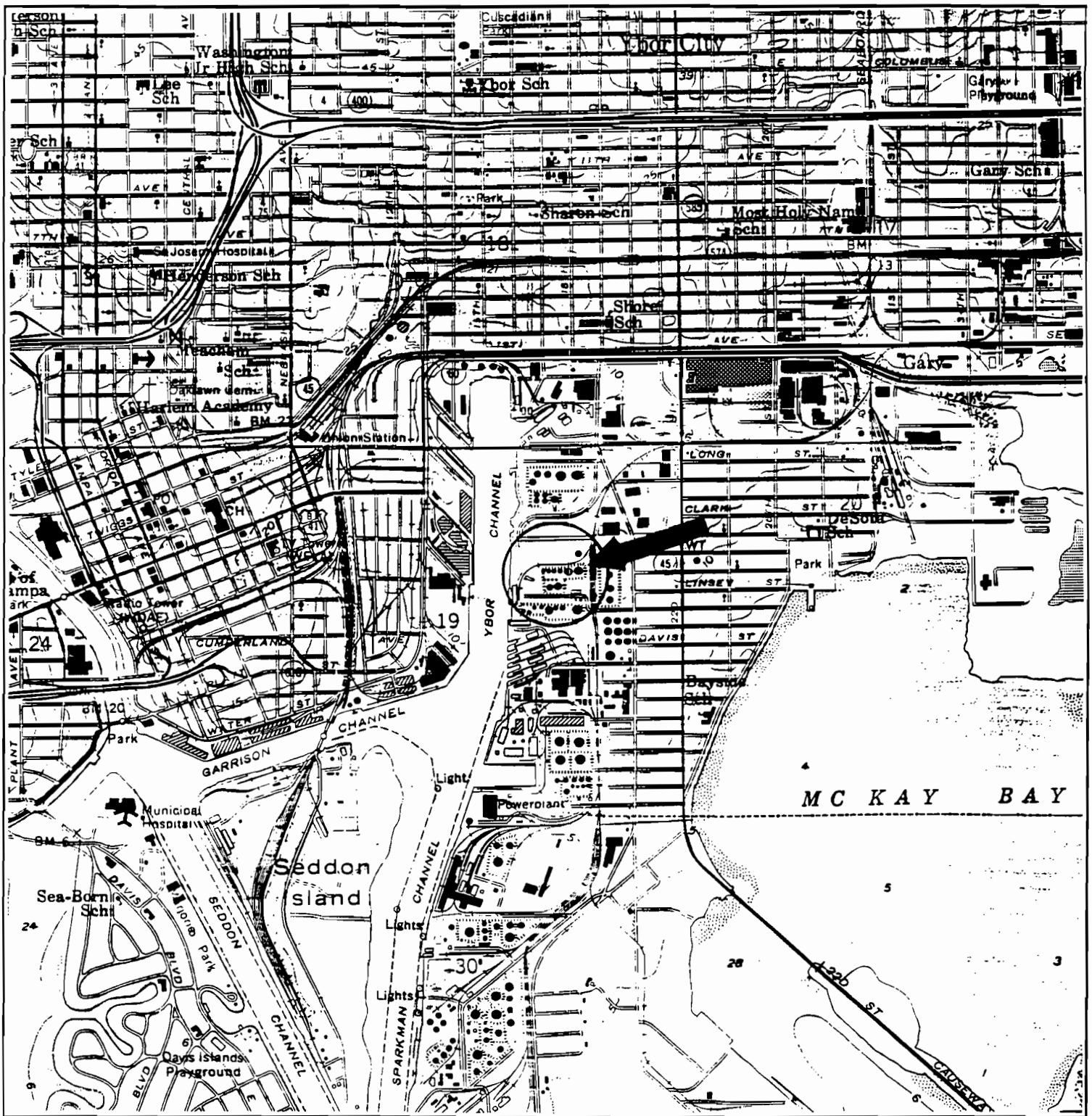
7. Attach all other information supportive to the PSD review. N/A

8. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e., jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources.

N/A

9. Attach scientific, engineering, and technical material, reports, publications, journals, and other competent relevant information describing the theory and application of the requested best available control technology.

N/A



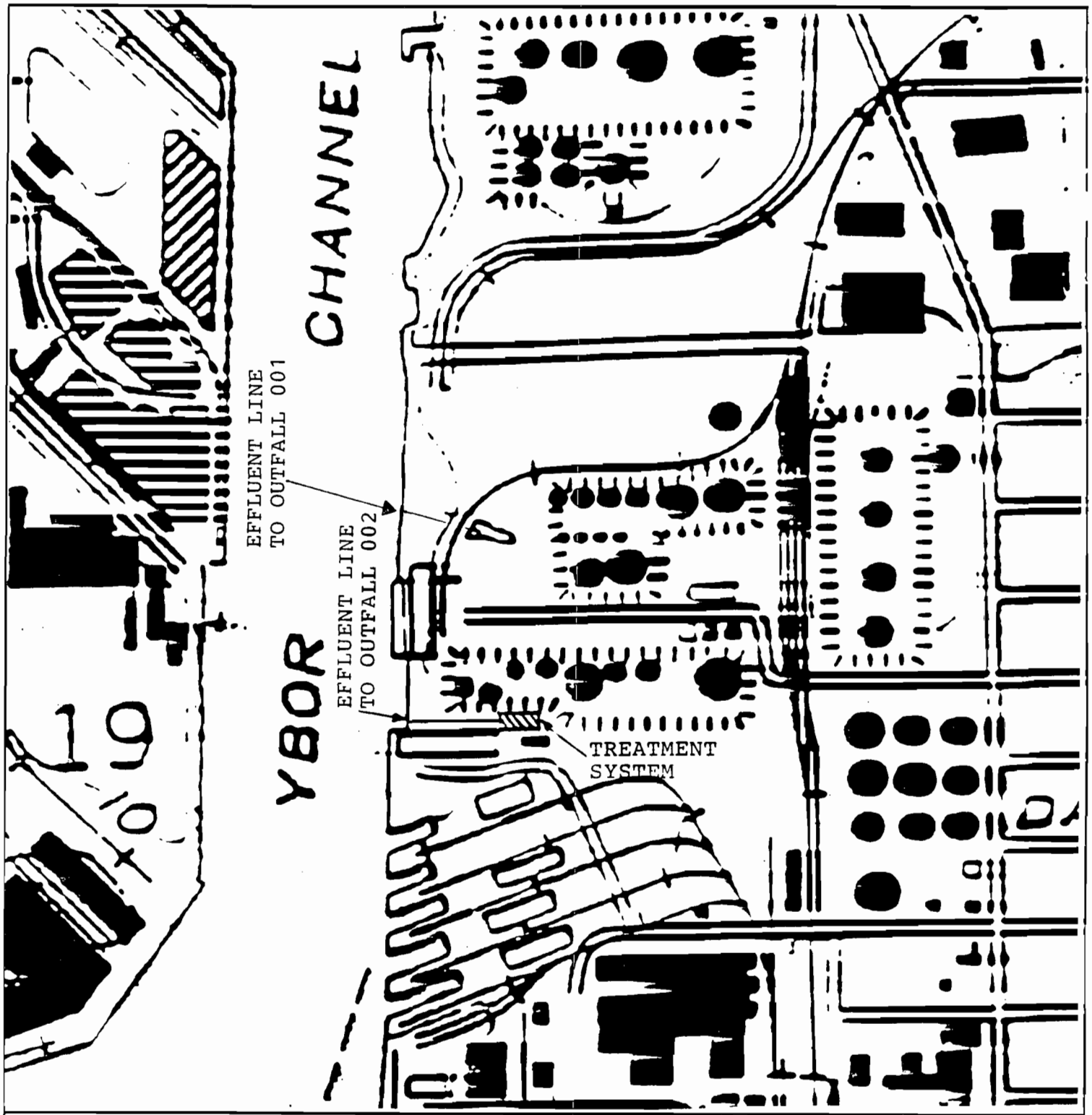
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

QUADRANGLE
FLORIDA-HILLSBOROUGH COUNTY
7.5 MINUTE SERIES (TOPOGRAPHIC)

SCALE 1:24000

1 MILE
4000 FEET
1 KILOMETER

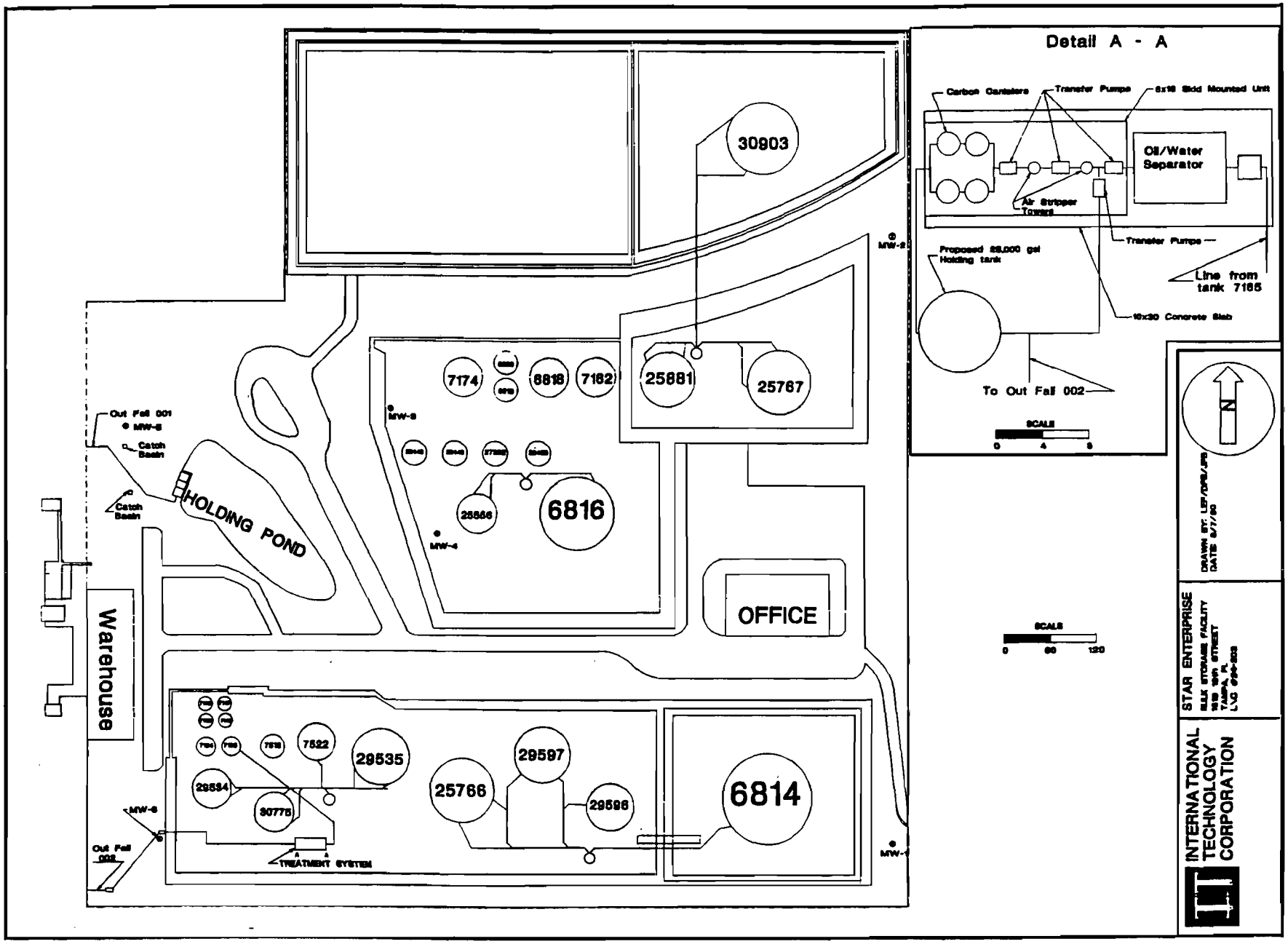
INTERNATIONAL TECHNOLOGY CORPORATION ENVIRONMENTAL SERVICES, INC.	**INDEX MAP** **Star Enterprise Port of Tampa** **Bulk Storage Facility**	Date: 8/15/90	Revised by: RLW
		Project# 585163	Scale: 1:24000



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

FLORIDA-HILLSBOROUGH COUNTY
7.5 MINUTE SERIES (TOPOGRAPHIC -NOT TO SCALE)

INTERNATIONAL TECHNOLOGY CORPORATION ENVIRONMENTAL SERVICES, INC.	**DRAINAGE DETAIL** **Star Enterprise Port of Tampa** **Bulk Storage Facility**	Date: 8/15/90	Revised by: RLW
		Project# 585163	Scale: NONE


Detail A - A
Carbon Canisters
Transfer Pumps
6x16 Skid Mounted Unit
Oil/Water Separator
Air Stripper Towers
Transfer Pumps
Proposed 55,000 gal Holding tank
Line from tank 7165
10x30 Concrete Slab
To Out Fall 002
SCALE
0 4 8
30903
7174
6818
7162
25881
25767
6816
25556
HOLDING POND
Out Fall 001
MW-5
Catch Basin
Catch Basin
MW-3
MW-4
MW-2
OFFICE
Warehouse
7522
29535
29534
30775
25766
29597
29596
6814
MW-6
Out Fall 002
TREATMENT SYSTEM
MW-1
SCALE
0 60 120
N
DRAWN BY: LEP/DPB/JPB
DATE 8/7/90
STAR ENTERPRISE
BULK STORAGE FACILITY
INTERNATIONAL TECHNOLOGY CORPORATION

August 9, 1990

INTERNATIONAL TECHNOLOGY CORPORATION

Wastewater Treatment Plan

Star Enterprise-Tampa
Bulk Storage Facility
519 19th Street
Tampa, Florida

ENVIRONMENTAL ENGINEERING
AND
SERVICES PROJECT 585-163

Prepared By: James P. Bowen
Project Manager

Prepared By: Dennis Boudreaux
Project Engineer

Reviewed By: J.S. Reese
P.E.

INTRODUCTION

Star Enterprise is preparing to treat accumulated bottom water from their above ground storage tanks before discharging this treated water into a designated drainage system. The treatment system proposed will return the subject water to concentrations well below standards indicated in Chapter 17-3 F.A.C. (Florida Administrative Code) for Class III surface waters. The ideal discharge point for this water is Ybor Channel through the Sparkman Channel. The Star Enterprise bulk storage facility located at the Port of Tampa currently operates under an Industrial Wastewater Treatment and Disposal permit (#I029-128056), filed with the Florida Department of Environmental Regulation (F.D.E.R.). The Environmental Protection Agency (E.P.A.) has issued a National Pollutant Discharge Elimination System (N.P.D.E.S.) permit (# FI 0001384). These permits regulates two outfall into the Sparkman Channel. The waste stream being served by outfall (#001) is a surface water catch basin and associated oil/water separator. The waste stream being served by outfall (#002) is a single catchment basin. Star Enterprise would like to modify the existing permit to allow for a second waste steam using the outfall (#002). This waste stream includes water from the dock area (94%) and accumulated tank-bottom waters (6%)[1].This process will be accomplished while staying within the Acceptable Ambient Concentration Levels as stated by the Florida Department of Environmental Regulations.

WASTEWATER TREATMENT

This water treatment system has been designed specifically for the use in this situation and will be maintained solely for the purposes mentioned here. The system has been designed by IT Corporation based on the data collected under an approved Quality Assurance Project Plan (GQAPP #427087G). It should be noted that this data represents a one time analysis and is not a time weighted average over time. This analytical data is presented in Table 1 along with target effluent levels.

Table 1
Tank-Bottom Water Analytical Results
Influent-Effluent Criteria

	Influent	Class III Surface Water Standards	Target Effluent Levels
benzene	420 ppb	none	< 1.0 ppb
BTEX	6,990 ppb	200 ppb	< 50.0 ppb
M-Tert Butyl Ether	32,000 ppb	none	< 50.0 ppb
phenol[2]	15,000 ppb	1.0 ppb	< 1.0 ppb
2-nitrophenol	21,000 ppb	1.0 ppb	< 1.0 ppb

[1] source-actual tank volume readings since collection system installation in 7/88

[2] The phenol concentrations are derived from analytical results from other bottom water collection tanks.

