This document was scanned as it was received –

Illegible/difficult to view pages/tables/figures

Duplicate pages, out of order pages/missing pages

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY - UNDERGROUND STORAGE TANK DIVISION

DEQ

LEAKING UNDERGROUND STORAGE TANK CLOSURE REPORT

APR - 7 1997

INSTRUCTIONS: COMPLETION OF THIS REPORT WITH ALL APPLICABLE INFORMATION IS MANDATORY. The Certified Underground Storage Tank Professional (CP) MUST sign below. Failure to submit this report within the stated time period may result in Administrative Penalties as provided for in Part 213, Section 21321 of Act 451, P.A. 1994 as amended.

FACILITY NAME: T.C. Realty, Inc.	FACILITY ID NUMBER: 0-006304 #43731
ADDRESS: 1600 W. Eight Mile Road, Ferndale, MI COUNTY: Oakland	MERA SITE ID NUMBER:
DATE(S) RELEASE DISCOVERED: March 28, 1996	CONFIRMED RELEASE NUMBER(S): C-185-96
O/O NAME: As Above	MUSTFA CLAIM NUMBER:
O/O ADDRESS: As Above	
CONTACT PERSON: Mr. Jeff Norton	PHONE NUMBER: (810) 399-9600

ANSWER ALL QUESTIONS, (DO NOT LEAVE BLANKS):

1. Has the UST been emptied? ___ Yes _X_ No (If no, explain why): Fuel vendor error during dispensing of gasoline into USTs and secondary containment chamber (SCC) boot failure, UST system passes tightness testing. SCC's have been repaired.
2. Free product present: a. Currently? ___ YES _X_ NO If YES, total gallons recovered since last report:
   b. Previously? ___ YES _X_ NO If YES, total gallons recovered to date:
3. Have vapors been identified in any confined spaces (basement, sewers)? ___ YES _X_ NO
4. State the number of homes where drinking water is or was affected as a result of a release from this facility: NONE
5. Estimated distance and direction from point of release to nearest:
   a. Private well: NA b. Municipal well: NA c. Surface water/wetland: approximately 1 mile
6. Since last report: a. cubic yards of soil remediated: 0 b. gallons of groundwater remediated: 0
7. Totals to date: a. cubic yards of soil remediated: 90 b. gallons of groundwater remediated: 0
8. Michigan RBCA Site Classification (1-4): 4

CERTIFICATION OF REPORT COMPLETION

I, the undersigned CP, hereby attest to the best of my knowledge and belief that the statements in this document and all attachments are true, accurate and complete. I certify that it was submitted to the USTD on April 3, 1997 (date submitted-Required).

Stephen H. Manz — April 3, 1997
CP Original Signature - Required — Date

Joel E. Gagnon
PRINT QC Project Manager's Name

Stephen H. Manz
PRINT CP's Name

Swanson Environmental, A Braun Intertec Company
CONSULTANT

24156 Haggerty Road, Farmington Hills, MI 48335
ADDRESS

(810) 478-2700
TELEPHONE NO.

(810) 478-3819
FAX NO.

CERTIFICATION OF CLOSURE

1. Type of RBCA Evaluation: _X_ Tier 1 ___ Tier 2 ___ Tier 3
2. Closure report based on which type of land use?: _X_ Residential ___ Commercial III ___ Commercial IV ___ Industrial
3. Institutional Controls: _X_ None ___ Notice of Corrective Action ___ Restrictive Covenant

I certify under penalty of law that corrective actions associated with the above referenced release at this facility were completed in accordance with Part 213, Act 451, P.A. 1994 as amended, and current departmental guidance and procedures available at this time.

I further certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment for knowing violations.

Stephen H. Manz — April 3, 1997
CP Signature - Required — Date

PLEASE RETURN THIS COMPLETED REPORT AND ASSOCIATED ATTACHMENTS TO THE APPROPRIATE USTD DISTRICT OFFICE LISTED ON THE BACK OF THIS PAGE.

MAIL TO:

UNDERGROUND STORAGE TANK DIVISION ~~OFFICES AND LOCATIONS~~

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

Determine in which county the UST release occurred. Return all completed forms and associated reports to the USTD office listed next to that county in the following table. Addresses for the USTD offices are listed below.

COUNTY	USTD OFFICE	COUNTY	USTD OFFICE	COUNTY	USTD OFFICE	COUNTY	USTD OFFICE
Alcona	Grayling	Dickinson	Marquette	Lake	Grayling	Oceana	Grand Rapids
Alger	Marquette	Eaton	Shiawassee	Lapeer	Shiawassee	Ogemaw	Grayling
Allegan	Plainwell	Emmet	Grayling	Leelanau	Grayling	Ontonagon	Marquette
Alpena	Grayling	Genesee	Shiawassee	Lenawee	Jackson	Osceola	Grayling
Antrim	Grayling	Gladwin	Grayling	Livingston	Shiawassee	Oscoda	Grayling
Arenac	Grayling	Gogebic	Marquette	Luce	Marquette	Otsego	Grayling
Baraga	Marquette	Grand Traverse	Grayling	Mackinac	Marquette	Ottawa	Grand Rapids
Barry	Plainwell	Gratiot	Shiawassee	Macomb	SE Michigan	Presque Isle	Grayling
Bay	Saginaw-Bay	Hillsdale	Jackson	Manistee	Grayling	Roscommon	Grayling
Benzie	Grayling	Houghton	Marquette	Marquette	Marquette	Saginaw	Saginaw-Bay
Berrien	Plainwell	Huron	Saginaw-Bay	Mason	Grayling	Sanilac	Saginaw-Bay
Branch	Jackson	Ingham	Shiawassee	Mecosta	Grand Rapids	Schoolcraft	Marquette
Calhoun	Jackson	Ionia	Grand Rapids	Menominee	Marquette	Shiawassee	Shiawassee
Cass	Plainwell	Iosco	Grayling	Midland	Saginaw-Bay	St Clair	SE Michigan
Charlevoix	Grayling	Iron	Marquette	Missaukee	Grayling	St Joseph	Plainwell
Cheboygan	Grayling	Isabella	Saginaw-Bay	Monroe	SE Michigan	Tuscola	Saginaw-Bay
Chippewa	Marquette	Jackson	Jackson	Montcalm	Grand Rapids	Van Buren	Plainwell
Clare	Grayling	Kalamazoo	Plainwell	Montmorency	Grayling	Washtenaw	Jackson
Clinton	Shiawassee	Kalkaska	Grayling	Muskegon	Grand Rapids	Wayne	SE Michigan
Crawford	Grayling	Kent	Grand Rapids	Newaygo	Grand Rapids	Wexford	Grayling
Delta	Marquette	Keweenaw	Marquette	Oakland	SE Michigan		

CADILLAC OFFICE ROUTE #1 8015 MACKINAW TRAIL CADILLAC MI 49601 616-775-9727 (PHONE) 616-775-9671 (FAX)	**JACKSON OFFICE** 301 E LOUIS GLICK HIGHWAY JACKSON MI 49201 517-780-7900 (PHONE) 517-780-7855 (FAX)	**SAGINAW BAY OFFICE** 503 N EUCLID AVE SUITE 9 BAY CITY MI 48706 517-684-9141 (PHONE) 517-684-9799 (FAX)
GAYLORD OFFICE P0 BOX 667 GAYLORD MI 49735 517-732-3541 (PHONE) 517-732-0794 (FAX)	**MARQUETTE OFFICE** 1990 US 41 SOUTH MARQUETTE MI 49855 906-228-6561 (PHONE) 906-228-5245 (FAX)	**SHIAWASSEE OFFICE** 10650 BENNETT DR MORRICE MI 48857-9792 517-625-4600 (PHONE) 517-625-5600 (FAX)
GRAND RAPIDS OFFICE 350 OTTAWA ST NW GRAND RAPIDS MI 49503 616-456-5071 (PHONE) 616-456-1239 (FAX)	**PLAINWELL OFFICE** 1342 SR-89 SUITE B PLAINWELL MI 49080-1915 616-692-2120 (PHONE) 616-692-3050 (FAX)	**SE MICHIGAN OFFICE** 38980 SEVEN MILE RD LIVONIA MI 48152 313-953-0241 (PHONE) 313-953-0243 (FAX)
GRAYLING OFFICE 1955 NORTH I-75 BL GRAYLING MI 49738 517-348-6371 (PHONE) 517-348-8825 (FAX)	at this address	

UNDERGROUND STORAGE TANK DIVISION OFFICES AND LOCATIONS

Determine in which county the UST release occurred. Return all completed forms and associated reports to the USTD office listed next to that county in the following table. Addresses for the USTD offices are listed below.

COUNTY	USTD OFFICE	COUNTY	USTD OFFICE	COUNTY	USTD OFFICE	COUNTY	USTD OFFICE
Alcona	Grayling	Dickinson	Marquette	Lake	Grayling	Oceana	Grand Rapids
Alger	Marquette	Eaton	Shiawassee	Lapeer	Shiawassee	Ogemaw	Grayling
Allegan	Plainwell	Emmet	Grayling	Leelanau	Grayling	Ontonagon	Marquette
Alpena	Grayling	Genesee	Shiawassee	Lenawee	Jackson	Osceola	Grayling
Antrim	Grayling	Gladwin	Grayling	Livingston	Shiawassee	Oscoda	Grayling
Arenac	Grayling	Gogebic	Marquette	Luce	Marquette	Otsego	Grayling
Baraga	Marquette	Grand Traverse	Grayling	Mackinac	Marquette	Ottawa	Grand Rapids
Barry	Plainwell	Gratiot	Shiawassee	Macomb	SE Michigan	Presque Isle	Grayling
Bay	Saginaw-Bay	Hillsdale	Jackson	Manistee	Grayling	Roscommon	Grayling
Benzie	Grayling	Houghton	Marquette	Marquette	Marquette	Saginaw	Saginaw-Bay
Berrien	Plainwell	Huron	Saginaw-Bay	Mason	Grayling	Sanilac	Saginaw-Bay
Branch	Jackson	Ingham	Shiawassee	Mecosta	Grand Rapids	Schoolcraft	Marquette
Calhoun	Jackson	Ionia	Grand Rapids	Menominee	Marquette	Shiawassee	Shiawassee
Cass	Plainwell	Iosco	Grayling	Midland	Saginaw-Bay	St Clair	SE Michigan
Charlevoix	Grayling	Iron	Marquette	Missaukee	Grayling	St Joseph	Plainwell
Cheboygan	Grayling	Isabella	Saginaw-Bay	Monroe	SE Michigan	Tuscola	Saginaw-Bay
Chippewa	Marquette	Jackson	Jackson	Montcalm	Grand Rapids	Van Buren	Plainwell
Clare	Grayling	Kalamazoo	Plainwell	Montmorency	Grayling	Washtenaw	Jackson
Clinton	Shiawassee	Kalkaska	Grayling	Muskegon	Grand Rapids	Wayne	SE Michigan
Crawford	Grayling	Kent	Grand Rapids	Newaygo	Grand Rapids	Wexford	Grayling
Delta	Marquette	Keweenaw	Marquette	Oakland	SE Michigan		