Table 1 (cont.)
Tank-Bottom Water Analytical Results
Influent-Effluent Criteria

	Influent	Class III Surface Water Standards	Target Effluent Levels
2,4-dichlorophenol	28,000 ppb	1.0 ppb	< 1.0 ppb
2-chlorophenol	7,100 ppb	1.0 ppb	< 1.0 ppb
4-chloro-3 -methylphenol	18,000 ppb	1.0 ppb	<1.0 ppb
recoverable petr. hydrocarbons[3]	205 ppm	5 ppm	<5.0 ppm

Air stripping and carbon adsorption will be used as the treatment technologies after the liquid phase hydrocarbons are separated by an oil-water separator. Two air stripping towers in series will reduce the volatile organic contaminants to levels below those required for Class III surface waters as indicated in the Target Effluent Levels in Table 1. The combination of air stripping and carbon adsorption is recognized as one of the the best techniques for reducing the water to drinking water standards. In the proposed system, air stripping will be used first to remove a large percentage of the V.O.C.s, followed by carbon adsorption to remove residual organic contaminants and non volatile compounds. Four 55 gallon canisters, containing 165 pounds each of activated carbon, will be arranged in series. Sample points between canisters will facilitate early detection of contaminant breakthrough. Spent cannisters will be replaced with cannisters containing virgin carbon. Figures 1 through 4 are scaled engineering drawings depicting the design of each aspect of the treatment system. The water will be treated in a batch process. The treatment process will transfer the water from an existing 184,000 gallon bottom water collection tank (#7165) to a proposed 25,000 gallon holding tank. The average accumulation of bottom water is approximately 700 gallons per month and the total volume of runoff expected from the dock area is 5,000 gallons per month. Considering the relatively small volume of water, a maximum of 2.5 days per month will be required to process the water through the treatment system into the proposed holding tank. The water will remain in this holding tank until sample analyses results are received and verified as acceptable for discharge. Once verified for discharge the water will be drained into the Sparkman Channel at what ever rate prescribed by the governing agency.

OPERATIONS AND MAINTENANCE

The water treatment system will only run once per month considering the present

[3] This value is an average of the TPH analyses done on samples taken from each of the storage tanks

rate of accumulation and hydrocarbon saturation. The day the system is to be run experienced technicians from IT Corporation will prepare the treatment system for operations, record the time, and start up the system. The following day, qualified scientists from IT Corporation will return to the site to secure the system for down time. This will include disconnecting electrical service from the system, and taking samples from the holding tank for the appropriate analyses. In the unlikely event that the analyses proved that the contaminant concentrations are above the levels in Table 2 the water will be re-routed through the air strippers and carbon canisters to be held for reanalysis.

Table 2
Tank-Bottom Water Analytical Results
Recirculation Criteria

	Concentration
BTEX	50.0 ppb
M-Tert Butyl Ether	50.0 ppb
naphthalene	10.0 ppb
recoverable petr. hydrocarbons	5.0 ppm
phenol	1.0 ppb
Lead	50.0 ppb

Analyses above these levels will prompt the water to be recirculated through the treatment system to lower the contaminant levels to below target levels. The effluent valve will be kept locked at all times, except when discharges have been approved. Access to this valve, flow/totalizer readings, maintenance performed to the system and pertinent analyses will be documented in a system log kept on site at all times. Copies of the systems logs, sample documentation and analyses will be made available upon request.

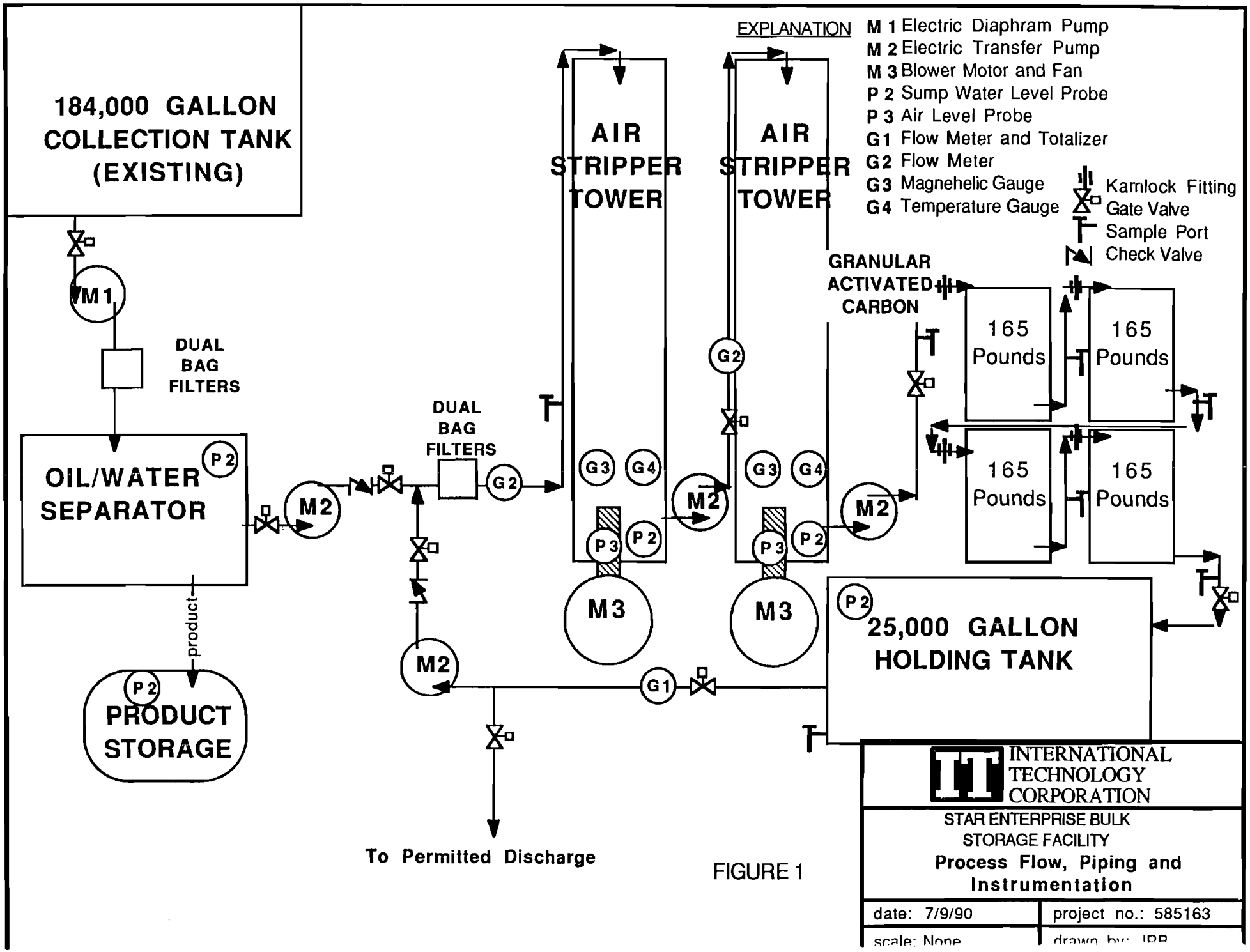


FIGURE 1

INTERNATIONAL TECHNOLOGY CORPORATION

STAR ENTERPRISE BULK STORAGE FACILITY

Process Flow, Piping and Instrumentation

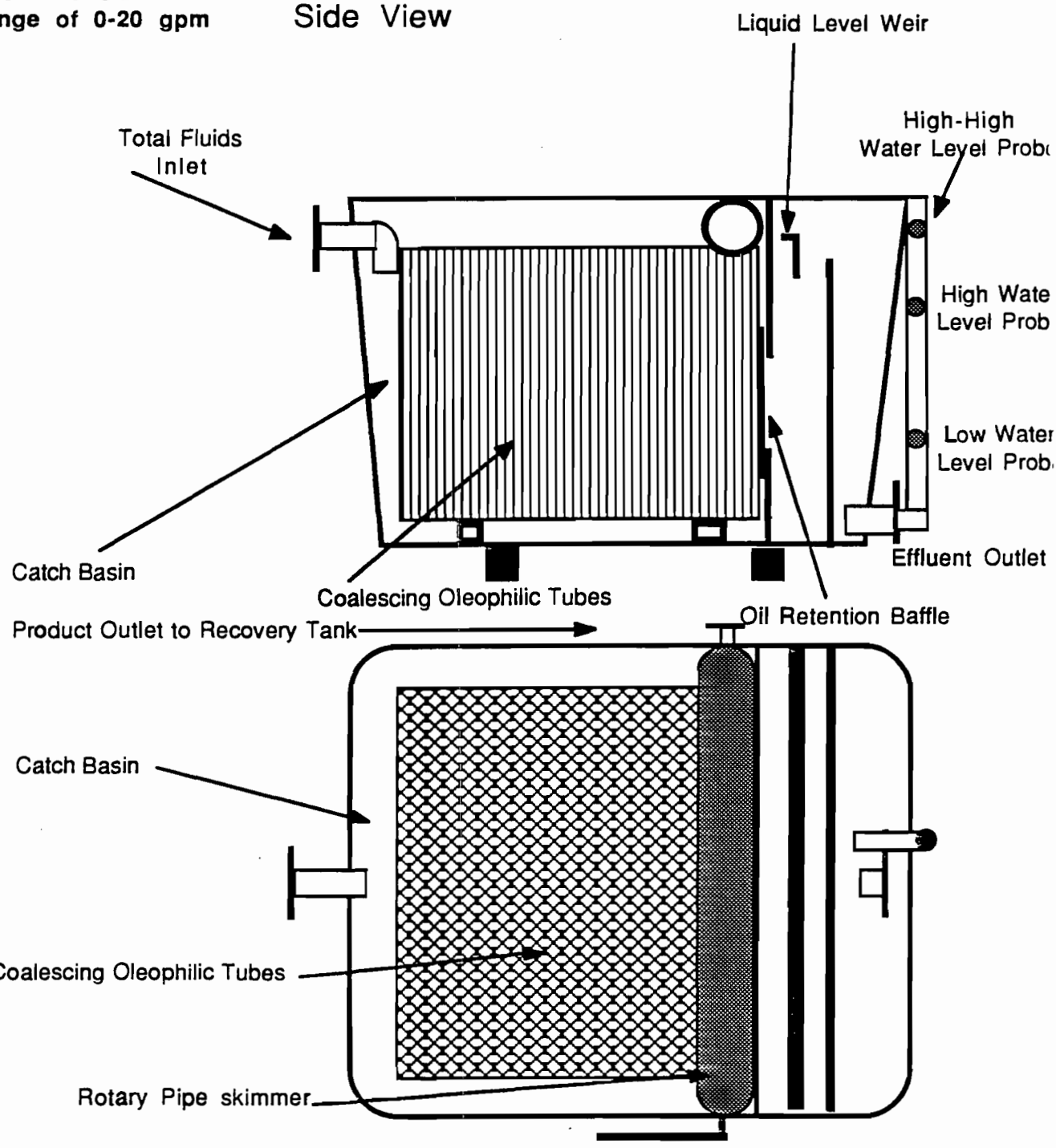
date: 7/9/90	project no.: 585163
scale: None	drawn by: IRR

BEST AVAILABLE COPY

NEPCCO MODEL:

OPS-010-020
Flow Range of 0-20 gpm

Side View



Plan View

Scale
(Feet)

0 .5 1 2 3

INTERNATIONAL TECHNOLOGY CORPORATION

STAR ENTERPRISE BULK
STORAGE FACILITY

Oil-Water Separator

Figure 2.

Date : 6-26-90	Drawn By: SMD
Scale: 1"=2'	Project No.: 585163

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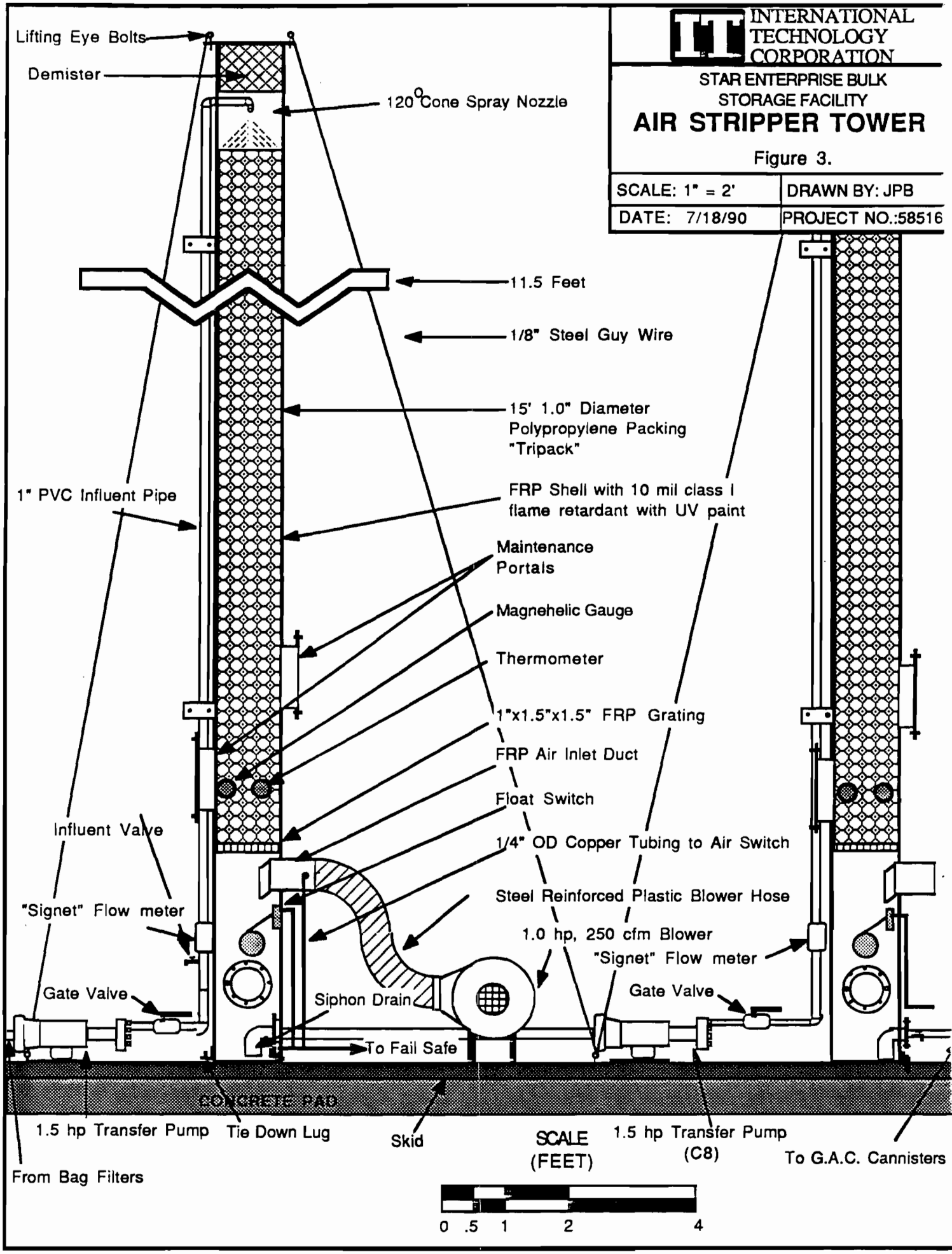