CADILLAC OFFICE ROUTE #1 8015 MACKINAW TRAIL CADILLAC MI 49601 616-775-9727 (PHONE) 616-775-9671 (FAX)	**JACKSON OFFICE** 301 E LOUIS GLICK HIGHWAY JACKSON MI 49201 517-780-7900 (PHONE) 517-780-7855 (FAX)	**SAGINAW BAY OFFICE** 503 N EUCLID AVE SUITE 9 BAY CITY MI 48706 517-684-9141 (PHONE) 517-684-9799 (FAX)
GAYLORD OFFICE P0 BOX 667 GAYLORD MI 49735 517-732-3541 (PHONE) 517-732-0794 (FAX)	**MARQUETTE OFFICE** 1990 US 41 SOUTH MARQUETTE MI 49855 906-228-6561 (PHONE) 906-228-5245 (FAX)	**SHIAWASSEE OFFICE** 10650 BENNETT DR MORRICE MI 48857-9792 517-625-4600 (PHONE) 517-625-5000 (FAX)
GRAND RAPIDS OFFICE 350 OTTAWA ST NW GRAND RAPIDS MI 49503 616-456-5071 (PHONE) 616-456-1239 (FAX)	**PLAINWELL OFFICE** 1342 SR-89 SUITE B PLAINWELL MI 49080-1915 616-692-2120 (PHONE) 616-692-3050 (FAX)	**SE MICHIGAN OFFICE** 38980 SEVEN MILE RD LIVONIA MI 48152 313-953-0241 (PHONE) 313-953-0243 (FAX)
GRAYLING OFFICE 1955 NORTH I-75 BL GRAYLING MI 49738 517-348-6371 (PHONE) 517-348-8825 (FAX)		

TABLE OF CONTENTS

LIST OF ATTACHMENTS

(Include as Required and Check Box if Attached)

Attachments 1 - 6, 9 and 12 are to be submitted if applicable.

Attachments 7,8, 10, 11, 13 and 14 are found in the back of this document and should be completed and submitted when necessary to certify closure.

ATTACHMENT NUMBER		DESCRIPTION
1	☐	Schematic Drawing of the Remedial System
2	☐	Public Notification Document(s)
3	☐	Permission of Property Owner to File a Notice of Corrective Action
4	☐	Permission of Property Owner to File a Notice of Restrictive Covenant
5	X	Site Map Showing the Extent of the Former Soil Contamination and the Soil Verification Sampling Locations
6	X	Excavation Drawing Showing Soil Verification Sampling Locations
7	X	Data Table Showing All Soil Verification Sampling Results (Laboratory)
8	X	Comparison Table for Soil Verification
9	X	Site Map Showing the Extent of the Former Groundwater Contamination and the Groundwater Verification Sampling Locations
10	X	Data Table Showing All Groundwater Verification Sampling Results (Laboratory)
11	X	Comparison Table for Groundwater Verification
12	☐	Site Map Showing the Extent of the Former Other Media Contamination and the Other MediaVerification Sampling Locations
13	☐	Data Table Showing All Other Media Verification Sampling Results (Laboratory)
14	☐	Comparison Table for Other Media Verification
15	X	Final Assessment Report (Sections 4.1, 4.2, and 4.3)
16	X	Calculations Supporting Development of Tier 1 Enclosed-Space (Indoor) Vapor Inhalation RBSL for MTBE

1.0 PROJECT CHRONOLOGY

A. Date Confirmed Release Discovered:	**4 / 3 / 96**
B. Date Confirmed Release Report Submitted:	**4 / 3 / 96**
C. Date Initial Assessment Report Submitted:	**7 / 2 / 96**
D. Other Milestone Date *(Specify: _____)*:	____/____/____
E. Other Milestone Date *(Specify: _____)*:	____/____/____
F. Date Final Assessment Report Submitted:	____/____/____
G. Other Milestone Date *(Specify: _____)*:	____/____/____
H. Date Closure Report Submitted:	**4 / 3 / 97**

2.0 DE MINIMIS CLASSIFICATION

A. Was this a *de minimis* spill as defined in Section 324.21302(e)? ☐ Yes **X** No

NOTE: If "Yes", complete questions "B" and "C" below and only the following remaining sections of this Closure Report: 3.1, 3.2, 3.6, 4.1, and the Cover Sheet Certification.

B. Volume of soil remediated or disposed to date: **90 yds^3**
C. Disposal facility name(s) and location(s): **Browning Ferris Industries (BFI), Arbor Hills Landfill, 10690 Six Mile Road, Northville, Michigan, 48167.**

3.0 SUMMARY OF CORRECTIVE ACTION ACTIVITIES PERFORMED

Summarize the overall program and the primary components of the corrective action performed at the facility by addressing each project phase identified below ***that was relevant to this site and its remediation. Include a schematic drawing of the remedial system (Attachment No. 1).***

3.1 RELEASE REPORTING

A. List the source(s) of the release and the location(s) where contamination was first discovered: **Swanson was retained by T. C. Realty, Inc. to investigate the possibility of a release of fuel from the secondary containment chambers of the USTs after fuel and water were noticed in the chambers. Swanson collected a groundwater sample from the monitor well for the UST system and shallow soil samples surrounding the two containment chambers. The samples exhibited olfactory and PID evidence of contamination and a suspected release was reported on 3/29/96. Groundwater and soil samples were submitted for laboratory analysis. Laboratory results (BTEX & MTBE) for the groundwater and soil samples confirmed the release on 4/3/96.**

3.2 IMMEDIATE RESPONSE ACTION IMPLEMENTATION

A. Date Began:	**4 / 2 / 96**
B. Date Completed:	**4 / 12 / 96**

C. List the initial response actions performed (*excluding free product removal*): **Measured VOC concentrations in air in the utility tunnel beneath the building downgradient from the release and removed all accessible gasoline - impacted soils above and adjacent to USTs. These soils were disposed of off-site in a licensed, Type II landfill.**

3.3 FREE PRODUCT DISCOVERY AND REMOVAL

A. Was free product discovered? ☐ Yes **X** No

If "No", skip to Section 3.4; if "Yes", complete questions "B" through "G"

B. Date Free Product Discovered: _____/_____/_____
C. Date Free Product Reported to USTD: _____/_____/_____
D. Date Free Product Removal Began: _____/_____/_____
E. Date Free Product Removal Completed: _____/_____/_____
F. Briefly describe the approach used to remove or recover the free product: _____

G. Total Quantity of Free Product Recovered: _____ gallons

3.4 SITE ASSESSMENT ACTIVITIES

A. Date Initial Assessment Began: **4 / 2 / 96**
B. Date Initial Assessment Completed: **4 / 12 / 96**
C. Check the environmental media sampled and analyzed during this phase of investigation: (*Check all that apply*)

X Soil	☐ Air	☐ Sediments	☐ Other *Specify)*:
X Groundwater	☐ Surface Water	☐ Biota	_____

D. Briefly describe the sampling and analysis performed during the initial assessment phase for each medium checked above: **Fifteen soil samples were collected from the excavation and analyzed for BTEX and MTBE to verify the completeness of soil remediation and to assess the quality of soils remaining in the vicinity of the USTs.**

E. Date Final Assessment Began: _____/_____/_____
F. Date Final Assessment Completed: _____/_____/_____
G. Check the environmental media sampled and analyzed during this phase of investigation: (*Check all that apply*)

☐ Soil	☐ Air	☐ Sediments	☐ Other
☐ Groundwater	☐ Surface Water	☐ Biota	*(Specify)*:_____

3.4 SITE ASSESSMENT ACTIVITIES (Continued)

H. Briefly describe the additional sampling and analysis performed during the final assessment phase for each medium checked above: _____

_____

_____

_____

_____

_____

I. Briefly describe and explain any differences between the Work Plan submitted with the Initial Assessment Report and the site characterization work performed:_____

_____

_____

_____

_____

_____

3.5 SITE CLASSIFICATION

A. Date of Initial Classification: **7 / 2 / 96**

B. Initial Classification Level:

☐ Class 1 ☐ Class 2 ☐ Class 3 **X** Class 4

C. Date of Most Recent Reclassification *(if any)*: _____/_____/_____

D. Most Recent Reclassification Level:

☐ Class 1 ☐ Class 2 ☐ Class 3 ☐ Class 4

E. Briefly describe the justification for any reclassifications: _____

_____

_____

_____

3.6 TIERED EVALUATIONS AND CLEANUP GOALS

A. What levels of evaluation were performed for this site?
(*Check all that apply*)

X Tier I ☐ Tier II ☐ Tier III

B. If a Tier II or Tier III evaluation was performed, describe the most significant alternate assumptions, models, or site-specific information used in place of the default assumptions, models, or model parameters:_____

_____

_____

_____

_____

_____

3.6 TIERED EVALUATIONS AND CLEANUP GOALS (Continued)

C. What was the ultimate basis for the cleanup goals established for this facility? *(Check only those that apply)*

	ON-SITE			OFF-SITE		
	Soil	Groundwater	Other Media	Soil	Groundwater	Other Media
RESIDENTIAL	**X** Tier I ☐Tier II ☐Tier III	**X** Tier I ☐Tier II ☐Tier III	☐Tier II ☐Tier III	☐Tier I ☐Tier II ☐Tier III	☐Tier I ☐Tier II ☐Tier III	☐Tier II ☐Tier III
COMMERCIAL III	☐Tier I ☐Tier II ☐Tier III	☐Tier I ☐Tier II ☐Tier III	☐Tier II ☐Tier III	☐Tier I ☐Tier II ☐Tier III	☐Tier I ☐Tier II ☐Tier III	☐Tier II ☐Tier III
COMMERCIAL IV	☐Tier I ☐Tier II ☐Tier III	☐Tier I ☐Tier II ☐Tier III	☐Tier II ☐Tier III	☐Tier I ☐Tier II ☐Tier III	☐Tier I ☐Tier II ☐Tier III	☐Tier II ☐Tier III
INDUSTRIAL	☐Tier I ☐Tier II ☐Tier III	☐Tier I ☐Tier II ☐Tier III	☐Tier II ☐Tier III	☐Tier I ☐Tier II ☐Tier III	☐Tier I ☐Tier II ☐Tier III	☐Tier II ☐Tier III

NOTE: If the site meets the Tier I criteria without any corrective action and the release was *de minimus*, complete Sections 4.1, 4.2 and the Cover Sheet Certification

3.7 PUBLIC NOTICE

If implementation of the corrective action plan will result in anything other than unrestricted land use or unlimited resource use, notice must be provided to the public directly impacted by the release and the planned corrective action.