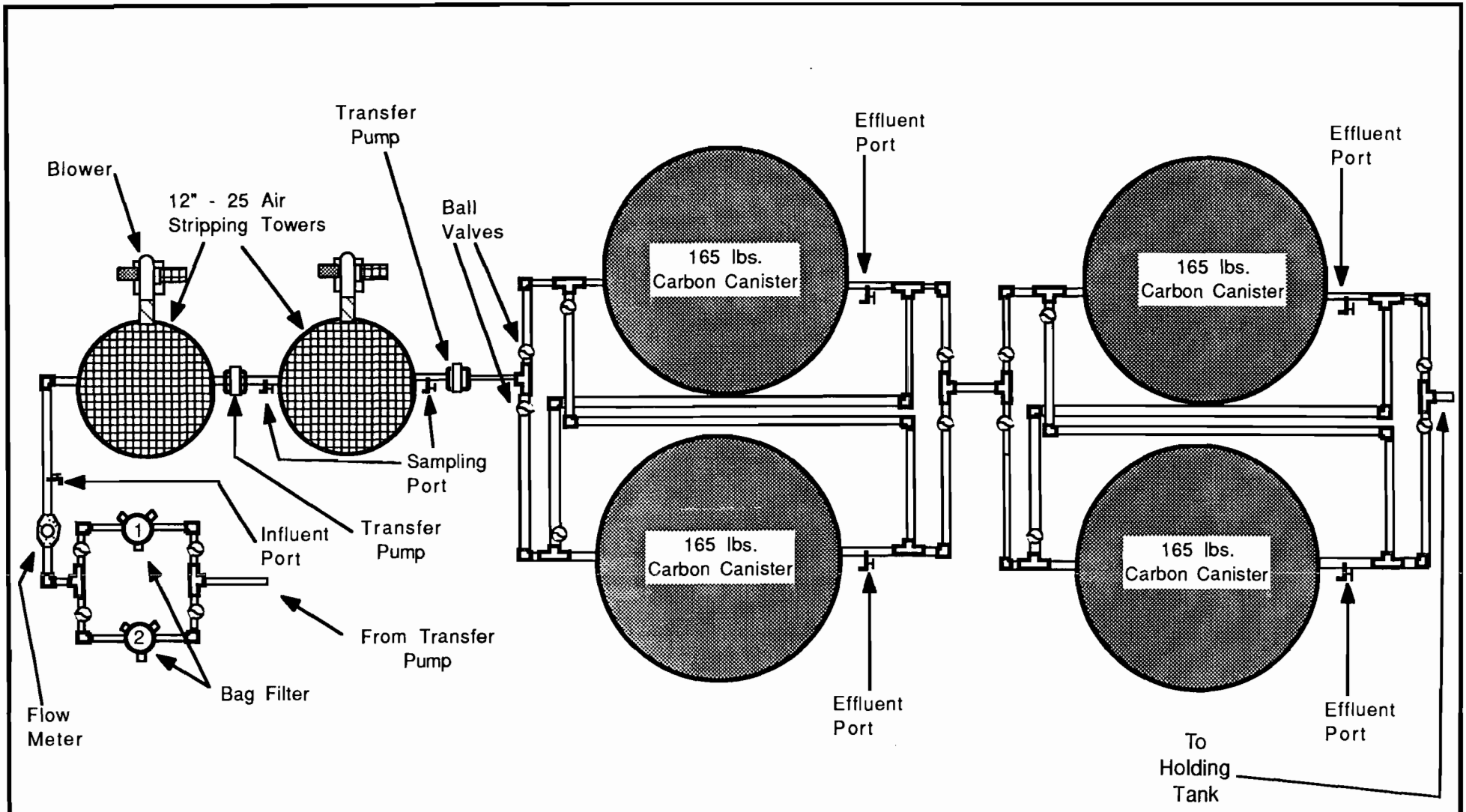

FIGURE 4.

INTERNATIONAL TECHNOLOGY CORPORATION

STAR ENTERPRISE BULK STORAGE FACILITY

AIR STRIPPING/ CARBON ADSORPTION PROCESS FLOW AND PIPING

SCALE: not to scale	REVISED BY: JPB
DATE: 7/18/90	PROJECT NO.: 585163

APPENDIX A

TOTAL DYMANIC HEAD (TDH)

LOCATION: COLLECTION TANK TO OIL/WATER SEPARATOR

Q	=	10
D	=	2.06
A	=	0.023
Q in CFS=		0.022
V	=	0.96
Vel. Head =		1.00E-02
Reynolds No.		15562
f	=	0.028
L	=	80
K	=	13.05

No.	Fittings	K	No. X K
10	90 Ells	0.75	7.5
0	45 Ells	0.35	0
1	T Branch	0.40	0.4
1	Gate Val-FO	0.17	0.17
0	Gate Val-.5	0.90	0
0	Check Valve	10.00	0
0	Flow Meter	10.00	0
		TOTAL	8.07

Sumation of (K) = 21.12

Frictional Head Loss = 0.3

Additional Head Losses due to Friction

Spray Nozzle	=	0
Greensand Filter	=	0
Static Mixer	=	0
Carbon Canister	=	0
Bag Filter	=	12
Total	=	12

Head Loss due to Friction = 12.3

Head Loss due to Friction with 20% Safety Factor = 14.76

Total Change in Elevation

Height to Tower Inlet	=	4.00
Depth to Water Level	=	0.00
Total	=	4.00

Sum of Head Losses and Total Change in Elevation (TDH)

TDH = 18.76

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INTERNATIONAL TECHNOLOGY CORPORATION

By DPB Date 7/18/90 Subject TAMPA TERM Sheet No. 1 of 1

Chkd. By ___ Date ___ Proj. No. 585/6

COLLECTION TANK TO O/W SEPERATOR

ASSUMPTIONS:

(1) 80' OF 2" PVC PIPE
(2) 10 ELBOWS

GIVEN:

(1) FLOW RATE - 10 gpm
(2) BAG FILTER - PRESSURE DROP = 5 PSI OR 12' HEAD LOSS.

FROM CALCULATIONS:
TDH = 19'

CHOOSE: CH&E 5410 (STATIONARY) MODEL

THIS PUMP WILL HAVE TO BE POSITIVE DISPLACEMENT TO PREVENT EMULSIFICATION

TOTAL DYMANIC HEAD (TDH)

LOCATION: OIL/WATER SEPARATOR TO FIRST TOWER

Q	=	10
D	=	2.06
A	=	0.023
Q in CFS=		0.022
V	=	0.96
Vel. Head =		1.00E-02
Reynolds No.		15562
f	=	0.028
L	=	50
K	=	8.16

No.	Fittings	K	No. X K
6	90 Ells	0.75	4.5
0	45 Ells	0.35	0
0	T Branch	0.40	0
1	Gate Val-FO	0.17	0.17
0	Gate Val-.5	0.90	0
0	Check Valve	10.00	0
1	Flow Meter	10.00	10
		TOTAL	14.67

Sumation of (K) = 22.83

Frictional Head Loss = 0.33

Additional Head Losses due to Friction

Spray Nozzle	=	23
Greensand Filter	=	0
Static Mixer	=	0
Carbon Canister	=	0
Bag Filter	=	12
Total	=	35

Head Loss due to Friction = 35.33

Head Loss due to Friction with 20% Safety Factor = 42.4

Total Change in Elevation Heignt to Tower Inlet = 20.00

Total = 20.00

Sum of Head Losses and Total Change in Elevation (TDH)

TDH = 62.4

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INTERNATIONAL TECHNOLOGY CORPORATION

By DPB Date 7/18/90 Subject Tampa Teem Sheet No. 1 of
Chkd. By Date Proj. No. 585163

Oil/Water to First Tower

Assumptions:

(1) Flooded Suction
(2) 50' of 2" PVC pipe
(3) 6 Elbows.

Given:

(1) Flow Rate: 10 gpm
(2) Bag Filter: Pressure Drop = 5 psi = 12'
(3) Nozzle: Pressure Drop = 10 psi = 23' Loss
(4) Flowmeter: 1
(5) Height of Tower inlet = 20'

From Calculations:

TDH = 62'

Choose: STA-Rite Industrial Pump

model C8 with 4.2 impeller

Performance curve shows approximately 70' head at 10 gpm.

TOTAL DYMANIC HEAD (TDH)

LOCATION: FIRST TOWER TO SECOND TOWER

Q	=	10			
D	=	2.06			
		No.	Fittings	K	No. X K
A	=	0.023	6	90 Ells	0.75	4.5
Q in CFS=		0.022	0	45 Ells	0.35	0
			0	T Branch	0.40	0
V	=	0.96	0	Gate Val-FO	0.17	0
			0	Gate Val-.5	0.90	0
Vel. Head =		1.00E-02	0	Check Valve	10.00	0
			0	Flow Meter	10.00	0
Reynolds No.		15562		TOTAL		4.5
f	=	0.028	Sumation of (K)	=		10.21
L	=	35	Frictional Head Loss	=		0.15
K	=	5.71	Additional Head Losses due to Friction			

Spray Nozzle	=	23
Greensand Filter	=	0
Static Mixer	=	0
Carbon Canister	=	0
Bag Filter	=	0
Total	=	23

Head Loss due to Friction =		23.15
Head Loss due to Friction with 20% Safety Factor =		27.78
Total Change in Elevation		
Height to Tower Inlet	=	20.00
Depth to Water Level	=	0.00
Total	=	20.00

Sum of Head Losses and Total Change in Elevation (TDH)

TDH = 47.78

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INTERNATIONAL TECHNOLOGY CORPORATION

By DPB Date 7/18/90 Subject Tampa Term Sheet No. 1 of

Chkd. By Date Proj. No. 585163

First Tower To Second Tower

Assumptions:

(1) Flooded suction
(2) 35' of 2" pvc pipe
(3) 6 elbows

Given:

(1) Flow rate : 10 gpm
(2) Nozzle : Pressure Drop = 10 PSI = 23' Hd
(3) Height to Lower Inlet : 20'

From Calculations:

TDH = 48'

Choose : Sta-Rite Industrial Pump

Model C7 with 3.7 impeller

Performance curve shows Approximately 54' head at 10 gpm

TOTAL DYMANIC HEAD (TDH)

LOCATION: SECOND TOWER TO HOLDING TANK

Q	=	10
D	=	2.06
A	=	0.023
Q in CFS=		0.022
V	=	0.96
Vel. Head =		1.00E-02
Reynolds No.		15562
f	=	0.028
L	=	125
K	=	20.39

No.	Fittings	K	No. X K
30	90 Ells	0.75	22.5
0	45 Ells	0.35	0
0	T Branch	0.40	0
1	Gate Val-FO	0.17	0.17
0	Gate Val-.5	0.90	0
0	Check Valve	10.00	0
0	Flow Meter	10.00	0
		TOTAL	22.67

Sumation of (K) = 43.06

Frictional Head Loss = 0.62

Additional Head Losses due to Friction

Spray Nozzle	=	0
Greensand Filter	=	0
Static Mixer	=	0
Carbon Canister	=	0
Bag Filter	=	0
Total	=	0

Head Loss due to Friction = 0.62

Head Loss due to Friction with 20% Safety Factor = 0.74

Total Change in Elevation

Height to Canister Inlet	=	12.00
Height to Tank Inlet	=	25.00
Pressure Drop/Canister	=	4.33
Total	=	41.33

Sum of Head Losses and Total Change in Elevation (TDH)

TDH = 42.07

BEST AVAILABLE COPY

INTERNATIONAL TECHNOLOGY CORPORATION

By DLB Date 7/18/90 Subject Tampa Team Sheet No. 1 of 1

Chkd. By ___ Date ___ Proj. No. 585163

Second tower to Holding tank

Assumptions:

(1) Flooded Section
(2) 125' of 2" PVC Pipe
(3) 30 Elbows
(4) one Valve

Given:

(1) Flow rate: 10 gpm
(2) Four (4) Carbon Canisters in Series
Pressure drop = 13" H_2O / can
(3) Height of Canisters — 3'
(4) Height of Water inlet on tank: 30'

From Calculations:

TDH = 42'

Choose: Sta Rite Industrial Pumps.

Model C7 with 3.7 Impeller

Performance curves show Approximately 54' head at 10 gpm.

TOTAL DYMANIC HEAD (TDH)

LOCATION: HOLDING TANK TO FIRST TOWER

Q	=	10			
D	=	2.06			
		No.	Fittings	K	No. X K
A	=	0.023	8	90 Ells	0.75 6
Q in CFS=		0.022	0	45 Ells	0.35 0
			0	T Branch	0.40 0
V	=	0.96	1	Gate Val-FO	0.17 0.17
			0	Gate Val-.5	0.90 0
Vel. Head =		1.00E-02	0	Check Valve	10.00 0
			1	Flow Meter	10.00 10
Reynolds No.		15562		TOTAL	16.17
f	=	0.028	Sumation of (K)	=	40.64
L	=	150	Frictional Head Loss	=	0.58
K	=	24.47	Additional Head Losses due to Friction		

Spray Nozzle	=	23
Greensand Filter	=	0
Static Mixer	=	0
Carbon Canister	=	0
Bag Filter	=	12
Total	=	35

Head Loss due to Friction = 35.58

Head Loss due to Friction with 20% Safety Factor = 42.7

Total Change in Elevation Heignt to Tower Inlet = 20.00

Total = 20.00

Sum of Head Losses and Total Change in Elevation (TDH)

TDH = 62.7

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INTERNATIONAL TECHNOLOGY CORPORATION

By DPB Date 7/18/90 Subject Tampa Team Sheet No. 1 of 1

Chkd. By ___ Date ___ Proj. No. 58516

Holding Tank to First Tower

Assumptions:

(1) Flooded Suction
(2) 150' of 2" PVC Pipe
(3) 8 Elbows : 1
(4) one Valve : 1
(5) one Flow meter: 1

Given:

(1) Flow Rate : 10 gpm
(2) Bag Filter : ΔP = 5PSI
(3) Nozzle : ΔP = 10PSI
(4) Height of Inlet on tower : 20'

From Calculations:

TDH = 63'

Choose : Sta-Rite Industrial Pump

Model C8 with 4.2 impeller
Performance curves show Approximately 70' Head at 10 gpm.

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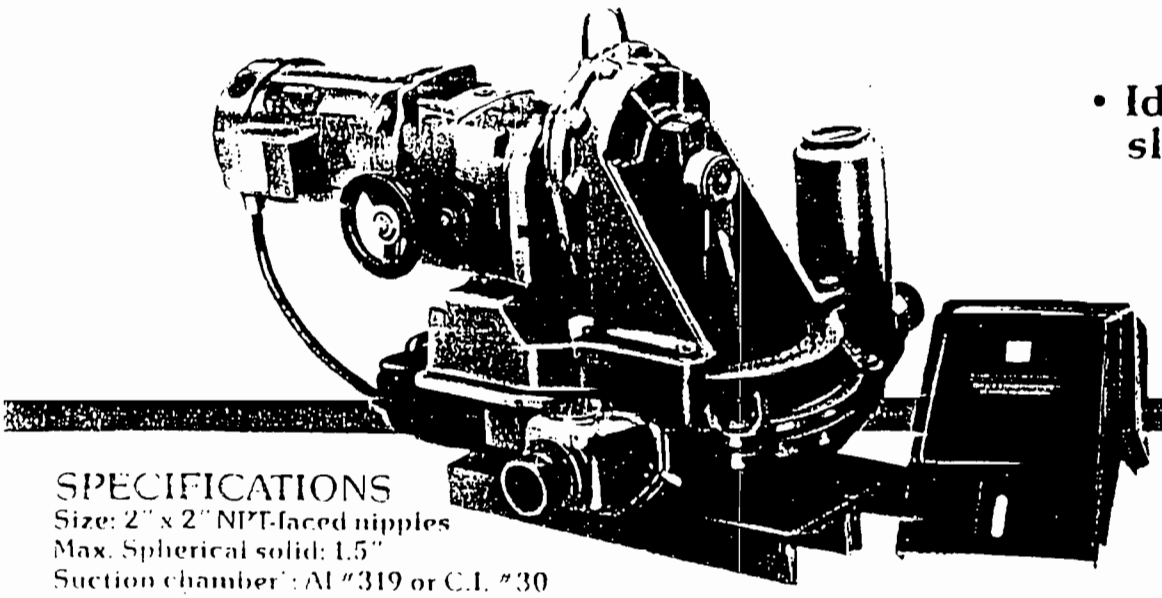
2" DIAPHRAGM PUMP



• Ideal for corrosive
sludge, and highl
up to 6,000 gal
diameter. • S
coupling. •
1 HP. or 1
diesel o