A. Will implementation of the corrective action plan result in any restrictions to land use or limitations on resource use? ☐ Yes **X** No

If "No", skip to Section 3.9; if "Yes", continue with question "B" below.

B. Describe all land use or resource use limitations associated with the implemented corrective action: _____

_____

_____

_____

_____

_____

C. Was USTD guidance used to establish the form and content of the Public Notice ? *(See Attachment No. 20 to the "Guidance Document for Risk-Based Corrective Action at Leaking Underground Storage Tanks".)* ☐ Yes ☐ No

D. If "No", provide an explanation:_____

_____

_____

_____

3.7 PUBLIC NOTICE (Continued)

E. Attach a copy of the public notification document(s) used to provide the required public notice. *(Include as Attachment No. 2.)*

F. Identify the individuals or segments of the public that were provided notice of the proposed land use restrictions or limitations to be placed on resource use: _____

_____

_____

_____

G. Describe the mechanism(s) by which the directly impacted public was notified:_____

_____

_____

_____

3.8 NOTICE OF CORRECTIVE ACTION, DECLARATION OF RESTRICTIVE COVENANT, AND OTHER RESTRICTIVE MECHANISMS

If the corrective action depends on the use of institutional controls or other land use restrictions, a Notice of Corrective Action (for corrective actions based on Tier I clean-up criteria with institutional controls or land use restrictions) or a Declaration of Restrictive Covenant (for corrective actions based on Tier II or III clean-up criteria with institutional controls or land use restrictions) must be recorded with the Register of Deeds for the County in which the site is located.

A. Does the corrective action depend on the use of institutional controls or other land use or resource use restrictions? ☐ Yes ☐ No

If "No", skip to Section 3.9; if "Yes", continue with question "B" below.

B. Was a Notice of Corrective Action as defined in Section 324.21310a(1) required as part of the corrective action? ☐ Yes ☐ No

If "No", skip to question "P"; if "Yes", continue with question "C" below.

C. Was USTD guidance used to establish the form and content of the notice? *(See Attachment No. 20 to the "Guidance Document for Risk-Based Corrective Action at Leaking Underground Storage Tanks").* ☐ Yes ☐ No

D. If "No", provide an explanation:_____

_____

_____

_____

_____

_____

3.8 NOTICE OF CORRECTIVE ACTION, DECLARATION OF RESTRICTIVE COVENANT, AND OTHER RESTRICTIVE MECHANISMS (Continued)

E. Date the Notice of Corrective Action was submitted to the USTD for approval: _____/_____/_____

F. Date of USTD approval of the Notice of Corrective Action: _____/_____/_____

G. Was the Notice of Corrective Action recorded with the Register of Deeds for the County in which the site is located? ☐ Yes ☐ No

H. If "No", provide an explanation; **then skip to question "P":**_____

If "Yes", provide the following:

I. Date Recorded: _____/_____/_____

J. County Where Site is Located: _____

K. Register of Deeds Contact Name: _____

L. Register of Deeds Telephone No.: _____

M. Person Filing: _____

N. Is the person filing the property owner? ☐ Yes ☐ No

O. If "No", attach a copy of the written permission for the filing from the property owner. *(Include as Attachment No. 3.)*

P. Was a Restrictive Covenant as defined in Section 324.21310a(2) required as part of the Corrective Action? ☐ Yes ☐ No

If "No", skip to question "II"; if "Yes", continue with question "Q" below.

Q. Was USTD guidance used to establish the form and content of the Declaration of Restrictive Covenant? *(See Attachment No. 20 to the "Guidance Document for Risk-Based Corrective Action at Leaking Underground Storage Tanks".)* ☐ Yes ☐ No

R. If "No", provide an explanation:_____

S. Date the Declaration of Restrictive Covenant was submitted to the USTD: _____/_____/_____

T. Date of USTD approval of the Declaration of Restrictive Covenant: _____/_____/_____

3.8 NOTICE OF CORRECTIVE ACTION, DECLARATION OF RESTRICTIVE COVENANT, AND OTHER RESTRICTIVE MECHANISMS (Continued)

U. Was the Declaration of Restrictive Covenant recorded with the Register of Deeds for the County in which the site is located? ☐ Yes ☐ No

V. If "No", provide an explanation:_____

_____

_____

_____

_____

If "Yes", provide the following:

W. Date Recorded: ____/____/____

X. County Where Site is Located: _____

Y. Register of Deeds Contact Name: _____

Z. Register of Deeds Telephone Number: _____

AA. Person Filing: _____

BB. Is the person filing the property owner? ☐ Yes ☐ No

CC. If "No", attach a copy of the written permission for the filing from the property owner. *(Include as Attachment No. 4.)*

Does the restrictive covenant include:

DD. Provisions that the restrictions run with the land? ☐ Yes ☐ No

EE. Provisions that restrictions are binding on the owner's successors, assigns, and lessees? ☐ Yes ☐ No

FF. Provisions that restrictions are binding until the USTD determines that the regulated substances no longer present an unacceptable risk? ☐ Yes ☐ No

GG. A survey and description of the property addressed by the corrective action plan? ☐ Yes ☐ No

HH. The scope of any land use or resource use restrictions? ☐ Yes ☐ No

II. Was an alternate mechanism to restrict exposure to regulated substances as defined in Section 324.21310a(3) associated with the Corrective Action? ☐ Yes ☐ No

If "No", skip to Section 3.9; if "Yes", continue with question "JJ" below.

JJ. Describe the alternate restrictive mechanism(s) associated with the corrective action. *(Check all that apply):*

☐ Ordinance prohibiting certain activities to control exposures to regulated substances. *(Specify the prohibited activity):* _____

_____

_____

_____

3.8 NOTICE OF CORRECTIVE ACTION, DECLARATION OF RESTRICTIVE COVENANT, AND OTHER RESTRICTIVE MECHANISMS (Continued)

☐ Other mechanism. *(Describe):*_____

_____

_____

_____

KK. Date other restrictive mechanism(s) was submitted to USTD for approval: _____/_____/_____

LL. Date of USTD approval of the alternative restrictive mechanism: _____/_____/_____

3.9 PERMITS

A. List all discharge permits required for the corrective action:

Type of Permit	Permit No.	Application Date	Approval Date

3.10 CORRECTIVE ACTIONS

A. Description of activities performed:
All gasoline-impacted vadose zone soil that could be removed without jeopardizing the integrity of the USTs or adjacent structures was excavated, transported off-site and disposed of at the BFI Arbor Hills Landfill._____

_____

B. Was the corrective action implemented as outlined in the Corrective Action Plan section of the Final Assessment Report? ☐ Yes **X** No

C. If "No", summarize the changes and provide justification for why these changes were necessary. (*Attach additional sheets, if necessary*): **Since the accessible gasoline-impacted soil from the release was excavated and disposed of off-site as an initial abatement measure and the BTEX and MTBE concentrations in the remaining soil are below the Tier 1 Residential clean-up criteria, a corrective action plan and a final assessment report were not applicable.**_____

3.11 PERFORMANCE MONITORING

A. Date Performance Monitoring Began: _____/_____/_____

B. Date Performance Monitoring Completed: _____/_____/_____

C. Describe the types of monitoring activities performed, and the media and parameters monitored:

_____

_____

_____

4.0 CLOSURE VERIFICATION SAMPLING

A. Date Corrective Action Plan Implemented: **4 / 10 / 96**

B. Date Corrective Actions Completed: **4 / 12 / 96**

4.1 VERIFICATION OF SOIL REMEDIATION

A. Was the MDEQ guidance document "Verification of Soil Remediation Guidance Document" (Attachment No. 25 of the "Guidance Document for Risk-Based Corrective Action at Leaking Underground Storage Tanks") used to prepare the soil verification sampling plan?

X Yes ☐ No

B. If "No", provide an explanation: _____

_____

_____

_____

C. If "Yes", under what category did the site fall? **X** "Small Site" ☐ "Medium or Large Site"

D. Describe the soil verification sampling strategy applied at the site by providing the following. *(Attach additional sheets, as necessary)*:

- Scaled site map (Attachment No. 5) which identifies the former extent of the soil contamination, and the soil verification sampling locations relative to existing site features. *(Multiple chemical contaminants and multiple sample depths should be addressed on the minimum number of site maps needed to convey the information with clarity and legibility).*

- For a corrective action involving excavation, a scaled drawing(s) (Attachment No. 6) showing the floor and walls of the excavation and the associated sampling locations. The drawing should also depict the subsurface stratigraphy, soil types, fractures, discolored soil locations, and adjoining conduits or potential migration pathways, as appropriate.

E. Describe how the number of samples collected for soil verification purposes was established: **The area of the release is classified as a small site (<10,890 square feet). The area of the excavation floor (420 square feet) required a minimum of two soil samples to verify soil remediation was complete. The total area of the sidewalls (817 square feet) required a minimum of five sidewall samples with at least one soil sample per sidewall to verify soil remediation was complete.**

F. List the analytical parameters used to verify the soil remediation:
Benzene, toluene, ethylbenzene, xylenes (BTEX) and methyl-tert-butyl-ether (MTBE)

G. Were all soil verification samples analyzed, preserved, and handled in accordance with the USTD guidance document entitled "Guidance for Parameters, Analytical Methods, Sample Handling, Quality Control, and Cleanup Limits for Petroleum Hydrocarbon Releases" (Attachment No. 12 of the "Guidance Document for Risk-Based Corrective Action at Leaking Underground Storage Tanks")? **X** Yes ☐ No

H. If "No", provide an explanation for any differences:

I. Attach data tables presenting the analytical results of all on-site and off-site soil verification sampling performed in the attached Laboratory Results table format (Attachment No. 7). Include all pertinent sample results submitted previously with the Initial Assessment Report or Final Assessment Report. *(NOTE: The USTD may request copies of the laboratory data sheets, chain of custody forms, and all available QA/QC information relating to these verification samples.)*

J. Attach a Comparison Table for Soil Verification (Attachment No. 8) to demonstrate that the established target cleanup levels have been attained in accordance with the applicable MDEQ/USTD closure guidance.

K. Total volume of soil remediated or disposed to date: **90 yds^3**

L. Disposal facility name(s) and location(s):
Browning Ferris Industries (BFI), Arbor Hills Landfill, 10690 Six Mile Road, Northville, MI 48167

4.2 VERIFICATION OF GROUNDWATER REMEDIATION

A. Was the USTD "Groundwater and Soil Closure Guidance" (Attachment No. 26 of the "Guidance Document for Risk-Based Corrective Action at Leaking Underground Storage Tanks") used to prepare the groundwater verification sampling plan? **X** Yes ☐ No

4.2 VERIFICATION OF GROUNDWATER REMEDIATION (Continued)

B. If "No", provide an explanation:_____

Describe the groundwater verification sampling strategy applied at the site by answering questions "C" through "G". *(Attach additional sheets, as necessary):*

C. Attach a scaled site map (Attachment No. 9) that identifies the former extent of the groundwater contamination and the groundwater verification sampling locations relative to existing site features. *(Multiple chemical contaminants and multiple aquifer/sample depths should be addressed on the minimum number of site maps needed to convey the information with clarity and legibility.)*

D. Describe how the sampling frequency and duration of sampling used for groundwater verification purposes was established: **Groundwater sampling was conducted during the various phases of site investigation/soil remediation. The groundwater monitor wells in the vicinity and downgradient of the release were sampled at least twice in less than a sixth month period with the exception of the newly installed monitor well, MW-C, directly downgradient of the USTs which was sampled once.**

E. List the analytical parameters used to verify the groundwater remediation, and the justification for their selection: **No groundwater remediation activities were conducted. Analytical parameters used to assess the quality of the on-site groundwater include BTEX, MTBE, and the trimethylbenzene isomers.**_____

F. Were all groundwater verification samples analyzed, preserved, and handled in accordance with the USTD guidance document entitled "Guidance for Parameters, Analytical Methods, Sample Handling, Quality Control, and Cleanup Limits for Petroleum Hydrocarbon Releases" (Attachment No. 12 of the "Guidance Document for Risk-based Corrective Action at Leaking Underground Storage Tanks")?

X Yes ☐ No

G. If "No", provide an explanation for any differences: _____

H. Attach data tables presenting the analytical results of all on-site and off-site groundwater verification sampling performed in the attached Laboratory Results table format (Attachment No. 10). Include applicable sample results submitted previously with the Initial Assessment Report or Final Assessment Report. *(NOTE: The USTD may request copies of laboratory data sheets, chain of custody forms, and all available QA/QC information relating to these verification samples.)*

I. Attach a Comparison Table for Groundwater Verification (Attachment No. 11) to demonstrate that the established target cleanup levels have been attained in accordance with the applicable MDEQ /USTD closure guidance.

4.2 VERIFICATION OF GROUNDWATER REMEDIATION (Continued)

For corrective actions involving the operation of a groundwater treatment system, answer questions "J" through "N". Otherwise, skip to question "O".

J. Were the target cleanup levels met for six consecutive months *(minimum of two quarterly samplings)* with the treatment system operating? ☐ Yes ☐ No

K. If "No", provide an explanation:_____

L. Were the sample results from all wells used for verification at or below the target cleanup levels for a full year (*minimum of four quarterly samplings*) after the remedial system was turned off? ☐ Yes ☐ No

M. If "No", provide an explanation: _____

For corrective actions where no groundwater remediation was required, answer questions "O" through "P". Otherwise, skip to Section 4.3.

N. Total volume of groundwater remediated to date: **0 gallons**

O. Were the target cleanup levels met for at least one sampling event? ☐ Yes X No

P. If "No", provide an explanation: **Analytical results from the multiple groundwater sampling events from the monitor wells down and cross gradient from the USTs indicate concentrations of BTEX and the trimethylbenzene isomers in groundwater are below the Act 451 Part 201 generic residential clean-up criteria. MTBE is present in groundwater at a downgradient well (MW-15) at concentrations above the Tier 1 potable water RBSL but below the next restrictive RBSL for enclosed-space (indoor) vapor inhalation.**

Potable water is not an applicable RBSL for the site because the site and the surrounding areas within three miles utilize only city water provided via the City of Detroit. Based on U.S. EPA and MDEQ documents obtained by a FOIA request, there are no water supply wells within three miles of the site and no wetlands or sensitive environments within four miles of the site. The nearest surface waterbody to the site is a small pond in a cemetery located approximately one mile southwest of the site. No underlying aquifers could be impacted because boring logs for the site indicate an unconsolidated sand unit extends from the ground surface to about 20 feet below ground surface. The sand unit is reported to be underlain by approximately 127 feet of clay which overlies non water-bearing bedrock (shale) to a minimum depth of 561 feet. In addition, water supply wells of depths less than 25 feet and in areas where a shallow aquifer is not overlain by a confining layer are prohibited.

4.3 VERIFICATION OF REMEDIATION FOR OTHER MEDIA

A. Was the corrective action for this site implemented for any media other than soil or groundwater? ☐ Yes **X** No

4.3 VERIFICATION OF REMEDIATION FOR OTHER MEDIA (Continued)

If "Yes", continue with questions "B" through "J" answering each question in the series for each of the other environmental media remediated. If "No", complete the Cover Sheet Certification and quit.

B. What other environmental media were remediated as part of this corrective action? *(Check all that apply):*

☐ Air ☐ Sediments ☐ Other *(Specify)*:
☐ Surface Water ☐ Biota _____

Describe the verification sampling strategy applied at the site by providing the following information pertaining to each of the other media remediated. *(Attach additional sheets, as necessary.)*

C. Provide a scaled site or area map (Attachment No. 12) which identifies the former extent of the contamination in each of these other media and the verification sampling locations relative to existing site features and boundaries. *(Multiple chemical contaminants should be addressed on the minimum number of site or area maps needed to convey the information with clarity and legibility.)*

D. Describe how the sampling frequency and duration of sampling used for verification purposes in each of these other media was established: _____

_____
_____
_____
_____
_____

E. List the analytical parameters used to verify the specified remediation in each of these other media, and the justification for their selection: _____

_____
_____
_____
_____
_____

F. Were all verification samples associated with each of these other media analyzed, preserved, and handled in accordance with the USTD guidance document entitled "Guidance for Parameters, Analytical Methods, Sample Handling, Quality Control, and Cleanup Limits for Petroleum Hydrocarbon Releases" (Attachment No. 12 of the "Guidance Document for Risk-Based Corrective Action at Leaking Underground Storage Tanks" to the maximum extent possible)? ☐ Yes ☐ No

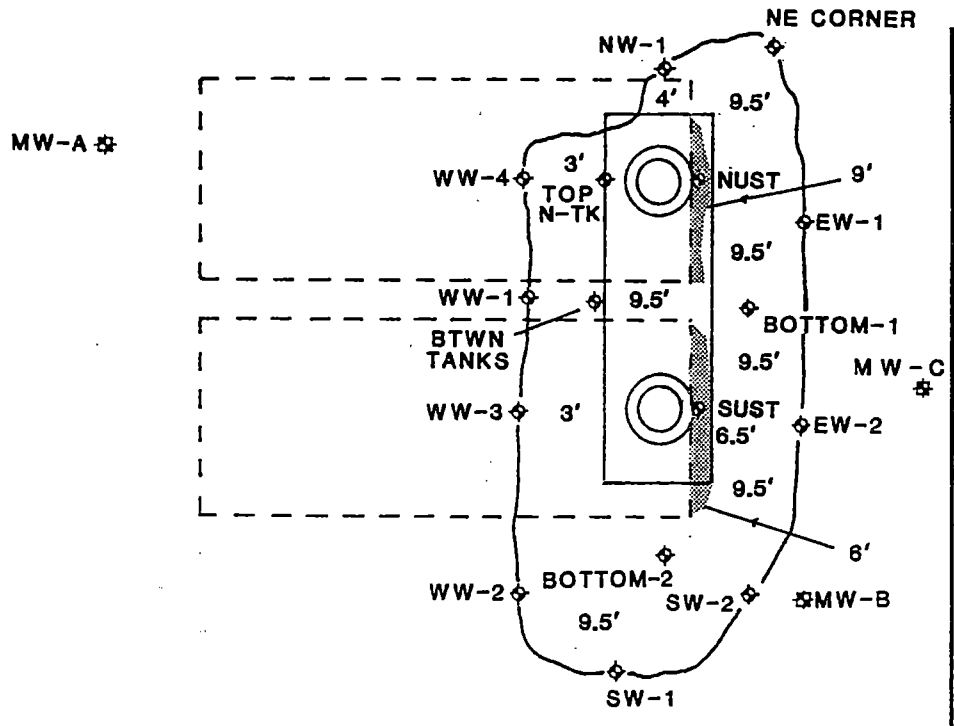
G. If "No", provide an explanation for any differences: _____

_____
_____
_____

H. Attach data tables presenting the results of all on-site and off-site verification sampling performed for each of these other media in the attached Laboratory Results table format (Attachment No. 13). Include applicable sample results submitted previously with the Initial Assessment Report or Final Assessment Report. *(NOTE: The USTD may request copies of laboratory data sheets, chain of custody forms, and all available QA/QC information relating to these verification samples.)*

I. Attach a Verification Comparison Table for each of the other remediated media (Attachment No. 14) to demonstrate that the established target cleanup levels have been attained in accordance with the applicable MDEQ /USTD closure guidance.