[2" variable speed drive-skid]

SPECIFICATIONS

Size: 2" x 2" NPT-faced nipples
Max. Spherical solid: 1.5"
Suction chamber*: Al #319 or C.I. #30
Discharge chamber*: Al #319 or C.I. #30
Water box*: Al #319 or C.I. #30
Diaphragm bottom*: Al #319 or C.I. #30
Gaskets: Velumoide
Crank Arm: Steel CF1018
Connecting rod: Al Tenzalloy
Frame: Al Tenzalloy
Conn. Rod Bearing: Cam roller bearing
Gear shaft: Steel C1117 hardened
Output gear: Forged #C1141
Intermediate gear: Ductile #80-60-03
Gear case: Al #319
Gear cover: Al #319
Bearings: Ball bearings
Flap valve: Neoprene
Diaphragm: TPE (Thermal Plastic Elastomer)
Pinions: Steel HR C1144 hardened
Valve weights: Steel-Iridite plated
Thrust washer: Rvertex #CE

*Model Number Indicates Aluminum or Cast Iron

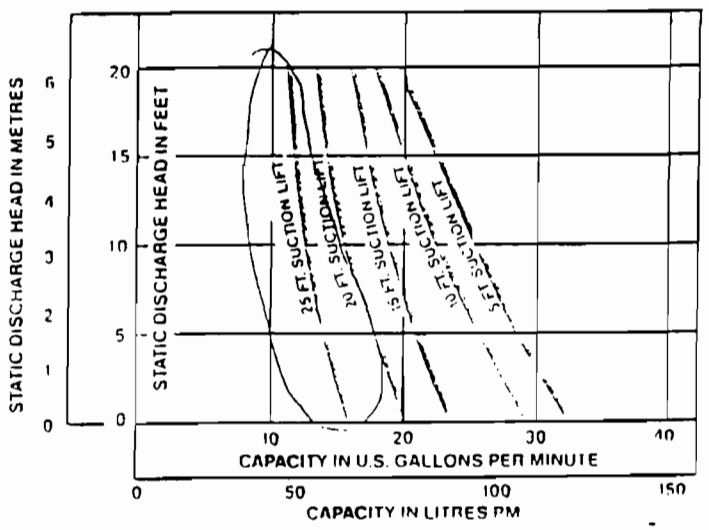
SPECIFIC DATA

Transmission: Enclosed, oil bath, double reduction
Gear ratio: 43:1
Output Strokes: 41 per minute
Input R.P.M.: 1750
Note: With variable speed, stroke may be adjusted between 8 and 60 strokes per minute.

MOTOR SPECIFICATIONS

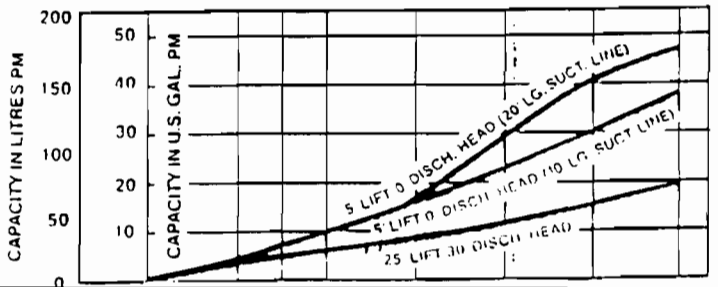
Horsepower: 1 HP.
Type: TEFC (Totally Enclosed Fan Cooled)
Frame: 56C
R.P.M.: 1750
Voltage: 1 ph. 115/230v 60 cycle
3 ph. 230/460v 60 cycle
Amp.: (running)
1 HP. 115 7.2

CH&E 5411 & 6411 2" DIAPHRAGM PUMP SERIES
2" SUCTION & 2" DISCHARGE (41 STROKES/MIN.)



CH&E 5400/6400
2" VARIABLE SPEED DIAPHRAGM PUMP SERIES
2" SUCTION & 2" DISCHARGE

This graph represents the minimum and maximum capabilities of the 2" variable speed diaphragm pump. The pump will normally operate in the area between the conditions of 5-ft. static suction lift with 0-ft. static discharge head and 25-ft. static suction lift with 30-ft. static discharge head. The colored area represents the increased capacity possible at low suction lifts and discharge heads due to inertia effects created by the use of long suction line (the extra length being under the surface of the liquid.)



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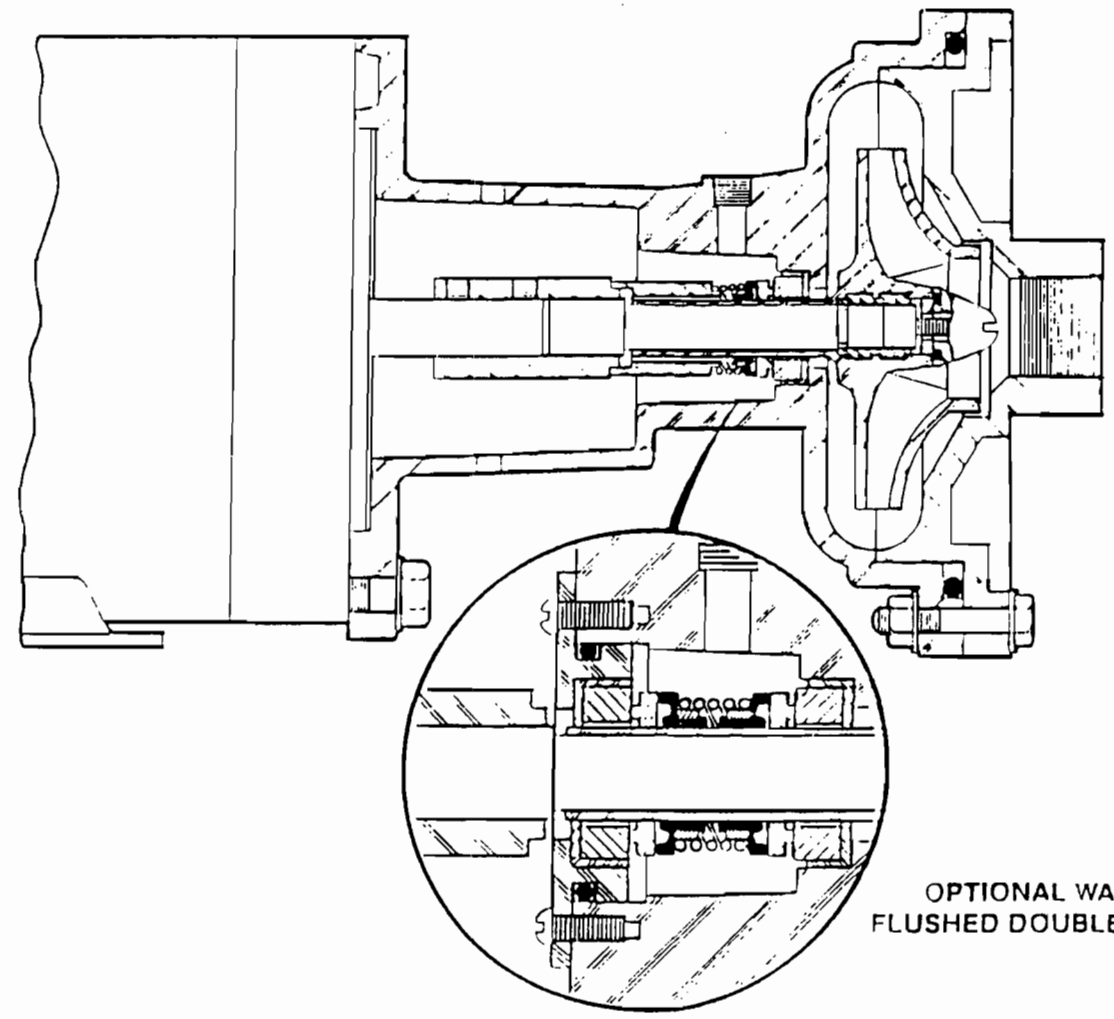
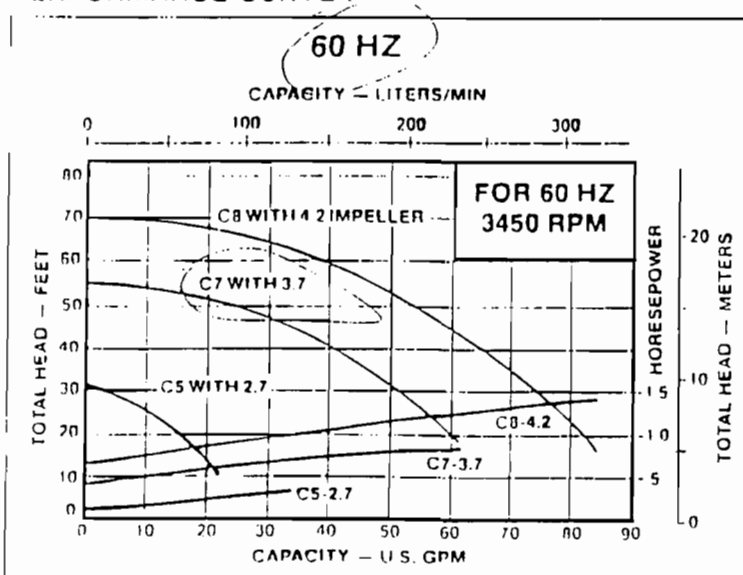
SERIES C5,C7&8

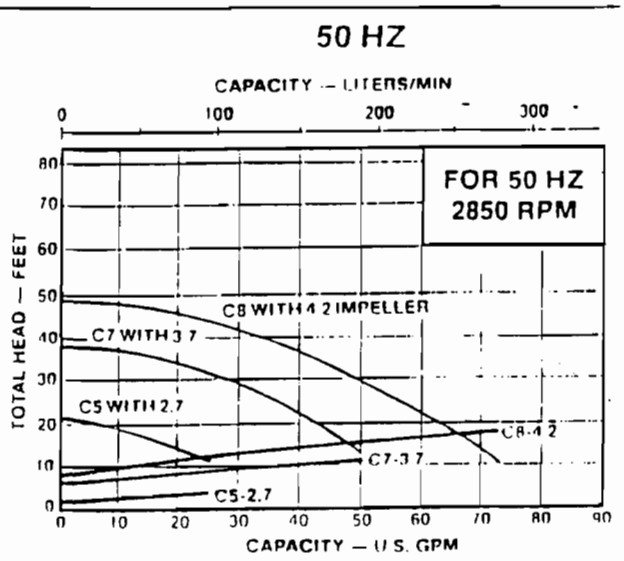
SECTIONAL VIEW



OPTIONAL WATER FLUSHED DOUBLE SEALS

PERFORMANCE CURVE





All complete pump models are performance tested prior to shipment.
For larger capacities/heads to 130 GPM and 145 Ft. THD see bulletin S3559 for C10 Series. [1] NOTE: CURVES BASED ON 70°F WATER WIT

APPENDIX B

OVERVIEW

The ability of a particular volatile organic compound to be removed ("stripped") from water is dependent on Henry's law constants and liquid mass transfer coefficients. The actual physical dimensions of an "air stripping tower" are a function of the following parameters:

- •particular compound to be removed
- •water temperature
- •water flow rate (primarily affects tower diameter)
- •required stripping efficiency (primarily affects tower height)
- •Height of Transfer Unit (HTU) of the selected packing material

Usually, a nominal air to water flow ratio (Acfm/Wcfm) from between 50:1 and 200:1 can be used and still remain between the limits of flooding (excessive water) and channeling (excessive air). Ratios outside these limits can be accommodated with special design considerations if necessary.

For a wide range of petroleum hydrocarbon problems, especially gasoline station sites, the predominant component to be removed is benzene. Benzene usually drives the system design because the allowable benzene effluent concentration (1 ppb) is the lowest of all components specified. When benzene is the design driver an air to water ratio of 150:1 is typically used. Other components can necessitate a higher or lower ratio depending on their specific chemical and physical properties.

The following steps summarize the design of an air stripping system:

STEP 1-List the design driving component and the design input data
STEP 2-Analyze key parameters and use computer results for STEPS 3 thru 7
STEP 3-Calculate tower diameter, D
STEP 4-Calculate tower height, H_t
STEP 5-Calculate total pressure drop, P
STEP 6-Calculate Blower Air Flow, A
STEP 7-Select blower size and horsepower using blower air flow curves

INTRODUCTION

The following step by step air stripper design sizing uses intermediate results from a copyrighted computer analysis program; AIRSTRIP. The computer program documentation and references for all calculations are listed in the attached bibliography.

DESIGN CALCULATIONS

STEP 1-List of the design driving component and design input data

Design Driving Component **MTBE**
Water flow rate **W=10 gpm**
Water Volumetric Loading Rate **L=12.7 gpm/ft^2**
Water Temperature **T=72°F**
Influent concentration **Ci=32000 ppb**
Effluent concentration desired **Co < 413 ppb**

STEP 2-Using AIRSTRIP, Calculate and List the following groups of key parameters:

Physical Constants
Contaminant Properties
Packing Properties
Loading Rates
Mass Transfer Parameters
Contaminant Removal

PHYSICAL CONSTANTS

Design temperature	:	72.0 degrees F.
Density of water	:	62.3 lb/ft^3
Density of air	:	0.0746 lb/ft^3
Viscosity of water	:	6.40E-04 lb/ft.s
Viscosity of air	:	1.20E-05 lb/ft.s
Surface tension of water	:	72 dyne/cm
Atmospheric pressure	:	1.00 atm

CONTAMINANT PROPERTIES

Name	:	MTBE-FDER
Molecular weight	:	42.0 g/mol
Boiling point	:	104 degrees F.
Molal volume at boiling point	:	0.1500 L/mol
Henry's Constant	:	0.02200
Enthalpy upon dissolution in water	:	3800 cal/mol
Molecular diffusivity in air	:	9.63E-05 ft^2/s
Molecular diffusivity in water	:	7.79E-09 ft^2/s

PACKING PROPERTIES

Name	:	Jaeger Tripacks
Packing Material	:	Plastic
Nominal Size	:	1.00 inch
Specific Area	:	84.7 ft^2/ft^3
Critical surface tension	:	33 dyne/cm
Packing depth	:	15.0 ft
Air friction factor	:	28

LOADING RATES

Water mass loading rate	:	1.8 lb/ft^2.s	*
Air mass loading rate	:	0.317 lb/ft^2.s	*
Water volumetric loading rate	:	12.69 gpm/ft^2	*
Air volumetric loading rate	:	1904 gpm/ft^2	*
Air pressure gradient	:	0.199 " H2O/ft	#
Volumetric air/water ratio	:	150.0	
Stripping factor	:	3.7	

MASS TRANSFER PARAMETERS

Percentage of packing area wetted	:	39.7 %	
Wetted packing area	:	33.6 ft^2/ft^3	*
Transfer rate constant in water	:	0.000400 ft/s	
Transfer rate constant in air	:	0.056552 ft/s	
Overall transfer rate constant	:	0.000311 ft/s	
Overall mass transfer coefficient	:	0.0104 1/s	
NTU	:	5.5371	
HTU	:	2.7090 ft	

CONTAMINANT REMOVAL

Influent concentration	:	32.0 mg/L	
Effluent concentration	:	412.6 ug/L	
Fraction removed	:	98.7 %	
Mass of contaminant removed	:	4.81391 lb/ft^2.day	*
Concentration in airstream	:	0.55383 mg/ft^2.ft^3	

* Expressed per unit of stripping tower cross-sectional area
\# Expressed per unit of tower length

From the computer analysis summary, four parameters are used for the remainder of the design process:

Z=15 Packing Depth in feet; **Pg 1:Packing Properties**
L=12.7 Water Volumetric Loading Rate in gpm/ft^2; **Pg 2:Loading Rates**
ΔP=0.199 Air Pressure Gradient in " H_2O/ft of packing depth; **Pg 2:Loading Rates**
A/W=150 Volumetric Air/Water Ratio; **Page2:Loading Rates**

STEP 3-Calculate tower diameter D in inches

$D=((\mathbf{W} \times 1.273 \times 144)/\mathbf{L})^{1/2}$
$D=((10 \times 1.273 \times 144)/12.7)^{1/2}$
D=12 inches; Select the nearest available standard tower diameter
D=12 inches

STEP 4-Calculate tower height H_t

H_t=Z + TB +TT + IDH where;
Z= 15 ft; Packing Depth from analysis rounded off to nearest one half foot
TB= 4.0 ft; Tower Bottom fixed height below packing support grate
TT=0.5 ft; Height allowed for top section and demister
IDH= 0.29 ft = (D/(2$\sqrt{3}$))/12 ft; Influent Distributer Height based on 120 degree spray nozzle pattern

H_t=15 + 4.0 + 0.5 + 0.29 ft
H_t=19.79 ft
Select the standard tower height nearest to H_t; Use a 20 ft tower.