J. Estimated volume of each of the other specified media remediated, or treated or disposed to date *(specify units):*_____



LEGEND

- EXCAVATION SOIL SAMPLE LOCATION
- LIMIT OF EXCAVATION
- MONITOR WELL LOCATION
- RESIDUAL GASOLINE IMPACTED VADOSE ZONE SOILS

ALL DEPTHS ARE MEASURED BELOW SURFACE GRADE

0 NORTH 10
FEET

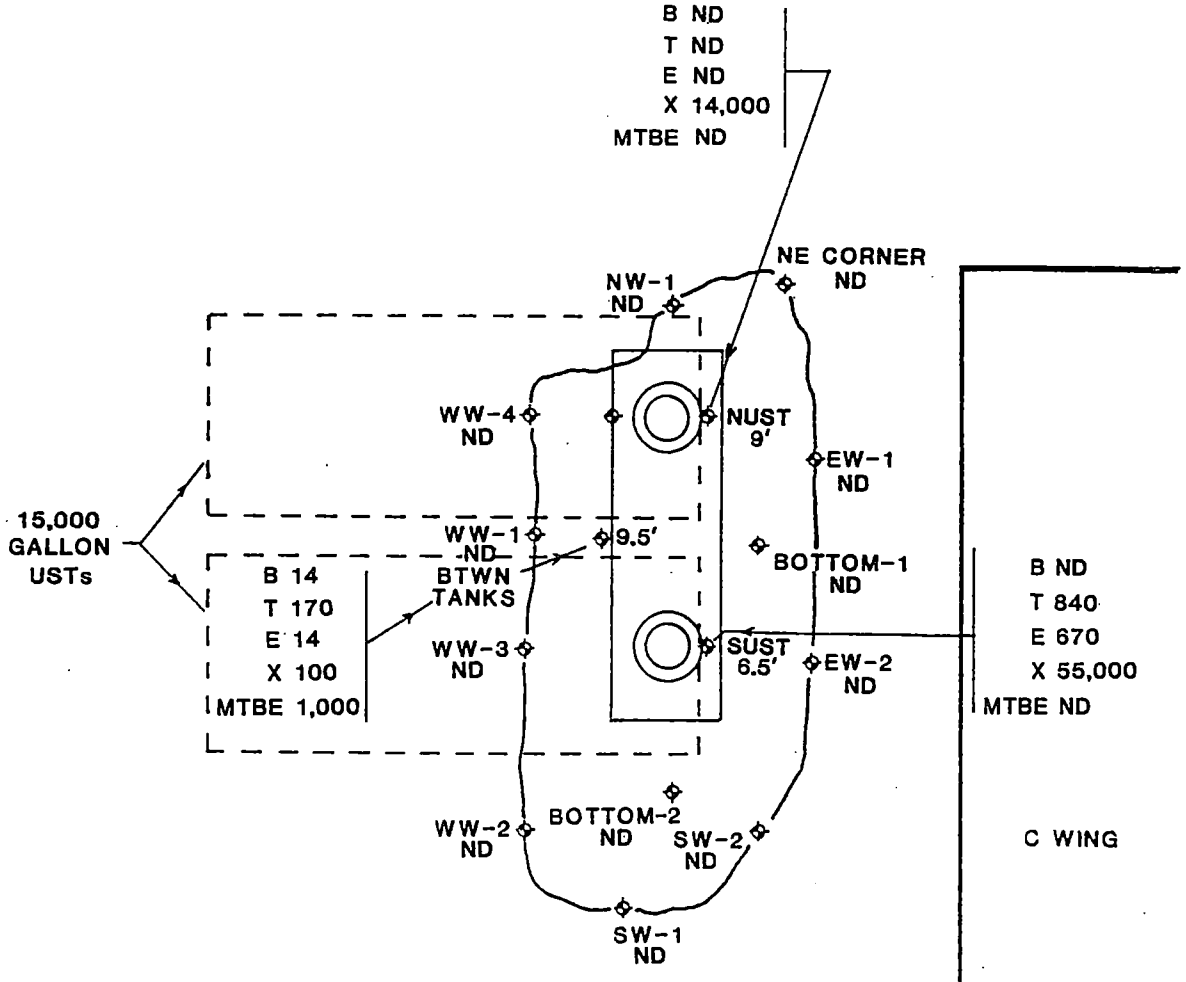
SWANSON ENVIRONMENTAL INC.

ATTACHMENT 5

APPROXIMATE AREAL EXTENT OF VADOSE ZONE CONTAMINATION

1600 WEST 8 MILE ROAD
FERNDALE, MICHIGAN

scale	1" = 10'	date drawn	5/2/96
drawn by	JZB	job no.	MH 8809



LEGEND

- EXCAVATION SOIL SAMPLE LOCATION
- LIMIT OF EXCAVATION
- MONITOR WELL LOCATION

ALL CONCENTRATIONS IN ug/kg (ppb)

ND NOT DETECTED

0 NORTH 10

FEET

SWANSON ENVIRONMENTAL INC.

ATTACHMENT 6

SOIL SAMPLE LOCATIONS AND RESIDUAL BTEX/MTBE CONCENTRATIONS

1600 WEST 8 MILE ROAD
FERNDALE, MICHIGAN

scale	1" = 10'	date drawn	5/2/96
drawn by	JZB	job no.	MH 8809

ATTACHMENT NO. 7

SOIL VERIFICATION SAMPLING RESULTS (LABORATORY)

FACILITY NAME T.C. Realty, Inc.

FACILITY NUMBER 0-006304

VOLATILES										
Sample ID	SW-1		SW-2		EW-1		WW-1		WW-2	
Sample Depth (feet BGS)	6		4		6		6		6	
Date Collected	4/11/96		4/11/96		4/11/96		4/11/96		4/1196	
Date Extracted	4/11/96		4/11/96		4/11/96		4/11/96		4/11/96	
Date Analyzed	4/11/96		4/11/96		4/11/96		4/11/96		4/17/96	
Analytical Method No.	8020		8020		8020		8020		8020	
Collection Method*	GS		GS		GS		GS		GS	
CONSTITUENT (ug/kg)	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL
X☐ Benzene	ND	10	ND	10	ND	10	ND	10	ND	10
X☐ Toluene	ND	10	ND	10	ND	10	ND	10	ND	10
X☐ Ethylbenzene	ND	10	ND	10	ND	10	ND	10	ND	10
X☐ Total Xylenes	ND	30	ND	30	ND	30	ND	30	ND	30
X☐ MTBE	ND	100	ND	100	ND	100	ND	100	ND	100
POLYNUCLEAR AROMATICS (PNAs)										
Sample ID										
Sample Depth (feet BGS)										
Date Collected										
Date Extracted										
Date Analyzed										
Analytical Method No.										
Collection Method*										
CONSTITUENT (ug/kg)	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL
☐ Acenaphthene										
☐ Acenaphthylene										
☐ Anthracene										
☐ Benzo(a)anthracene										
☐ Benzo(a)pyrene										
☐ Benzo(b)fluoranthene										
☐ Benzo(g,h,i)perylene										
☐ Benzo(k)fluoranthene										

BGS = Below Ground Surface

* Collection Method Codes: Grab Sample (GS), Hand Auger (HA)

MDL = Method Detection Limit

CLOSURE REPORT (Continued)

SOIL VERIFICATION SAMPLING RESULTS (LABORATORY)

FACILITY NAME T.C. Realty

FACILITY NUMBER 0-006304

VOLATILES										
Sample ID	WW-3		WW-4		NW-1		NE CORNER		BTWN TANKS	
Sample Depth (feet BGS)	3		3		3.2		5		9.5	
Date Collected	4/12/96		4/12/96		4/12/96		4/11/96		4/11/96	
Date Extracted	- -		- -		- -		4/11/96		4/11/96	
Date Analyzed	4/17/96		4/17/96		4/17/96		4/11/96		4/11/96	
Analytical Method No.	8020		8020		8020		8020		8020	
Collection Method*	GS		GS		GS		GS		GS	
CONSTITUENT (ug/kg)	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL
X☐ Benzene	ND	10	ND	10	ND	10	ND	10	14	10
X☐ Toluene	ND	10	ND	10	ND	10	ND	10	170	10
X☐ Ethylbenzene	ND	10	ND	10	ND	10	ND	10	14	10
X☐ Total Xylenes	ND	30	ND	30	ND	30	ND	30	100	30
X☐ MTBE	ND	100	ND	100	ND	100	ND	100	1000	100
POLYNUCLEAR AROMATICS (PNAs)										
Sample ID										
Sample Depth (feet BGS)										
Date Collected										
Date Extracted										
Date Analyzed										
Analytical Method No.										
Collection Method*										
CONSTITUENT (ug/kg)	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL
☐ Acenaphthene										
☐ Acenaphthylene										
☐ Anthracene										
☐ Benzo(a)anthracene										
☐ Benzo(a)pyrene										
☐ Benzo(b)fluoranthene										
☐ Benzo(g,h,i)perylene										
☐ Benzo(k)fluoranthene										

BGS = Below Ground Surface

* Collection Method Codes: Grab Sample (GS), Hand Auger (HA)

MDL = Method Detection Limit

CLOSURE REPORT (Continued)

SOIL VERIFICATION SAMPLING RESULTS (LABORATORY)

FACILITY NAME T.C. Realty, Inc.

FACILITY NUMBER 0-006304

VOLATILES										
Sample ID	BOTTOM-1		BOTTOM-2		NUST		SUST		EW-2	
Sample Depth (feet BGS)	9.5		9.5		9		6.5		6	
Date Collected	4/11/96		4/11/96		5/17/96		5/17/96		4/11/96	
Date Extracted	- -		- -		- -		- -		- -	
Date Analyzed	4/19/96		4/21/96		5/21/96		5/21/96		4/17/96	
Analytical Method No.	8020		8020		8020		8020		8020	
Collection Method*	GS		GS		GS		GS		GS	
CONSTITUENT (ug/kg)	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL
X☐ Benzene	ND	10	ND	10	ND	10	ND	10	ND	10
X☐ Toluene	ND	10	ND	10	ND	10	840	10	ND	10
X☐ Ethylbenzene	ND	10	ND	10	ND	10	670	10	ND	10
X☐ Total Xylenes	ND	30	ND	30	14000	30	55000	30	ND	30
X☐ MTBE	ND	100	ND	100	ND	100	ND	100	ND	100
POLYNUCLEAR AROMATICS (PNAs)										
Sample ID										
Sample Depth (feet BGS)										
Date Collected										
Date Extracted										
Date Analyzed										
Analytical Method No.										
Collection Method*										
CONSTITUENT (ug/kg)	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL
☐ Acenaphthene										
☐ Acenaphthylene										
☐ Anthracene										
☐ Benzo(a)anthracene										
☐ Benzo(a)pyrene										
☐ Benzo(b)fluoranthene										
☐ Benzo(g,h,i)perylene										
☐ Benzo(k)fluoranthene										

BGS = Below Ground Surface

* Collection Method Codes: Grab Sample (GS), Hand Auger (HA)

MDL = Method Detection Limit

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY - UNDERGROUND STORAGE TANK DIVISION

CLOSURE REPORT (Continued)

ATTACHMENT NO. 8

COMPARISON TABLE FOR SOIL VERIFICATION

FACILITY NAME T.C. Realty, Inc.