STEP 5-Calculate total pressure drop P

P=Z x ΔP
P=15 x 0.199
P=2.99 inches H_2O +0.25 inches for demister=3.24 inches H_2O

STEP 6 Calculate Blower Air Flow, A
where Wcfm = Wgpm/7.481
Wcfm=10/7.481=1.34
A=A/W ratio x Wcfm
A=150 x 1.34
A=200 cfm

STEP 7-Use blower chart to look up blower size selection using A(cfm) and P(in inches H_2O). Use a design margin of 30% to 100% in selecting the blower cfm versus pressure drop(ie, if 300 cfm is needed into 1" pressure drop then select blower for 300 cfm into 1.3" to 2"). Include an adjustable air cutoff so that the system may be set up at the proper operating point. The adjustable air flow can be used over the life of the system to periodically increase the flow as modest packing fouling or degradation occurs. The design margin can also be used to adjust for future system changes such as modest changes in water flow rate.

Final Design Summary

Tower Model-Nepcco Model 120-20
Tower Diameter 12 inches
Tower Height 20 ft
Packing Material-Tripac 1" dia
Packing Height 15 ft
Blower Unit- NYB 95JA or equivalent
Blower Motor 1.0 HP; 3450 rpm
Blower Output 200 cfm @ up to 5.1 inches H_2O

Project Manager: J. Bowen

Reviewed by: J S Reese Date 8/7/90
J.S. Reese, P.E. #9846

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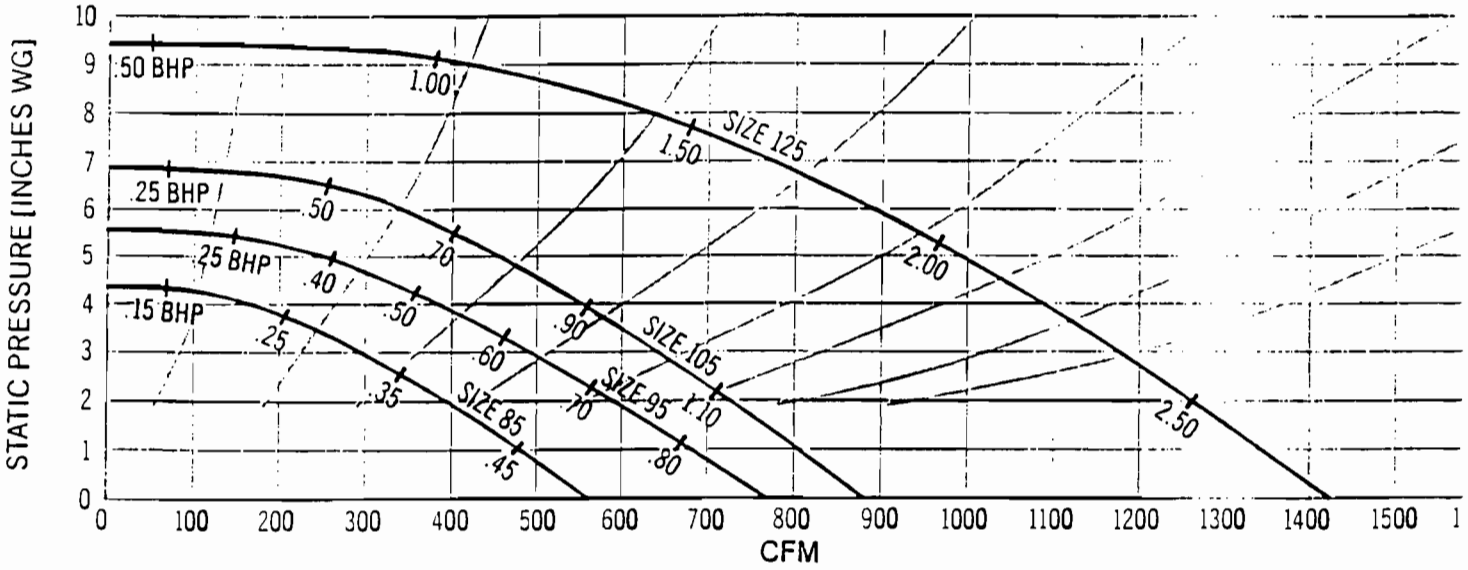
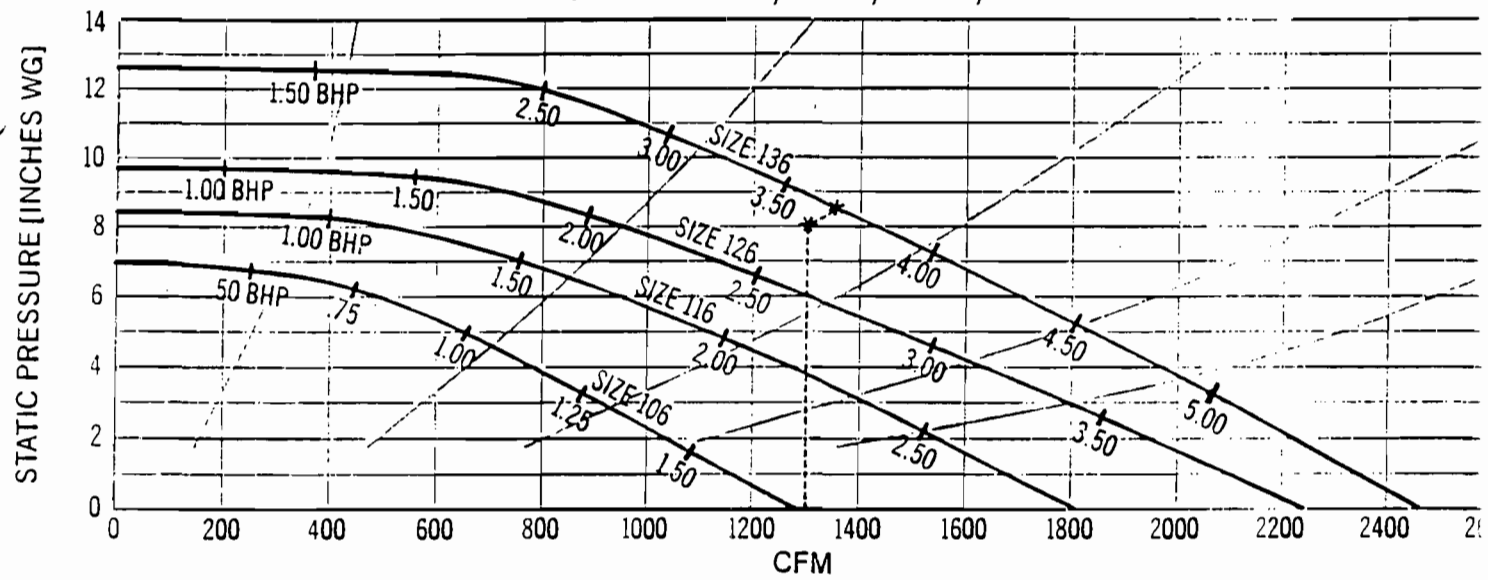
DIRECT-DRIVE PERFORMANCE CURVES – 3500 RPM

CURVE SELECTION EXAMPLE: Select a fan for 1300 CFM at 8"SP. See dotted lines on lower graph. Aft locating point on grid for 1300 CFM at 8"SP, follow direction of background system curves to intersection with f performance curve. In this system example, a Size 136 will deliver 1350 CFM and 8.3"SP with approximately 3.65 BH

SIZES 85, 95, 105, 125



SIZES 106, 116, 126, 136



DIRECT-DRIVE CAPACITY TABLE AT 3500 RPM

Model No.	HP	Inlet dia. OD	Outlet area sq. ft.	1"SP			2"SP			3"SP			4"SP			5"SP			6"SP			7"SP			8"SP		
				CFM	OV	BHP	CFM	OV	BHP	CFM	OV	BHP	CFM	OV	BHP	CFM	OV	BHP	CFM	OV	BHP	CFM	OV	BHP	CFM	OV	BHP
85 HA	½	5	.103	485	4710	.45	394	3830	.38	297	2880	.31	173	1680	.22												
95 JA	1	6	.126	684	5430	.80	591	4690	.72	495	3930	.63	386	3060	.52	258	2050	.39									
105 JA	1	6	.126	–	–	–	–	–	–	643	5100	1.00	553	4390	.89	458	3640	.75	342	2710	.60						
105 KA	1½	6	.126	805	6390	1.20	726	5760	1.10	643	5100	1.00	553	4390	.89	458	3640	.75	342	2710	.60						
106 KA	1½	6	.203	–	–	–	1042	5130	1.44	912	4490	1.29	782	3850	1.13	652	3210	.98	496	2440	.80						
106 LA	2	6	.203	1167	5750	1.57	1042	5130	1.44	912	4490	1.29	782	3850	1.13	652	3210	.98	496	2440	.80						
125 LA	2	7	.158	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	896	5670	1.86	774	4900	1.65	624	3950	1.40
125 MA	3	7	.158	1344	8510	2.66	1263	7990	2.51	1182	7480	2.36	1097	6940	2.21	1005	6360	2.06	896	5670	1.86	774	4900	1.65	624	3950	1.40
116 LA	2	7	.255	–	–	–	–	–	–	–	–	–	–	–	–	1122	4400	2.00	961	3770	1.77	776	3040	1.50	493	1930	1.11
116 MA	3	7	.255	1694	6640	2.70	1555	6100	2.53	1417	5560	2.37	1278	5010	2.19	1122	4400	2.00	961	3770	1.77	776	3040	1.50	493	1930	1.11
126 MA	3	8	.255	–	–	–	–	–	–	–	–	–	–	–	–	1459	5720	2.87	1305	5120	2.63	1139	4470	2.37	948	3720	2.10
126 NA	5	8	.255	2025	7940	3.75	1889	7410	3.53	1751	6870	3.31	1608	6310	3.09	1459	5720	2.87	1305	5120	2.63	1139	4470	2.37	948	3720	2.10
136 NA	5	8	.293	–	–	–	–	–	–	–	–	–	1968	6720	4.80	1839	6280	4.55	1701	5810	4.30	1566	5350	4.05	1426	4870	3.80

Performance shown is for Compact GI Fans with inlet and outlet ducts.

OVERVIEW

The ability of a particular volatile organic compound to be removed ("stripped") from water is dependent on Henry's law constants and liquid mass transfer coefficients. The actual physical dimensions of an "air stripping tower" are a function of the following parameters:

- •particular compound to be removed
- •water temperature
- •water flow rate (primarily affects tower diameter)
- •required stripping efficiency (primarily affects tower height)
- •Height of Transfer Unit (HTU) of the selected packing material

Usually, a nominal air to water flow ratio (Acfm/Wcfm) from between 50:1 and 200:1 can be used and still remain between the limits of flooding (excessive water) and channeling (excessive air). Ratios outside these limits can be accommodated with special design considerations if necessary.

For a wide range of petroleum hydrocarbon problems, especially gasoline station sites, the predominant component to be removed is benzene. Benzene usually drives the system design because the allowable benzene effluent concentration (1 ppb) is the lowest of all components specified. When benzene is the design driver an air to water ratio of 150:1 is typically used. Other components can necessitate a higher or lower ratio depending on their specific chemical and physical properties.

The following steps summarize the design of an air stripping system:

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STEP 3-Calculate tower diameter, D
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STEP 5-Calculate total pressure drop, P
STEP 6-Calculate Blower Air Flow, A
STEP 7-Select blower size and horsepower using blower air flow curves

INTRODUCTION

The following step by step air stripper design sizing uses intermediate results from a copyrighted computer analysis program; AIRSTRIP. The computer program documentation and references for all calculations are listed in the attached bibliography.

DESIGN CALCULATIONS

STEP 1-List of the design driving component and design input data

Design Driving Component **MTBE**
Water flow rate **W=10 gpm**
Water Volumetric Loading Rate **L=12.7 gpm/ft^2**
Water Temperature **T=72°F**
Influent concentration **Ci=413 ppb**
Effluent concentration desired **Co < 10 ppb**

STEP 2-Using AIRSTRIP, Calculate and List the following groups of key parameters:

Physical Constants
Contaminant Properties
Packing Properties
Loading Rates
Mass Transfer Parameters
Contaminant Removal

PHYSICAL CONSTANTS

Design temperature	:	72.0 degrees F.
Density of water	:	62.3 lb/ft^3
Density of air	:	0.0746 lb/ft^3
Viscosity of water	:	6.40E-04 lb/ft.s
Viscosity of air	:	1.20E-05 lb/ft.s
Surface tension of water	:	72 dyne/cm
Atmospheric pressure	:	1.00 atm

CONTAMINANT PROPERTIES

Name	:	MTBE-FDER
Molecular weight	:	42.0 g/mol
Boiling point	:	104 degrees F.
Molal volume at boiling point	:	0.1500 L/mol
Henry's Constant	:	0.02200
Enthalpy upon dissolution in water	:	3800 cal/mol
Molecular diffusivity in air	:	9.63E-05 ft^2/s
Molecular diffusivity in water	:	7.79E-09 ft^2/s

PACKING PROPERTIES

Name	:	Jaeger Tripacks
Packing Material	:	Plastic
Nominal Size	:	1.00 inch
Specific Area	:	84.7 ft^2/ft^3
Critical surface tension	:	33 dyne/cm
Packing depth	:	15.0 ft
Air friction factor	:	28

LOADING RATES

Water mass loading rate	:	1.8 lb/ft^2.s	*
Air mass loading rate	:	0.317 lb/ft^2.s	*
Water volumetric loading rate	:	12.69 gpm/ft^2	*
Air volumetric loading rate	:	1904 gpm/ft^2	*
Air pressure gradient	:	0.199 " H20/ft	#
Volumetric air/water ratio	:	150.0	
Stripping factor	:	3.7	

MASS TRANSFER PARAMETERS

Percentage of packing area wetted	:	39.7 %	
Wetted packing area	:	33.6 ft^2/ft^3	*
Transfer rate constant in water	:	0.000400 ft/s	
Transfer rate constant in air	:	0.056552 ft/s	
Overall transfer rate constant	:	0.000311 ft/s	
Overall mass transfer coefficient	:	0.0104 1/s	
NTU	:	5.5371	
HTU	:	2.7090 ft	

CONTAMINANT REMOVAL

Influent concentration	:	412.6 ug/L	
Effluent concentration	:	5.3 ug/L	
Fraction removed	:	98.7 %	
Mass of contaminant removed	:	0.06207 lb/ft^2.day	*
Concentration in airstream	:	0.00714 mg/ft^2.ft^3	

* Expressed per unit of stripping tower cross-sectional area
\# Expressed per unit of tower length

From the computer analysis summary, four parameters are used for the remainder of the design process:

Z=15 Packing Depth in feet; **Pg 1:Packing Properties**

L=12.7 Water Volumetric Loading Rate in gpm/ft^2; **Pg 2:Loading Rates**

ΔP=0.199 Air Pressure Gradient in " H_2O/ft of packing depth; **Pg 2:Loading Rates**

A/W=150 Volumetric Air/Water Ratio; **Page2:Loading Rates**

STEP 3-Calculate tower diameter D in inches

$D=((\mathbf{W} \times 1.273 \times 144)/\mathbf{L})^{1/2}$

$D=((10 \times 1.273 \times 144)/12.7)^{1/2}$

D=12 inches; Select the nearest available standard tower diameter
D=12 inches

STEP 4-Calculate tower height H_t

$H_t=Z + TB + TT + IDH$ where;

Z= 15 ft; Packing Depth from analysis rounded off to nearest one half foot
TB= 4.0 ft; Tower Bottom fixed height below packing support grate
TT=0.5 ft; Height allowed for top section and demister
IDH= 0.29 ft = $(D/(2\sqrt{3}))/12$ ft; Influent Distributer Height based on 120 degree spray nozzle pattern

$H_t=15 + 4.0 + 0.5 + 0.29$ ft

$H_t=19.79$ ft

Select the standard tower height nearest to H_t; Use a 20 ft tower.

STEP 5-Calculate total pressure drop P

$P=Z \times \Delta P$

$P=15 \times 0.199$

P=2.99 inches H_2O +0.25 inches for demister=3.24 inches H_2O

STEP 6 Calculate Blower Air Flow, A
where Wcfm = Wgpm/7.481
Wcfm=10/7.481=1.34
A=A/W ratio x Wcfm
A=150 x 1.34
A=200 cfm

STEP 7-Use blower chart to look up blower size selection using A(cfm) and P(in inches H_2O). Use a design margin of 30% to 100% in selecting the blower cfm versus pressure drop(ie, if 300 cfm is needed into 1" pressure drop then select blower for 300 cfm into 1.3" to 2"). Include an adjustable air cutoff so that the system may be set up at the proper operating point. The adjustable air flow can be used over the life of the system to periodically increase the flow as modest packing fouling or degradation occurs. The design margin can also be used to adjust for future system changes such as modest changes in water flow rate.

Final Design Summary

Tower Model-Nepcco Model 120-20
Tower Diameter 12 inches
Tower Height 20 ft
Packing Material-Tripac 1" dia
Packing Height 15 ft
Blower Unit- NYB 95JA or equivalent
Blower Motor 1.0 HP; 3450 rpm
Blower Output 200 cfm @ up to 5.1 inches H_2O

Project Manager: J. Bowen

Reviewed by: J S Reese Date 8/7/90
J.S. Reese, P.E. #9846

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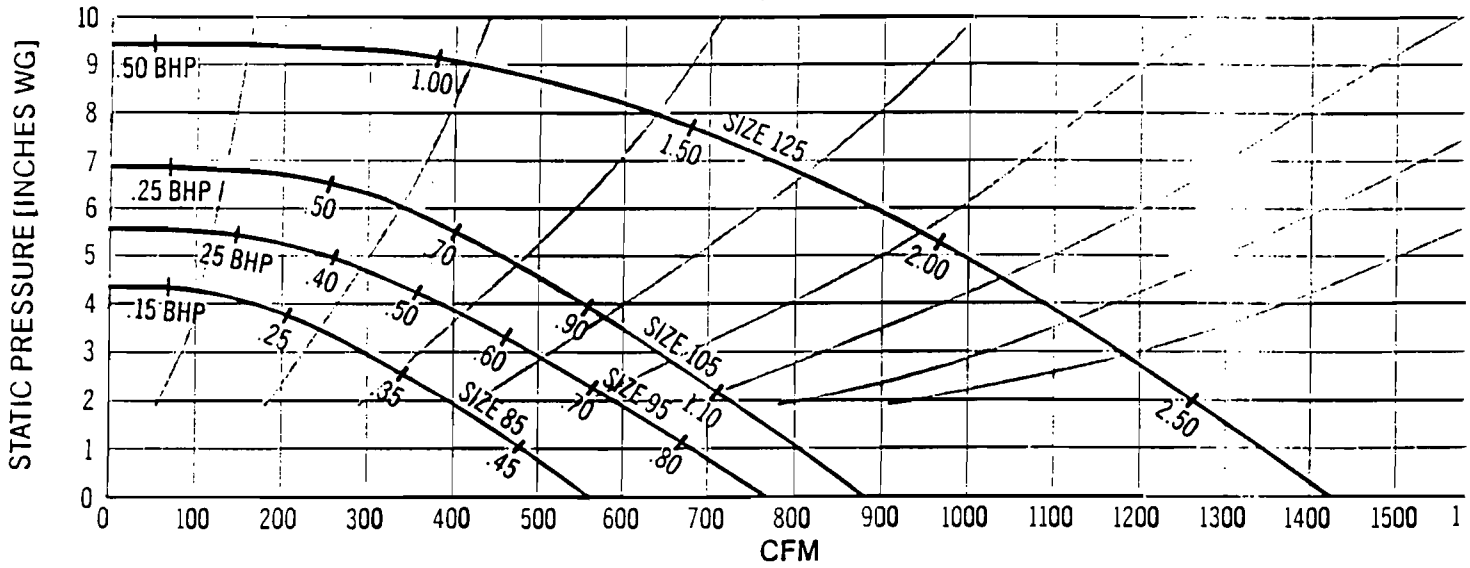
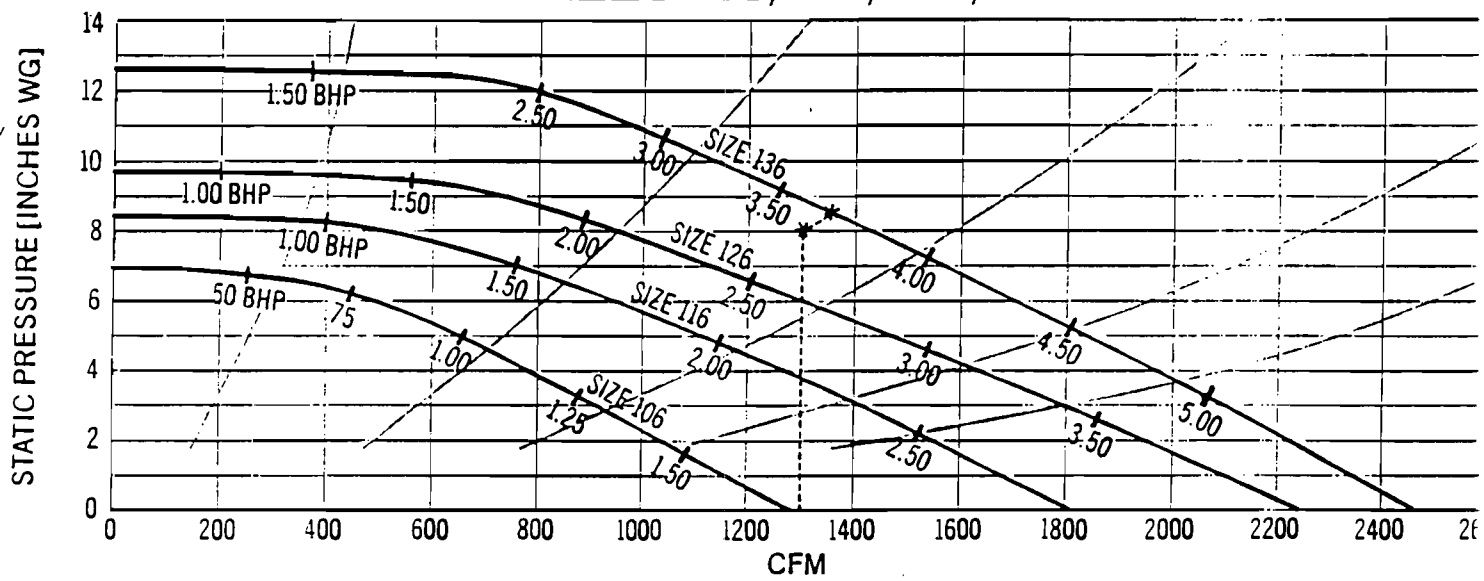
DIRECT-DRIVE PERFORMANCE CURVES – 3500 RPM

CURVE SELECTION EXAMPLE: Select a fan for 1300 CFM at 8"SP. See dotted lines on lower graph. Aft locating point on grid for 1300 CFM at 8"SP, follow direction of background system curves to intersection with fa performance curve. In this system example, a Size 136 will deliver 1350 CFM and 8.3"SP with approximately 3.65 BH

SIZES 85, 95, 105, 125



SIZES 106, 116, 126, 136



DIRECT-DRIVE CAPACITY TABLE AT 3500 RPM

Model No.	HP	Inlet dia. OD	Outlet area sq. ft.	1"SP			2"SP			3"SP			4"SP			5"SP			6"SP			7"SP			8"SP		
				CFM	OV	BHP	CFM	OV	BHP	CFM	OV	BHP	CFM	OV	BHP	CFM	OV	BHP	CFM	OV	BHP	CFM	OV	BHP	CFM	OV	BHP
85 HA	½	5	.103	485	4710	.45	394	3830	.38	297	2880	.31	173	1680	.22												
95 JA	1	6	.126	684	5430	.80	591	4690	.72	495	3930	.63	386	3060	.52	258	2050	.39									
105 JA	1	6	.126	–	–	–	–	–	–	643	5100	1.00	553	4390	.89	458	3640	.75	342	2710	.60						
105 KA	1½	6	.126	805	6390	1.20	726	5760	1.10	643	5100	1.00	553	4390	.89	458	3640	.75	342	2710	.60						
106 KA	1½	6	.203	–	–	–	1042	5130	1.44	912	4490	1.29	782	3850	1.13	652	3210	.98	496	2440	.80						
106 LA	2	6	.203	1167	5750	1.57	1042	5130	1.44	912	4490	1.29	782	3850	1.13	652	3210	.98	496	2440	.80						
125 LA	2	7	.158	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	896	5670	1.86	774	4900	1.65	624	3950	1.40
125 MA	3	7	.158	1344	8510	2.66	1263	7990	2.51	1182	7480	2.36	1097	6940	2.21	1005	6360	2.06	896	5670	1.86	774	4900	1.65	624	3950	1.40
116 LA	2	7	.255	–	–	–	–	–	–	–	–	–	–	–	–	1122	4400	2.00	961	3770	1.77	776	3040	1.50	493	1930	1.11
116 MA	3	7	.255	1694	6640	2.70	1555	6100	2.53	1417	5560	2.37	1278	5010	2.19	1122	4400	2.00	961	3770	1.77	776	3040	1.50	493	1930	1.11
126 MA	3	8	.255	–	–	–	–	–	–	–	–	–	–	–	–	1459	5720	2.87	1305	5120	2.63	1139	4470	2.37	948	3720	2.10
126 NA	5	8	.255	2025	7940	3.75	1889	7410	3.53	1751	6870	3.31	1608	6310	3.09	1459	5720	2.87	1305	5120	2.63	1139	4470	2.37	948	3720	2.10
136 NA	5	8	.293	–	–	–	–	–	–	–	–	–	1968	6720	4.80	1839	6280	4.55	1701	5810	4.30	1566	5350	4.05	1426	4870	3.80

Performance shown is for Compact GI Fans with inlet and outlet ducts.

Air Stripper Design
Bibliography
Computer Program Documentation

HENRY'S LAW

In a gas/liquid system, a contaminant will partition itself between the gas and liquid phases. According to Henry's Law, the concentration of the contaminant in the gas above the solution is proportional to the concentration of the contaminant in the solution. Henry's Law is only valid for relatively dilute contaminant concentrations, and for systems which are at equilibrium. The proportionality constant, Henry's constant, is expressed in different forms, depending on the units chosen for expressing the contaminant concentrations. Throughout AIRSTRIP, we will use the following form:

A = H * C with
A = contaminant concentration in air (gram per cubic meter)
H = Henry's constant (dimensionless)
C = contaminant concentration in water (gram per cubic meter)

The following alternative form of Henry's Law is commonly encountered in the chemical literature:

pp = Ha * MF with
pp = partial pressure of contaminant in air (atmospheres)
Ha = Henry's constant (atmospheres)
MF = mole fraction of contaminant in solution (dimensionless)

This form of Henry's constant is related to the one used in AIRSTRIP by:

H = Ha / (Co * R * (T + 273.2)) = 0.219 * Ha / (T +273.2)
Co = molar density of water = 55.6 mole per liter
R = universal gas constant = 0.08206 liter.atm per mole.Kelvin
T= water temperature in degrees Celsius

Like all equilibrium constants, Henry's constant H is strongly influenced by temperature - H increases as the temperature rises. The relationship between H at two different temperatures is:

H2 = H1 * 10^{ [D / R] * [1 / (T1 + 273.2) - 1 / (T2 + 273.2)] }
H1 = H at temperature T1 (dimensionless)
H2 = H at temperature T2 (dimensionless)
D = enthalpy change upon dissolution in water (cal / mole)
R = universal gas constant; 1.987 cal / degrees Kelvin. mole
T = water temperature (degrees Celsius)

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EQUILIBRIUM CONDITIONS

In a countercurrent aeration tower, where water flows down form the top ar air is pumped up from the bottom, a mass balance on the contaminant yields:

Q(water) * [C(in) - C(out)] = Q(air) * [A(out) - A(in)]

where the C's and the A's are the water and air concentrations of the contaminant, and the Q's are the volumetric flow rates.

Ideally, the contaminant will be completely stripped, or C(out) = 0. The incoming air will be practically contaminant-free, or A(in) = 0. Also, at the top of the tower where outgoing air meets incoming water, the application c Henry's Law yields:

A(out) = H * C(in)

With these substitutions, the mass balance on the contaminant simplifies to

Q(water) = H * Q(air)

The above expression can be rearranged to:

H * (A/W ratio) = 1

where A/W ratio is the dimensionless volumetric air /water ratio. The term on the left side is also the expression for the stripping factor R.

This simple derivation is only valid for ideal, equilibrium conditions. In practical terms, it gives the minimum A/W ratio that will completely strip the contaminant from the water with an infinitely tall tower. In order to s a substantial fraction of the contaminant with a tower of reasonable height, higher A/W ratio (or stripping factor) will be required.

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STRIPPING FACTOR

The stripping factor R was previously defined by the expression:

$$R = H * (A/W \text{ ratio})$$

In the previous section dealing with "Equilibrium Conditions", R=1 was derived for the special case when the contaminant was totally stripped in an infinitely tall tower. If $R < 1$, complete stripping cannot occur, even with an infinitely tall tower. If $R > 1$, then complete stripping becomes possible with a tower of finite size.

In practice, complete stripping is seldom required and tower height is limited to a several meters. With these conditions, substantial stripping only becomes possible if $R > 2$. At $R < 2$, the stripping process is limited by the capacity of the air to carry the contaminant away.

When $R > 2$, however, there will be a point where little is to be gained with further increase of the A/W ratio, because stripping will be essentially complete. The ideal design condition, therefore, will exist with the stripping factor somewhere between 2 and the point of diminishing return.

With the more recently available high efficiency polypropylene packing materials such as Jaeger Tri-Packs and Lantec LANPAC, practical A/W ratios (cfm/cfm) vary from about 50:1 to 200:1. Above 200:1, the energy requirement for pumping the air makes the process significantly more expensive than at lower ratios. Since some contaminants can only be effectively stripped at A/W ratios > 200, tradeoffs are not always possible. The stripping factor is, therefore, limited by the practical A/W ratio. If the Henry's constant H is between about 0.02 and 1.00, the optimum R can be reached simply be adjusting the A/W ratio. If the Henry's constant H is higher than 1.00, then stripping will be essentially complete, even at very low A/W ratios.

If the Henry's constant H is less than about 0.02, the compound is not very volatile and stripping will become poorer with lower H. In these cases, the designer has no other option than to select the highest practical A/W ratio and to increase the tower height, or consider an alternative process.

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MASS TRANSFER EQUATION

The basic mass transfer equation for countercurrent aeration towers is:

$Z = HTU * NTU$ where Z = tower height
HTU = height of transfer units
NTU = number of transfer units

The following symbols will be used in its derivation:

Q = volumetric flow rate	H = Henry's constant
L = areal liquid loading rate	J = mass transfer rate per tower volume
w = unit mass of water	KLa = mass transfer rate constant
B = cross-sectional tower area	R = stripping factor
C = concentration in water	i = suffix denoting "in"
A = concentration in air	o = suffix denoting "out"
dz= infinitesimal height incr.	$ = suffix denoting "at equilibrium"

For any infinitesimal tower element of height dz, the mass transfer rate is:

$$J = [\ Q(water) * dC\ ] / [\ B * dz\ ]$$

For the same element, another expression for J is available from the concentration gradient across the water/air interface:

$$J = Kla * [\ C\$ - C\ ]$$

(C$ is the water concentration that would have been in equilibrium with the air at that point. The difference between C$ and the actual concentration C provides the driving force for the mass transfer.)