FACILITY NUMBER 0-006304

Contaminant	Number of Samples Taken	Range of Detected Concentrations [Min - Max] (ug/kg)	Maximum Detected (ug/kg)	Applicable RBSL or SSTL Criterion *[Specify Tier Level in ( )]* (ug/kg)		
				Residential	☐ Commercial III ☐ Commercial IV	Industrial
VOLATILES						
X☐ Benzene	15	ND -- 14	14	100 (1)	( )	( )
X☐ Toluene	15	ND -- 840	840	16,000 (1)	( )	( )
X☐ Ethylbenzene	15	ND -- 670	670	4700 (1)	( )	( )
X☐ Total Xylenes	15	ND -- 55,000	55,000	74,000 (1)	( )	( )
X☐ MTBE	15	ND -- 1000	1000	4800 (1)	( )	( )
POLYNUCLEAR AROMATICS (PNAs)						
☐ Acenaphthene		--		( )	( )	( )
☐ Acenaphthylene						
☐ Anthracene		--		( )	( )	( )
☐ Benzo(a)anthracene		--		( )	( )	( )
☐ Benzo(a)pyrene		--		( )	( )	( )
☐ Benzo(b)fluoranthene		--		( )	( )	( )
☐ Benzo(g,h,i)perylene						
☐ Benzo(k)fluoranthene		--		( )	( )	( )
☐ Chrysene		--		( )	( )	( )
☐ Dibenzo(a,h)anthracene		--		( )	( )	( )
☐ Fluoranthene		--		( )	( )	( )
☐ Fluorene		--		( )	( )	( )
☐ Indeno(1,2,3-cd)pyrene		--		( )	( )	( )
☐ Naphthalene		--		( )	( )	( )
☐ Phenanthrene						
☐ Pyrene		--		( )	( )	( )
METALS						
☐ Cadmium		--		( )	( )	( )
☐ Chromium III		--		( )	( )	( )
☐ Chromium VI		--		( )	( )	( )
☐ Total Lead		--		( )	( )	( )

ATTACHMENT NO. 8 (CONTINUED) PAGE 2 OF 2
COMPARISON TABLE FOR SOIL VERIFICATION

FACILITY NAME_____

FACILITY NUMBER_____

Contaminant	Number of Samples Taken	Range of Detected Concentrations [Min - Max] (ug/kg)	Maximum Detected (ug/kg)	Applicable RBSL or SSTL Criterion *[Specify Tier Level in ( )]* (ug/kg)		
				Residential	☐ Commercial III ☐ Commercial IV	Industrial
PCBs						
☐ Aroclor 1016		--		( )	( )	( )
☐ Aroclor 1221		--		( )	( )	( )
☐ Aroclor 1232		--		( )	( )	( )
☐ Aroclor 1242		--		( )	( )	( )
☐ Aroclor 1248		--		( )	( )	( )
☐ Aroclor 1254		--		( )	( )	( )
☐ Aroclor 1280		--		( )	( )	( )
HALOGENATED HYDROCARBONS						
☐ Carbon Tetrachloride		--		( )	( )	( )
☐ 1,1-Dichloroethane		--		( )	( )	( )
☐ 1,2-Dichloroethane		--		( )	( )	( )
☐ 1,1-Dichloroethylene		--		( )	( )	( )
☐ cis-1,2-Dichloroethylene		--		( )	( )	( )
☐ trans-1,2-Dichloroethylene		--		( )	( )	( )
☐ Tetrachloroethylene		--		( )	( )	( )
☐ 1,1,2-Trichloroethane						
OTHER*						
		--		( )	( )	( )
		--		( )	( )	( )
		--		( )	( )	( )
		--		( )	( )	( )
		--		( )	( )	( )
		--		( )	( )	( )
		--		( )	( )	( )

*List additional contaminants as appropriate

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY - UNDERGROUND STORAGE TANK DIVISION

CLOSURE ASSESSMENT REPORT (Continued)

ATTACHMENT NO. 10

GROUNDWATER VERIFICATION SAMPLING RESULTS (LAB)

FACILITY NAME T.C. Realty, Inc.

FACILITY NUMBER 0-006304

VOLATILES										
Sample ID	MW-A		MW-B		MW-C		MW-15		MW-25	
Sample Depth (feet BGS)	9.5 - 13.5		9.4 -14.5		9.5 - 14.5		8 -13		9 - 14	
Date Collected	10/7/96		10/7/96		10/10/96		10/7/96		10/7/96	
Date Extracted	- -		- -		- -		- -		- -	
Date Analyzed	10/14/96		10/14/96		10/14/96		10/15/96		10/15/96	
Collection Method*	BL		BL		BL		BL		BL	
Analytical Method No.	8260		8260		8260		8260		8260	
CONSTITUENT (ug/l)	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL
X Benzene	ND	5	ND	5	ND	5	ND	5	ND	5
X Toluene	ND	1	ND	1	ND	1	ND	1	ND	1
X Ethylbenzene	ND	1	ND	1	ND	1	ND	1	ND	1
X Total Xylenes	ND	3	ND	3	ND	3	ND	3	ND	3
X MTBE	ND	50	ND	50	ND	50	ND	50	ND	50
POLYNUCLEAR AROMATICS (PNAs)										
Sample ID										
Sample Depth (feet BGS)										
Date Collected										
Date Extracted										
Date Analyzed										
Collection Method*										
Analytical Method No.										
CONSTITUENT (ug/l)	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL
☐ Acenaphthene										
☐ Acenaphthylene										
☐ Anthracene										
☐ Benzo(a)anthracene										
☐ Benzo(a)pyrene										
☐ Benzo(b)fluoranthene										
☐ Benzo(g,h,i)perylene										
☐ Benzo(k)fluoranthene										
☐ Chrysene										
☐ Dibenzo(a,h)anthracene										

BGS=Below Ground Surface

D.L. = Detection Limit

* Collection Method Codes: Bailer (BL), Purge Pump (PP)

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY - UNDERGROUND STORAGE TANK DIVISION

CLOSURE REPORT (Continued)

ATTACHMENT NO. 10 (CONTINUED) PAGE 2 OF 4

GROUNDWATER VERIFICATION SAMPLING RESULTS (LAB)

FACILITY NAME T.C. Realty,Inc.

FACILITY NUMBER 0-006304

HALOGENATED HYDROCARBONS										
☐ Tetrachloroethylene										
☐ 1,1,2-Trichloroethane										
OTHER *(Specify)*										
Sample ID	MW-A		MW-B		MW-C		MW-15		MW-25	
Sample Depth (feet BGS)	9.5 - 13.5		9.4 - 14.5		9.5 - 14.5		8 - 13		9 - 14	
Date Collected	10/7/96		10/7/96		10/10/96		10/7/96		10/7/96	
Date Extracted	- -		- -		- -		- -		- -	
Date Analyzed	10/14/96		10/14/96		10/14/96		10/15/96		10/15/96	
Collection Method*	BL		BL		BL		BL		BL	
Analytical Method No.	8260		8260		8260		8260		8260	
CONSTITUENT (ug/l)	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL
X 1,2,4-Trimethylbenzene	22	1	21	1	ND	1	ND	1	ND	1
X 1,3,5-Trimethylbenzene	ND	1	7	1	ND	1	ND	1	ND	1
☐										
☐										
☐										
☐										
☐										
☐										
☐										
☐										
☐										
☐										
☐										
☐										
☐										
☐										
☐										

BGS=Below Ground Surface

D.L. = Detection Limit

* Collection Method Codes: Bailer (BL), Purge Pump (PP)

MDL = Method Detection Limit

CLOSURE ASSESSMENT REPORT (Continued)

ATTACHMENT NO. 11 (CONTINUED) PAGE 2 OF 2
COMPARISON TABLE FOR GROUNDWATER VERIFICATION
FACILITY NAME T.C. Realty, Inc.
FACILITY NUMBER 0-006304

Contaminant	Number of Samples Taken	Sampling Frequency	Sampling Duration (months)	Range of Detected Concentrations for 6 Consecutive Months with Treatment System Operating [Min - Max] (ug/l)	Range of Detected Concentrations for 12 Months Following Treatment System Shutdown or With No Treatment [Min - Max] (ug/l)	Applicable Act 451 Part 201 Generic Groundwater Criterion *[Specify Tier Level in ( )]* (ug/l)		
						Residential	Commercia l	Industrial
PCBs								
☐ Aroclor 1016				--	--	( )	( )	( )
☐ Aroclor 1221				--	--	( )	( )	( )
☐ Aroclor 1232				--	--	( )	( )	( )
☐ Aroclor 1242				--	--	( )	( )	( )
☐ Aroclor 1248				--	--	( )	( )	( )
☐ Aroclor 1254				--	--	( )	( )	( )
☐ Aroclor 1280				--	--	( )	( )	( )
HALOGENATED HYDROCARBONS								
☐ Carbon Tetrachloride				--	--	( )	( )	( )
☐ 1,1-Dichloroethane				--	--	( )	( )	( )
☐ 1,2-Dichloroethane				--	--	( )	( )	( )
☐ 1,1-Dichloroethylene				--	--	( )	( )	( )
☐ cis-1,2-Dichloroethylene				--	--	( )	( )	( )
☐ trans-1,2-Dichloroethylene				--	--	( )	( )	( )
☐ Tetrachloroethylene				--	--	( )	( )	( )
☐ 1,1,2-Trichloroethane				--	--	( )	( )	( )
OTHER*								
X 1,2,4-Trimethylbenzene	1			--	ND -- 27	30 (1)*	( )	( )
X 1,3,5-Trimethylbenzene	1			--	ND -- 7	23 (1)*	( )	( )
☐				--	--	( )	( )	( )
☐				--	--	( )	( )	( )
☐				--	--	( )	( )	( )
☐				--	--	( )	( )	( )

* Enclosed-space (indoor) vapor inhalation RSBL not available, health-based drinking water RBSL provided.