Setting these two expressions equal, and substituting L/w for Q(water)/B, yields the expression :

$$dz = \frac{L}{w * Kla} * \frac{dC}{(C\$ - C)}$$

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Integration of the left hand term across the tower height simply yields the overall tower height Z. The first factor on the right is unaffected by integration, because it contains nothing that varies over the tower height. This factor is called the HTU (height of transfer units).

The second factor on the right must be integrated between the concentration limits of the contaminant in the water, i.e. from C(in) to C(out). This integration will be developed in a moment. Once integrated, it is called the NTU (number of transfer units). The final expression for the mass transfer equation, in shorthand, becomes:

$$Z = HTU * NTU$$

To simplify the integrand in the expression for the NTU, the term C$ needs to be expressed as a function of the variable C. First apply Henry's Law at the element dz:

$$A = H * C\$$

Now take a mass balance from the bottom of the tower up to element dz:

$$Q(air) * (A - Ai) = Q(water) * (C - Co)$$

Eliminate A from these two expressions, set Ai = 0 (because the incoming air is contaminant-free), solve for C$, substitute into the integrand and integrate:

$$NTU = \frac{R}{R-1} * \ln\left\{ \frac{(R-1) * (Ci/Co) + 1}{R} \right\}$$

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TWO-FILM THEORY

The Whitman Two-film theory provides a conceptual basis for modeling mass transfer between a liquid and a gas. The bulk liquid and the bulk gas phases are turbulent, but where they meet, there are two laminar layers, one of each phase:

```
>>>>>>>>>>>>>>>>>>>>          !                    <<<<<<<<<<<<<<<<<<<<
>>>>turbulent>>>>>>  laminar  !  laminar  <<<<<turbulent<<<<<
>>>>  air  >>>>>>     air     !  liquid   <<<<<  liquid  <<<<<
>>>>>>>>>>>>>>>>>>>>          !                    <<<<<<<<<<<<<<<<<<<<
```

The transfer of a volatile contaminant from water to air, in terms of this theory, requires two distinctly different steps - diffusion through the lamin layer of water first, and then diffusion through the laminar air layer. The higher the diffusional resistance in either or both of the laminar layers, the lower the overall mass transfer rate.

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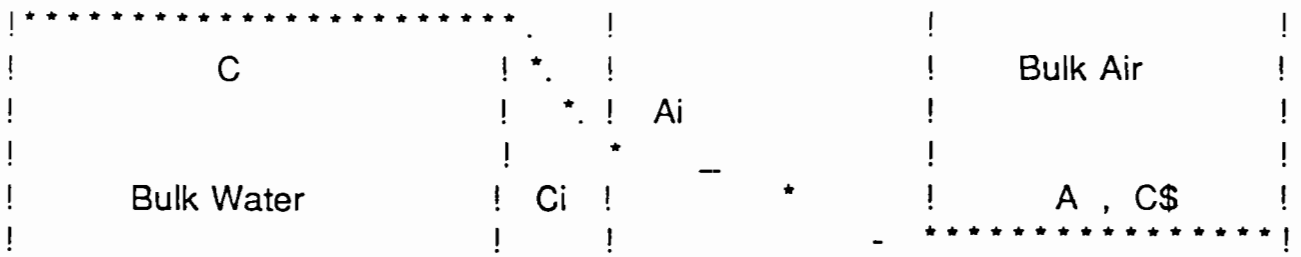
OVERALL MASS TRANSFER COEFFICIENT

In the mass transfer equation, the mass transfer coefficient appeared as the single term Kla. In reality, it reflects the combined effects of three quite different parameters, which are (1) the mass transfer properties of the laminar air layer, (2) the mass transfer properties of the laminar water film and (3) the total area of the air/water interface. In this section, the relationship between the overall mass transfer rate constant Kl and the mass transfer rate constants kl and kg (for the laminar water and air films, respectively) will be derived.

CONCENTRATION PROFILE ACROSS THE TWO-FILM INTERFACE



Three expressions for the mass transfer rate J follow from the concentration profile just given:

Through the water film	:	$J = kl * a * (C - Ci)$	..... (1)
Through the air film	:	$J = kg * a * (Ai - A)$	..... (2)
Through both films	:	$J = Kl * a * (C - C\$)$	..... (3)

From equations (1) and (3), the following expression can be derived:

$$kl * (C - Ci) = Kl * (C - Ci) + Kl * (Ci - C\$) \quad \text{..... (4)}$$

By applying Henry's Law at the interface, and in the bulk air, the following relationship is found:

$$(Ci - C\$) = (Ai - A) / H \quad \text{..... (5)}$$

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Combine equations (1) and (2) to find another expression for (Ai - A):

$$(Ai - A) = (C - Ci) * kl / kg \quad \text{..... (6)}$$

Substitute equation (6) into (5):

$$(Ci - C\$) = (C - Ci) * kl / (H * kg) \quad \text{..... (7)}$$

Substitute equation (7) into (4), cancel the (C - Ci) terms and divide through by (Kl * kl):

$$1 / Kl = 1 / kl + 1 / (H * kg) \quad \text{..... (8)}$$

Equation (8) is the final expression for combing the mass transfer rate constants of the water and air films into the overall mass transfer rate constant Kl.

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MODELING APPROACHES

The relationship between the different mass transfer rate constants was earlier derived as:

$$1 / Kl = 1 / kl + 1 / (H * kg)$$

For highly volatile contaminants (large H), the contribution of the air film rate constant kg is very small and may be safely ignored. If the contaminant is only slightly volatile (small H), the diffusional resistance in the air layer will obviously become more significant.

The SHERWOOD-HOLLOWAY relationship ignores the effects of the air film and estimates the overall mass transfer coefficient only on the basis of the diffusional resistance in the water film. It will work fine for the highly volatile contaminants, but falls short for the less volatile contaminants.

The ONDA and SHULMAN models are more explicit - they estimate kl, kg and the interfacial area a with three separate correlations, which can be combined into an overall mass transfer coefficient. These relationships are, therefore, valid for a wider range of contaminants, regardless of volatility. The SHULMAN model, however, uses a procedure for estimating the interfacial area which is not amenable to computer applications.

For the SHERWOOD-HOLLOWAY model, the properties of the tower packing are entered as a set of specially derived empirical packing constants, which makes it tough to apply it to a new type of packing. The ONDA and SHULMAN models use packing properties which are relatively easy to measure.

AIRSTRIP uses the ONDA correlations throughout. Their validity has been repeatedly verified by a number of studies reported in the environmental engineering literature. The model has emerged as a standard basis for countercurrent packed tower design.

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DESIGN TEMPERATURE

Temperature is the single most important factor affecting the performance of stripping towers. It has dramatic effects on two key variables - Henry's constant, and the mass transfer coefficient. The lower the temperature, the slower the mass transfer at the air/water interface. To be on the safe side, stripping towers should be designed for the coldest expected temperatures.

The derivation of the mass transfer equation implicitly assumed isothermal operation, i.e. both air and water remain at a common, constant temperature throughout the height of the tower. In practice, however, air and water enter the tower at different temperatures, and the water is cooled by its slight evaporation.

Simple thermodynamics allow us to estimate the effect of widely different air and water temperatures. The heat capacity of water is 75 kJ/mol.K, and that of air is 29 kJ/mol.K. A volumetric A/W ratio of 30 (a typical value for full-scale applications) is equivalent to a molar ratio of 0.024.

A heat balance then shows that there will be a 11 degree Celsius change in air temperature for every 0.1 degree Celsius change in water temperature. For even the widest conceivable difference in air and water temperatures, the final equilibrium temperature (assuming it could be reached in the tower) would be within 0.3 degrees Celsius of the incoming water temperature.

Evaporative cooling effects are also very small. At very low air temperatures (which are likely to occur during the critical winter months), the moisture-carrying capacity of air is also at its lowest.

For practical purposes, the critical design temperature can, therefore, be assumed to be equal to the coldest expected water temperature.

TRANSFER RATE CONSTANT IN AIR

The ONDA correlation for the mass transfer rate constant kg through the laminar air film is:

kg = CON * factor 1 * factor 2 * factor 3 * factor 4

CON = constant depending on packing size
factor 1 = { G / [a * vis(air)] } ^ (0.7)
factor 2 = { vis(air) / [den(air) * D(air)] } ^ (1/3)
factor 3 = { a * dp } ^ (-2)
factor 4 = { a * D(air) }

The explanation of symbols and their units appear below. This correlation was derived with various packing shapes in the gas flow range 0.014 to 1.7 kg/s.m^2, with packing sizes between 4 and 50 mm.

The following symbols were used in the above correlation :

kg	=	mass transfer rate constant	(m / s)
CON	=	5.23 if dp > 15 mm or larger	(-)
CON	=	2.00 if dp < 15 mm	(-)
den	=	density	(kg / m^3)
vis	=	absolute viscosity	(kg / m . s)
G	=	areal air loading rate	(kg / m^2 . s)
a	=	total specific packing area	(m^2 / m^3)
D	=	molecular diffusivity of contaminant	(m^2 / s)
dp	=	nominal packing size	(m)

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TRANSFER RATE CONSTANT IN WATER

The ONDA correlation for the mass transfer rate constant kl through the laminar water film is:

kl = 0.0051 * factor 1 * factor 2 * factor 3 * factor 4

factor 1 = { den(water) / [vis(water) * g] } ^ (-1/3)
factor 2 = { L / [aw * vis(water)] } ^ (2/3)
factor 3 = { vis(water) / [den(water) * D(water)] } ^ (-1/2)
factor 4 = { a * dp } ^ (2/5)

The explanation of symbols and their units appear below. This correlation wa derived from data collected with various packing shapes such as rings, spheres, rods and saddles. The nominal sizes ranged from 4 to 50 mm, and the liquid loading rate from 0.8 to 43 kg/s.m^2. The accuracy of the estimates is given as plus/minus 20%.

The following symbols were used in the above correlation:

kl	=	mass transfer rate constant	(m / s)
den	=	density	(kg / m^3)
vis	=	absolute viscosity	(kg / m . s)
g	=	gravitational acceleration	(9.81 m / s ^ 2)
L	=	areal liquid loading rate	(kg / m^2 . s)
a	=	total specific packing area	(m^2 / m^3)
aw	=	wetted specific packing area	(m^2 / m^3)
D	=	molecular diffusivity of contaminant	(m^2 / s)
dp	=	nominal packing size	(m)

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WETTED PACKING AREA

The ONDA correlation for the specific interfacial area (wetted packing area) is given by:

$$aw = a * \{ 1 - \exp [\text{factor 1} * \text{factor 2} * \text{factor 3} * \text{factor 4}] \}$$

$$\text{factor 1} = -1.45 * [\text{cst(packing)} / \text{st(water)}] ^ (3/4)$$
$$\text{factor 2} = \{ L / \{ a * \text{vis(water)}] \} ^ (0.1)$$
$$\text{factor 3} = \{ L^2 * a / [\text{den(water)}^2 * g] \} ^ (-0.05)$$
$$\text{factor 4} = \{ L^2 / [\text{den(water)} * \text{st(water)} * a] \} ^ (1/5)$$

The explanation of symbols and their units appear on the next screen. This correlation was derived for packing made of different materials such as ceramic, glass, plastic and wax-coated packing. The accuracy of the estimates is plus/minus 20%.

The following symbols were used in the above correlation:

aw	=	specific wetted packing area	(m^2 / m^3)
a	=	total specific packing area	(m^2 / m^3)
cst(packing)	=	critical surface tension	(kg / s^2)
st(water)	=	surface tension	(kg / s^2)
vis	=	absolute viscosity	(kg / m . s)
den	=	density	(kg / m^3)
L	=	areal liquid loading rate	(kg / m^2 . s)
g	=	gravitational acceleration	(9.81 m / s^2)

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MOLECULAR DIFFUSIVITY IN AIR

AIRSTRIP uses the estimation method published by Wilke and Lee:

$$D(air) = \frac{K * T^{(3/2)} * Mr^{(1/2)}}{P * CL^2 * CI}$$

D = molecular diffusivity (m^2/s)
K = 0.0001 * [0.00217 - 0.00050 * Mr^(1/2)]
T = air temperature (deg K)
Mr = 1 / 28.95 + 1 / Mw(contaminant)
Mw = molecular weight (gram/mol)
P = air pressure (atmospheres)
CL = characteristic length (also called collision radius)
CI = collision integral

The characteristic length is also known as the collision radius and is the arithmetic mean of the molecular radii of air and the contaminant:

CL = [Mr(air) + Mr(contaminant)] / 0.2 (CL in Angstrom)

Mr = molecular radius (nm or nanometer)
Mr(air) = 0.3711 (nm)

The molecular radius of the contaminant (in nm) is separately estimated:

Mr(contaminant) = 1.18 * [Vm^(1/3)]

VM = molal volume at boiling point (liter/mol)

The estimation of the collision integral is a multistep calculation:

CI = a / (Ts^b) + c / exp(Ts*d) + e / exp(Ts*f) + g / exp(Ts*h)

a = 1.06036	c = 0.19300	e = 1.03587	g = 1.76474
b = 0.15610	d = 0.47635	f = 1.52996	h = 3.89411

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Ts is a dimensionless intermediate parameter:

Ts = T / { [E(air) * E(contaminant)]^(1/2) }

T = air temperature (deg K)
E = function of molecular attraction and Boltzmann constant
E(air) = 78.6 (deg K)
E(contaminant) = 1.15 * Tb
Tb = boiling point of contaminant (deg K)

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MOLECULAR DIFFUSIVITY IN WATER

The molecular diffusivity in water can be calculated with a correlation developed by Wilke and Chang:

$$D(water) = 1.173 * 10^{(-16)} * \frac{(A * Mw)^{0.5} * (T + 273.2)}{vis(water * Vm^{0.6}}$$

D	=	molecular diffusivity, square meter per second
A	=	association parameter, dimensionless
	=	2.26 for water according to Hayduk and Laudie
Mw	=	molecular weight of water
	=	18 mole/liter
T	=	water temperature, degrees Celsius
vis	=	absolute viscosity, kilogram per meter.sec
Vm	=	molar volume of the contaminant as a liquid at boiling point, liter per mole

PHYSICAL PROPERTIES OF AIR

Density of atmospheric air (expressed in kilogram per cubic meter)

$$= \frac{1.293}{1 + 0.00367 * T} * \frac{P}{101.3}$$

Absolute viscosity of air (expressed in kilogram per meter . sec)

$$= 1.7 * 10^{-7} * (T + 273.2)^{0.818}$$

T = air temperature expressed in degrees Celsius
P = Ambient air pressure expressed in kiloPascal per square meter or kiloPascal

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PHYSICAL PROPERTIES OF WATER

Density of water (expressed in kilogram per cubic meter)

$$= \frac{999.84 + 16.945 * T - 7.9870 * 10^{-3} * T^2 - 4.6171 * 10^{-5} * T^3}{1 + 1.68799 * 10^{-2} * T}$$

Absolute viscosity of water (expressed in kilogram per meter.sec)

$$= 1.7868 * 10^{-3} - 5.8573 * 10^{-5} * T + 1.1951 * 10^{-6} * T^2 - 1.1146 * 10^{-8} * T$$

Surface tension of water (expressed in kilogram per second squared)

$$= 7.5583 * 10^{-2} - 1.3143 * 10^{-4} * T - 4.7616 * 10^{-7} * T^2$$

In all three cases, T is the water temperature expressed in degrees Celsius.

PROPERTIES OF TOWER PACKING

The NOMINAL PACKING SIZE roughly corresponds to the overall dimension of a packing piece and is ultimately determined by the manufacturer. AIRSTRIP does not consider nominal sizes smaller than 25 mm, because it is not practical.

The PACKING TYPE relates to the design of the packing, for example RASCHIG and Pall rings, TELLERETTES, BERL and INTALOX saddles, TRIPAC, etc.