ND - not detected

MDL = Method Detection Limit

CLOSURE REPORT (Continued)

ATTACHMENT NO. 10

GROUNDWATER VERIFICATION SAMPLING RESULTS (LAB)

FACILITY NAME T.C. Realty, Inc.

FACILITY NUMBER 0-006304

VOLATILES										
Sample ID	MW-C		MW-15		MW-15					
Sample Depth (feet BGS)	9.5 - 14.5		8 - 13		8 - 13					
Date Collected	12/5/96		12/5/96		12/13/96					
Date Extracted										
Date Analyzed	12/6/96		12/6/96		12/19/96					
Collection Method*	BL		BL		BL					
Analytical Method No.	8260		8260		602					
CONSTITUENT (ug/l)	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL
X Benzene	ND	5	ND	5	ND	5				
X Toluene	ND	1	ND	1	ND	1				
X Ethylbenzene	ND	1	ND	1	ND	1				
X Total Xylenes	ND	3	ND	3	ND	3				
X MTBE	ND	50	4900	50	4400	50				
POLYNUCLEAR AROMATICS (PNAs)										
Sample ID										
Sample Depth (feet BGS)										
Date Collected										
Date Extracted										
Date Analyzed										
Collection Method*										
Analytical Method No.										
CONSTITUENT (ug/l)	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL	Conc	MDL
☐ Acenaphthene										
☐ Acenaphthylene										
☐ Anthracene										
☐ Benzo(a)anthracene										
☐ Benzo(a)pyrene										
☐ Benzo(b)fluoranthene										
☐ Benzo(g,h,i)perylene										
☐ Benzo(k)fluoranthene										
☐ Chrysene										
☐ Dibenzo(a,h)anthracene										

MDL = Method Detection Limit

CLOSURE ASSESSMENT REPORT (Continued)

ATTACHMENT NO. 11

COMPARISON TABLE FOR GROUNDWATER VERIFICATION

FACILITY NAME T.C. Realty, Inc.

FACILITY NUMBER 0-006304

Contaminant	Number of Samples Taken	Sampling Frequency	Sampling Duration (months)	Range of Detected Concentrations for 6 Consecutive Months with Treatment System Operating [Min - Max] (ug/l)	Range of Detected Concentrations for 12 Months Following Treatment System Shutdown or With No Treatment [Min - Max] (ug/l)	Applicable RBSL or SSTL Criterion *[Specify Tier Level in ( )]* (ug/l)		
						Residential	Commercial	Industrial
VOLATILES								
X Benzene	1			--	ND	238 (1)*	( )	( )
X Toluene	1			--	ND	32,800 (1)*	( )	( )
X Ethylbenzene	1			--	ND	77,500 (1)*	( )	( )
X Total Xylenes	1			--	ND	>S (1)*	( )	( )
X MTBE	1			--	ND - 4900	2209000 (1) *	( )	( )
POLYNUCLEAR AROMATICS (PNAs)								
☐ Acenaphthene				--	--	( )	( )	( )
☐ Acenaphthylene								
☐ Anthracene				--	--	( )	( )	( )
☐ Benzo(a)anthracene				--	--	( )	( )	( )
☐ Benzo(a)pyrene				--	--	( )	( )	( )
☐ Benzo(b)fluoranthene				--	--	( )	( )	( )
☐ Benzo(g,h,i)perylene								
☐ Benzo(k)fluoranthene				--	--	( )	( )	( )
☐ Chrysene				--	--	( )	( )	( )
☐ Dibenzo(a,h)anthracene				--	--	( )	( )	( )
☐ Fluoranthene				--	--	( )	( )	( )
☐ Fluorene				--	--	( )	( )	( )
☐ Indeno(1,2,3-cd)pyrene				--	--	( )	( )	( )
☐ Naphthalene				--	--	( )	( )	( )
☐ Phenanthrene								
☐ Pyrene				--	--	( )	( )	( )
METALS - FILTERED								
☐ Cadmium				--	--	( )	( )	( )
☐ Chromium III				--	--	( )	( )	( )
☐ Chromium VI				--	--	( )	( )	( )
☐ Total Lead				--	--	( )	( )	( )

ND - not detected.

* Enclosed-space (indoor) vapor inhalation Tier 1 RSBL.

>S indicates that the selected risk level is not exceeded for all possible dissolved levels.

MDL = Method Detection Limit

ATTACHMENT NO. 15 (Page 1 0f 2)
TIER I RBSL/TIER II OR TIER III SSTL COMPARISON TABLE FOR GROUNDWATER
FACILITY NAME T.C. Realty, Inc.
FACILITY NUMBER 0-006304

X **Residential** ☐ **Commercial** ☐ **Industrial**

Exposure Codes
A. Potable **B. Groundwater/Surface Water Interface** **C. Enclosed-Space (indoor) Vapor Inhalation**

Contaminant	Sample ID with Maximum Detected Concentration	Corresponding Sample Date	Maximum Detected Concentration (ug/l)	Applicable Criterion with Exposure Code (ug/l)		Criterion Exceeded? (Yes or No)	
				Tier I RBSL	Tier II/III SSTL	Tier I RBSL	Tier II/III SSTL
VOLATILES							
X Benzene	MW-C, MW-15	12/5/96	ND	238 (C)		No	
X Toluene	MW-C, MW-15	12/5/96	ND	32,800 (C)		No	
X Ethylbenzene	MW-C, MW-15	12/5/96	ND	77,500 (C)		No	
X Total Xylenes	MW-C, MW-15	12/5/96	ND	>S (C)		No	
X MTBE	MW-15	12/5/96	4900	2,209,000 (C)		No	
POLYNUCLEAR AROMATICS (PNAs)							
☐ Acenaphthene							
☐ Acenaphthylene							
☐ Anthracene							
☐ Benzo(a)anthracene							
☐ Benzo(a)pyrene							
☐ Benzo(b)fluoranthene							
☐ Benzo(g,h,i)perylene							
☐ Benzo(k)fluoranthene							
☐ Chrysene							
☐ Dibenzo- (a,h)anthracene							
☐ Fluoranthene							
☐ Fluorene							
☐ Indeno(1,2,3-cd)pyrene							
☐ Naphthalene							
☐ Phenanthrene							
☐ Pyrene							

BGS = Below Ground Surface
** Footnote and define all Collection Method Codes used in this table: _____
MDL = Method Detection Limit
>S indicates that the selected risk level is not exceeded for all possible dissolved levels.

ATTACHMENT 15

Final Assessment Report
Sections 4.1,4.2, 4.3
Tier 1 RSBL Comparison Table for Soils
Tier 1 RSBL Comparison Table for Groundwater

T.C. Realty, Inc.
Facility Number 0-006304

4.1 CONFIRMATION OF EXPOSURE PATHWAYS AND SCENARIOS

A. Have any of the following site characteristics or conditions, transport mechanisms, exposure routes, or potential receptors at the site or the surrounding area been newly identified to be present or changed significantly in character since the submission of the Initial Assessment Report?

☐ Yes X No

B. If "Yes", check all that are newly identified or significantly changed since the submission of the Initial Assessment Report:

Site Characteristics or Conditions

- ☐ Neighboring Land Use or Local Zoning Changes
- ☐ New or Discontinued Uses of Groundwater At or Near the Site
- ☐ Changes in On-Site Facility Operations
- ☐ Construction of New Structures or Utilities At or Near the Site

Potential Transport Mechanism(s)

- ☐ Wind Erosion and Atmospheric Dispersion
- ☐ Volatilization and Atmospheric Dispersion
- ☐ Volatilization and Enclosed-Space Accumulation
- ☐ Leaching and Groundwater Transport
- ☐ Mobile Free-Liquid Migration
- ☐ Stormwater/Surface Water Transport
- ☐ Utility Corridors
- ☐ Other *(Specify)*: _____

Potential Exposure Route(s)

- ☐ Soil Ingestion
- ☐ Direct Contact of Soil with Skin
- ☐ Inhalation of Airborne Particulates
- ☐ Inhalation of Volatiles
- ☐ Potable Water Use
- ☐ Use of Non-Potable Water
- ☐ Other *(Specify)*: _____

Potential Receptor(s)

- ☐ Resident
- ☐ Commercial Worker III*
- ☐ Commercial Worker IV*
- ☐ Industrial Worker
- ☐ Construction Worker
- ☐ Sensitive Habitat
- ☐ Structures
- ☐ Utilities

4.1 CONFIRMATION OF EXPOSURE PATHWAYS AND SCENARIOS (Continued)

☐ Surface Waters ☐ Water Supply Wells ☐ Other *(Specify)*:_____

* As defined in Attachment No. 11 to the "Guidance Document for Risk-Based Corrective Action at Leaking Underground Storage Tanks"

C. For each item checked above, briefly describe the change and its potential impact on the selection of exposure route(s) and potential receptors for the Tier II or Tier III evaluation relative to the Tier I or Tier II evaluation included in the Initial Assessment Report (*use additional attached sheets, if necessary:*

_____
_____
_____

NOTE: A pathway must include three necessary elements:

1) *a source (e.g., contamination);*
2) *a mechanism by which the contamination can become available to result in exposures at the source or via migration to other locations (e.g., free product and contaminated groundwater movement along a buried utility corridor); and*
3) *an individual who may come into contact, ingest, or inhale the contamination at the point of exposure (e.g., a utility maintenance worker digging to repair the line).*

Examples include:

1. *inhalation of soils by an on-site construction worker*
2. *impacted soils leaching into potable ground water and being used by a nearby resident for drinking and bathing*
3. *inhalation of vapors resulting from the migration of free product by a neighboring industrial worker*
4. *groundwater discharging to wetlands*

D. List the most plausible potential residential exposure pathway(s) for the site: **None**

E. List the most plausible potential commercial exposure pathway(s) for the site: **None**

F. List the most plausible potential industrial exposure pathway(s) for the site: **As referenced on page 16 of the Closure Report, Swanson has evaluated the exposure pathway of inhalation of MTBE vapor in the adjacent building to the east. This exposure pathway, however, was not found to be an unacceptable risk to human health.**

G. List the most plausible potential sensitive habitat exposure pathway(s) for the site: **None**

4.2 JUSTIFICATION FOR ALTERNATE ASSUMPTIONS OR MODELING PARAMETER SELECTIONS

A. Has a site-specific Tier II or Tier III evaluation been conducted for this Final Assessment Report? ☐ Yes X No

B. If "Yes", identify and justify where alternate assumptions or site-specific information was used in place of the default assumptions as defined in Attachment No. 11 of the "Guidance Document For Risk-Based Corrective Action At Leaking Underground Storage Tanks". *(If a Tier II evaluation was performed and described in the Initial Assessment Report, explicitly indicate where different assumptions or site-specific information were used in this Tier II or Tier III evaluation and why the change was justified.)*

ASSUMPTION	DEFAULT TIER I OR PRIOR TIER II SELECTION	ALTERNATE SELECTION	JUSTIFICATION OR BASIS FOR SUBSTITUTION *(Attach sheets if needed)*

C. Include the calculations supporting the development of the relevant Tier I RBSLs and Tier II or Tier III SSTLs as Attachment No. 23.