The PACKING MATERIAL simply denotes what the packing is made of, and could be glass, ceramic, steel or plastic. AIRSTRIP limits itself to plastic (almost exclusively used for full-scale applications) and ceramic (sometimes used for laboratory studies).

The CRITICAL SURFACE TENSION determines the physical interaction between the packing and the water. It is a function of the packing material only, and not of the packing shape or size. AIRSTRIP uses the following values:

Plastic	0.033 kg/s^2
Ceramic	0.061 kg/s^2

the AIR FRICTION FACTOR determines the pressure gradient when air is pumped through the tower. It is a dimensionless parameter which is used in a standard graphical procedure for determining the air pressure gradient.

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AIR PRESSURE GRADIENT

The air pressure gradient through packed towers is normally read from a set empirical curves which are reproduced in a number of standard textbooks on chemical engineering. These curves are valid if the air pressure gradient is between 50 and 1200 Pa/m. The curves have recently been digitized into a s of equations, which is used in AIRSTRIP. The multistep computation is tedio and reversed, i.e. it treats the air pressure gradient as the independent variable. The air pressure gradient, therefore, is most easily calculated by iteration.

First calculate the intermediate values F, A0, A1 and A2:

```
F   =  log P                    (P is the air pressure gradient in Pa/m)
A0  =  -6.6599  +  4.3077*F  -  1.3503*F^2  +  0.15931*F^3
A1  =   3.0945  -  4.3512*F  +  1.6240*F^2  -  0.20855*F^3
A2  =   1.7611  -  2.3394*F  +  0.8991*F^2  -  0.11597*F^3
```

Calculate the intermediate value E from:

```
E   =  - log [ (A/W)  *  (S - S^2)^0.5 ]
```

```
A/W =  dimensionless volumetric air/water ratio
S   =  dimensionless air/water density ratio
```

Use the intermediate values A0, A1, A2 and E to calculate M:

```
M   =  10 ^ ( A0 + A1*E + A2*E^2 )
```

Calculate the air flow rate from:

```
Q(air) =  {M * [den(water) - den(air)] / [den(air)*Cf*vis(water)^0.1]} ^ 0.5
```


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The symbols and units in the equation on the preceding page are:

Q(air)	=	mass air loading rate, kg/m^2.s
M	=	intermediate value, dimensionless
den	=	density kg/m^3
vis	=	viscosity kg/m.s
Cf	=	dimensionless air friction factor (see "packing properties")

The above calculation sequence is only valid within certain bounds:

1. The air pressure gradient must be between 50 and 1200 Pa/m,
2. (A/W) * (S - S^2)^0.5 must be less than 33, and
3. M must be greater than 0.0015.

THEORETICAL LIMITATIONS

AIRSTRIP is based on theory which is commonly and successfully used in practice. Some assumptions have been implicitly made in the earlier derivations that warrant explicit attention:

- The contaminant is entirely strippable. Some reports have indicated that there may be an unstrippable contaminant fraction, but no theoretical explanation has been advanced.

- The contaminant is unreactive. Some compounds, such as carbon dioxide or ammonia, maintain an equilibrium with other chemical species in the water. AIRSTRIP will not be applicable to these contaminants.

- The ONDA correlations are based on experimental data which was collected with packing 50mm and smaller. They appear to work fairly well for packing up to 75mm, but no explicit verification has been published.

AIRSTRIP Documentation (C) 1988
prepared by Nepcco Equipment Division

Air Stripper Design
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APPENDIX C

AIR STRIPPER ATMOSPHERIC EMISSIONS
Pt. of Tampa 1st Tower
Intermittent Operation (25 hrs/mnth)

FLOW RATE 10 (gpm)
STACK HEIGHT 25 (ft)

	CONCEN. (ppb)	1.25 S.F.	INFLUENT FLOW RATE (lbs/hrs)
BENZENE	420	525	2.60E-03
TOLUENE	2700	3375	1.69E-02
ETHYL BENZENE	470	587.5	2.90E-03
XYLENES	3400	4250	2.13E-02
MTBE	32000	40000	2.00E-01

	MAC (mg/m3)	AAC (mg/m3)
BENZENE	6.00E-04	2.08E-01
TOLUENE	3.80E-03	5.20E+01
ETHYL BENZENE	7.00E-04	3.02E+01
XYLENES	4.80E-03	3.02E+01
MTBE	4.48E-02	3.47E+01

DO THE IMPACTS FROM THE BENZENE CONTAMINANTS EXCEED THE "AAC" NO

DO THE IMPACTS FROM THE TOLUENE CONTAMINANTS EXCEED THE "AAC" NO

DO THE IMPACTS FROM THE ETHYL BENZENE CONTAMINANTS EXCEED THE "AAC" NO

DO THE IMPACTS FROM THE XYLENE CONTAMINANTS EXCEED THE "AAC" NO

DO THE IMPACTS FROM THE MTBE CONTAMINANTS EXCEED THE "AAC" NO

AIR STRIPPER ATMOSPHERIC EMISSIONS
Pt. of Tampa 2nd Tower
Intermittent Operation (25 hrs/mnth)

FLOW RATE 10 (gpm)
STACK HEIGHT 25 (ft)

	CONCEN. (ppb)	1.25 S.F.	INFLUENT FLOW RATE (lbs/hrs)
BENZENE	0.2	0.25	0.00E+00
TOLUENE	2.5	3.125	0.00E+00
ETHYL BENZENE	0.6	0.75	0.00E+00
XYLENES	3.8	4.75	0.00E+00
MTBE	524	655	3.30E-03

	MAC (mg/m3)	AAC (mg/m3)
BENZENE	0.00E+00	2.08E-01
TOLUENE	0.00E+00	5.20E+01
ETHYL BENZENE	0.00E+00	3.02E+01
XYLENES	0.00E+00	3.02E+01
MTBE	7.00E-04	3.47E+01

DO THE IMPACTS FROM THE BENZENE CONTAMINANTS EXCEED THE "AAC" NO

DO THE IMPACTS FROM THE TOLUENE CONTAMINANTS EXCEED THE "AAC" NO

DO THE IMPACTS FROM THE ETHYL BENZENE CONTAMINANTS EXCEED THE "AAC" NO

DO THE IMPACTS FROM THE XYLENE CONTAMINANTS EXCEED THE "AAC" NO

DO THE IMPACTS FROM THE MTBE CONTAMINANTS EXCEED THE "AAC" NO

AIR STRIPPER ATMOSPHERIC EMISSIONS
Pt. of Tampa 1st Tower
Continuous Operation

FLOW RATE 10 (gpm)
STACK HEIGHT 25 (ft)

	CONCEN. (ppb)	1.25 S.F.	INFLUENT FLOW RATE (lbs/hrs)
BENZENE	420	525	2.60E-03
TOLUENE	2700	3375	1.69E-02
ETHYL BENZENE	470	587.5	2.90E-03
XYLENES	3400	4250	2.13E-02
MTBE	32000	40000	2.00E-01

	MAC (mg/m3)	AAC (mg/m3)
BENZENE	6.00E-04	7.14E-03
TOLUENE	3.80E-03	1.78E+00
ETHYL BENZENE	7.00E-04	1.04E+00
XYLENES	4.80E-03	1.04E+00
MTBE	4.48E-02	1.19E+00

DO THE IMPACTS FROM THE BENZENE CONTAMINANTS EXCEED THE "AAC" NO

DO THE IMPACTS FROM THE TOLUENE CONTAMINANTS EXCEED THE "AAC" NO

DO THE IMPACTS FROM THE ETHYL BENZENE CONTAMINANTS EXCEED THE "AAC" NO

DO THE IMPACTS FROM THE XYLENE CONTAMINANTS EXCEED THE "AAC" NO

DO THE IMPACTS FROM THE MTBE CONTAMINANTS EXCEED THE "AAC" NO

AIR STRIPPER ATMOSPHERIC EMISSIONS
Pt. of Tampa 2nd Tower
Continuous Operation

FLOW RATE	10 (gpm)
STACK HEIGHT	25 (ft)

	CONCEN. (ppb)	1.25 S.F.	INFLUENT FLOW RATE (lbs/hrs)
BENZENE	0.2	0.25	0.00E+00
TOLUENE	2.5	3.125	0.00E+00
ETHYL BENZENE	0.6	0.75	0.00E+00
XYLENES	3.8	4.75	0.00E+00
MTBE	524	655	3.30E-03

	MAC (mg/m3)	AAC (mg/m3)
BENZENE	0.00E+00	7.14E-03
TOLUENE	0.00E+00	1.78E+00
ETHYL BENZENE	0.00E+00	1.04E+00
XYLENES	0.00E+00	1.04E+00
MTBE	7.00E-04	1.19E+00

DO THE IMPACTS FROM THE BENZENE CONTAMINANTS EXCEED THE "AAC"	NO
DO THE IMPACTS FROM THE TOLUENE CONTAMINANTS EXCEED THE "AAC"	NO
DO THE IMPACTS FROM THE ETHYL BENZENE CONTAMINANTS EXCEED THE "AAC"	NO
DO THE IMPACTS FROM THE XYLENE CONTAMINANTS EXCEED THE "AAC"	NO
DO THE IMPACTS FROM THE MTBE CONTAMINANTS EXCEED THE "AAC"	NO

APPENDIX D

CARBON POLISHING DESIGN

Given

EBCT Target = 15 min.
Flow Rate = 10 gpm
Carbon Density 27 lb/ft^3
Carbon Loading Rate = .074 lbs Phenol/lb Carbon[1]
Phenol Concentration 15,000 ppb

REQUIRED VOLUME

$$V = \frac{(15)\ (10)}{7.485} = 20.04\ ft^3$$

WEIGHT OF CARBON

(20.04) (27) = 541.08 lbs

Use 3-200 lbs 55 gallon canister in series,
Plus 1 for security

CARBON USEAGE

15,000 ppb = 15 ppm = 15 mg/l
15 mg/l (8.34) lbs/1,000,000 = $.125 \times 10^{-3}$

(.125 x 10^{-3} lb/gal) (10 gal/min) (60 min/hr) (24 hr/day) = 1.80 lb/day

$\frac{1.8}{.074}$ = 24.3 lbs/day

$\frac{165}{24.3}$ = 6.79 days of continuous usage per 55 gal canister

[1]source-verbal communication Chuck Parmele, IT Corporation (7/90)

APPENDIX E

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ABOVEGROUND HOLDING TANK SPECIFICATIONS - 25,000 GALS CAPACIT

The subject holding tank will be shop fabricated and shipp to the site for onsite erection. The tank will be an API-650 an UL-142 atmospheric holding tank that will be used for stora of treated waste water only. The tank will not conform to t RCRA requirements and will not have any spill containment. T following is the summary of the tank design specifications.

* Tank diameter, ft. = 13.5'
* Tank height, ft. = 24'
* Material of construction = 1/4 inch, A36 carbon steel
* Manholes = Two (2) required, top and side, 24 inch diameter each.
* Nozzles = Five (5) required, 150 lbs. flanged, locati as specified.
* Coating = zinc oxide - 11 primer on the outside
* Caged ladder = Ladder to be provided to have access t the top of the tank
* Inspection = Tank to be spot x-rayed.
* Stamp = API 650 or UL-142

Delivery will be 4-6 weeks from the date of orde Fabricator will provide shop drawings for approval prior fabrication. The tank will be installed on a concrete ring wa foundation as shown on the following page.

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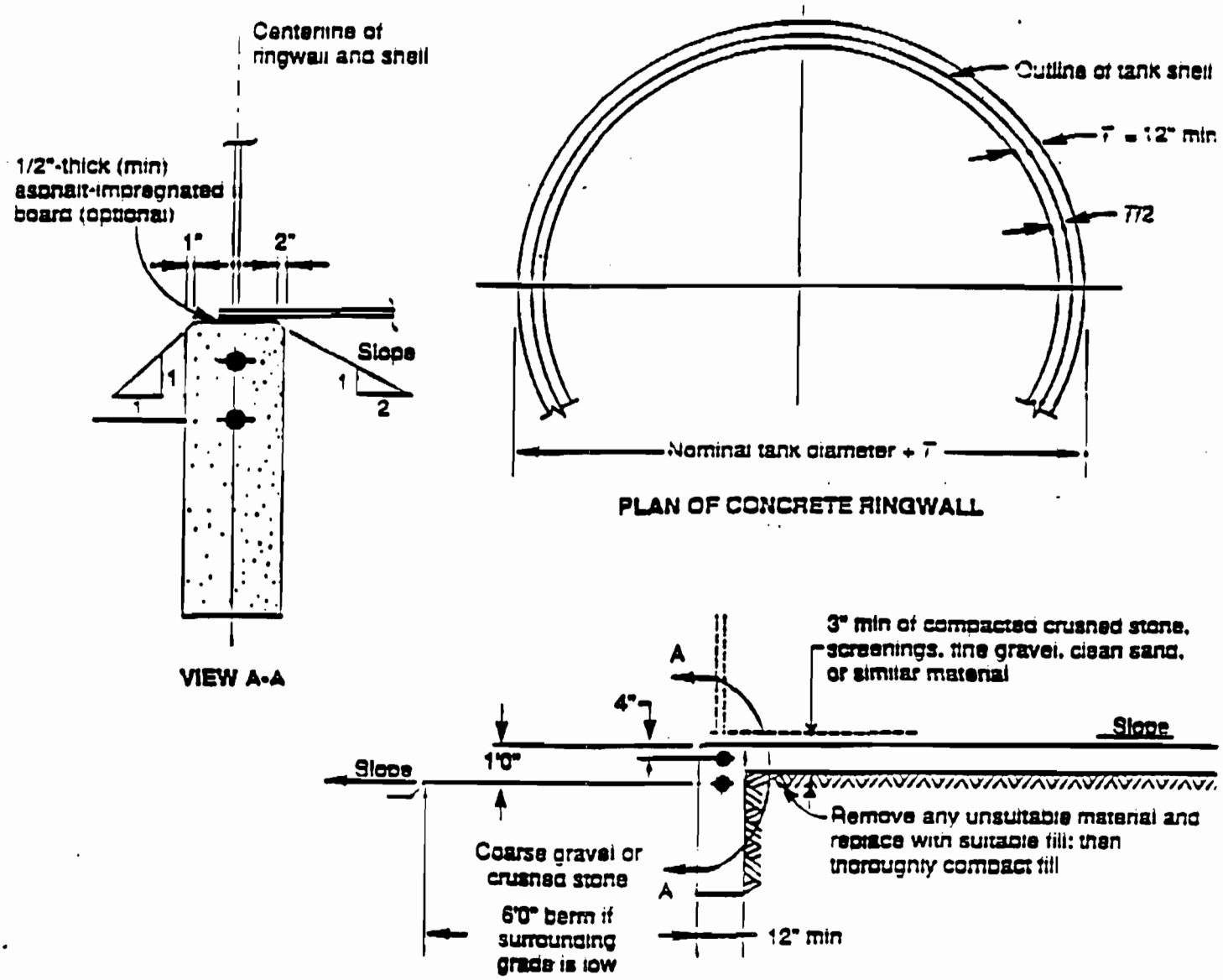
ABOVEGROUND HOLDING TANK SPECIFICATIONS - 25,000 GALS CAPACITY



The top of the concrete ringwall should be smooth and level. The concrete strength shall be at least 3000 pounds per square inch after 28 days. Reinforcement splices shall be lapped to develop full strength in the bond.

APPENDIX F

Cost Analysis for

Star Enterprise Bulk Storage Facility
Wastewater Treament System
Port Of Tampa, Florida

1) Skid	=$ 15,750
2) Tanks and Filters	=$ 26,564
3) Pumps and Motors	=$ 11,090
4) Panels, Power Boxes and Controllers	=$ 14,290
5) Instrumentation,Sensors, and Gauges	=$ 5,145
6) Above Ground Storage Tanks	=$ 45,000
7) Product Storage Tank	=$ 1,300
8) Other Process Design and Documentation	=$ 8,400
9) Installation	=$ 40,000
10) Miscellaneous	=$ 3,455
TOTAL	**=$171,000**