4.3 IDENTIFICATION OF TIER I RISK-BASED SCREENING LEVELS OR TIER II / TIER III SITE-SPECIFIC TARGET LEVELS AND COMPARISON TO SITE DATA

A. For each contaminated medium, complete a Tier I RBSL / Tier II or Tier III SSTL Comparison Table (Attachment No. 5 for soil, Attachment No. 15 for groundwater and Attachment No. 21 for other media, as appropriate) by:

1. Checking the box associated with the applicable land use scenario;

2. Checking the boxes associated with the contaminants currently present at the site;

3. Entering the current maximum detected on-site or off-site concentration for each selected contaminant, along with the corresponding sample identification number and date of sampling;

4.3 IDENTIFICATION OF TIER I RISK-BASED SCREENING LEVELS OR TIER II / TIER III SITE-SPECIFIC TARGET LEVELS AND COMPARISON TO SITE DATA (Continued)

4. Entering the lowest applicable RBSL value from the Tier I Look-Up Tables (*refer to Attachment No. 11 of the "Guidance Document For Risk-Based Corrective Action At Leaking Underground Storage Tanks"*) for the specific exposure routes present and environmental medium being considered or a corresponding optional Tier II SSTL. *[NOTE: Include the exposure route code that identifies the basis for each applicable criterion noted. For example, 12 ug/kg (A) for a cleanup goal based on the direct contact with soil exposure route, and 12 ug/kg (B) for a cleanup goal based on the soil leaching to groundwater exposure route*];

5. Comparing the contaminant-specific maximum concentration to the corresponding RBSL or SSTL criterion; and

6. Identifying and recording whether or not there is an exceedence of the RBSL or the SSTL.

B. Tier I RBSL / Tier II or Tier III SSTL Comparison Tables are attached for the following *(Check all that apply):*

	ENVIRONMENTAL MEDIUM		
LAND USE	**SOIL**	**GROUNDWATER**	**OTHER** *(Specify)*
Residential	X	X	☐
Commercial III	☐	☐	☐
Commercial IV	☐	☐	☐
Industrial	☐	☐	☐

4.4 PROPOSED FOLLOW-UP ACTIVITIES

A. Based on the results of the Tier II or III evaluation, indicate the follow-up activities proposed for the site:

X	Site conditions do not exceed the relevant Tier I RBSLs or the calculated Tier II/ Tier III SSTLs do not rely on institutional controls	Proceed with site closure. **No further sections of Final Assessment Report need to be completed.**
☐	Site conditions exceed some or all of the relevant Tier I RBSLs or Tier II/Tier III SSTLs	Propose final corrective action to achieve Tier I RBSLs or Tier II/Tier III SSTLs. **Continue with Section 5.0.**

MICHIGAN DEPARMENT OF ENVIRONMENTAL QUALITY - UNDERGROUND STORAGE TANK DIVISION
FINAL ASSESSMENT REPORT (Continued)

ATTACHMENT NO. 5
TIER I RBSL/TIER II OR TIER III SSTL COMPARISON TABLE FOR SOILS
FACILITY NAME T.C. Realty, Inc.
FACILITY NUMBER 0-006304

X Residential ☐ **Commercial III** ☐ **Commercial IV** ☐ **Industrial**
Exposure Codes

A. Direct Contact **B. Soil Leaching to Potable Groundwater**

Contaminant	Sample ID with Maximum Detected Concentration	Corresponding Sample Date	Maximum Detected Concentration (ug/kg)	Applicable Criterion with Exposure Codes (ug/kg)		Criterion Exceeded? (Yes or No)	
				Tier I RBSL	Tier II/III SSTL	Tier I RBSL	Tier II/III SSTL
VOLATILES							
X Benzene	BTWN TANKS	4/11/96	14	100 (B)		No	
X Toluene	SUST	5/17/96	840	16000 (B)		No	
X Ethylbenzene	SUST	5/17/96	670	1500 (B)		No	
X Total Xylenes	SUST	5/17/96	55000	56000 (B)		No	
X MTBE	BTWN TANKS	4/11/96	1000	4800 (B)		No	
POLYNUCLEAR AROMATICS							
☐ Acenaphthene							
☐ Acenaphthylene							
☐ Anthracene							
☐ Benzo(a)anthracene							
☐ Benzo(a)pyrene							
☐ Benzo(b)fluoranthene							
☐ Benzo(g,h,i)perylene							
☐ Benzo(k)fluoranthene							
☐ Chrysene							
☐ Dibenzo-(a,h)anthracene							
☐ Fluoranthene							
☐ Fluorene							
☐ Indeno(1,2,3- cd)pyrene							
☐ Naphthalene							
☐ Phenanthrene							
☐ Pyrene							

MICHIGAN DEPARMENT OF ENVIRONMENTAL QUALITY - UNDERGROUND STORAGE TANK DIVISION

FINAL ASSESSMENT REPORT (Continued)

ATTACHMENT NO. 15 (Page 2 0f 2)

TIER I RBSL/TIER II OR TIER III SSTL COMPARISON TABLE FOR GROUNDWATER

FACILITY NAME T.C. Realty, Inc.

FACILITY NUMBER 0-006304

Contaminant	Sample ID with Maximum Detected Concentration	Corresponding Sample Date	Maximum Detected Concentration (ug/l)	Applicable Criterion with Exposure Code (ug/l)		Criterion Exceeded? (Yes or No)	
				Tier I RBSL	Tier II/III SSTL	Tier I RBSL	Tier II/III SSTL
METALS - FILTERED							
☐ Cadmium							
☐ Chromium III							
☐ Chromium VI							
☐ Total Lead							
PCBs							
☐ Aroclor 1016							
☐ Aroclor 1221							
☐ Aroclor 1232							
☐ Aroclor 1242							
☐ Aroclor 1248							
☐ Aroclor 1254							
☐ Aroclor 1280							
HALOGENATED HYDROCARBONS							
☐ Carbon Tetrachloride							
☐ 1,1-Dichloroethane							
☐ 1,2-Dichloroethane							
☐ 1,1-Dichloroethylene							
☐ cis-1,2-Dichloroethylene							
☐ trans-1,2-Dichloroethylene							
☐ Tetrachloroethylene							
☐ 1,1,2-Trichloroethane							
OTHER							
X 1,2,4-Trimethylbenzene	MW-C, MW-15	12/5/96	ND	27 (A)		No	
X 1,3,5-Trimethylbenzene	MW-C, MW-15	12/5/96	ND	7 (A)		No	

BGS = Below Ground Surface

** Footnote and define all Collection Method Codes used in this table: _____

MDL = Method Detection Limit

ATTACHMENT 16

Calculations Supporting Development
of
Tier 1 Enclosed-Space (Indoor) Vapor Inhalation
for MTBE

T.C. Realty, Inc.
Facility Number 0-006304

BRAUN SM
INTERTEC

GW enclosed-space (indoor) vapor inhalation
(non carcinogenic effects)

FROM ASTM E 1739-95

$$RBSL_{w\,(MTBE)}\left[\frac{mg}{l\text{-}H_2O}\right] = \frac{RBSL_{air}}{VF_{wesp}} \times 10^{-3}$$

$$= \frac{THQ \times RfD_i \times BW \times AT_n \times 10^3 \frac{ug}{mg}}{IR_{air} \times EF \times ED} \times 10^{-3} \frac{mg}{ug}$$

$$VF_{wesp}$$

$$= \frac{(1.0)(0.64)(70)(10950)(10^3)(10^{-3}}{(15)(350)(30)}$$

$$1.41 \times 10^{-6}$$

$$RBSL_{w\,MTBE} = 2209\ mg/L$$

where $RfD_{i\,MTBE} = 3\frac{mg}{m^3} \cdot 15\frac{m^3}{day} \cdot \frac{1}{70kg} = 0.64\frac{mg}{Kg\text{-}day}$

↑ from IRIS database, Oct 1993

BRAUN SM
INTERTEC

$$VF_{wesp} = \frac{H\left[\frac{D_{eff_{ws}} / L_{GW}}{ER\, L_B}\right]}{1+\left[\frac{D_{eff_{ws}} / L_{GW}}{ER\, L_B}\right]+\left[\frac{D_{eff_{ws}} / L_{GW}}{(D_{eff_{crack}} / L_{crack})\eta}\right]} \times 10^3 \frac{L}{m^3}$$

$$= \frac{0.0240\left[\frac{2.16\times10^{-3}/300}{(0.00014)(300)}\right]}{1+\left[\frac{2.16\times10^{-3}/300}{(0.00014)(300)}\right]+\left[\frac{2.16\times10^{-3}/300}{(5.66\times10^{-3}/15)\,0.01}\right]} \times 10^3$$

$$\boxed{VF_{wesp} = 1.41\times10^{-6} \frac{mg/m^3\text{-air}}{mg/L\text{-}H_2O}}$$

where

$$D_{eff_{ws}} = (h_{cap}+h_v)\left[\frac{h_{cap}}{D_{eff_{cap}}}+\frac{h_v}{D_s^{eff}}\right]^{-1}$$

$$= (5+295)\left[\frac{5}{5.76\times10^{-5}}+\frac{295}{5.66\times10^{-3}}\right]^{-1}$$

$$\boxed{D_{eff_{ws}} = 2.16\times10^{-3} \frac{cm^2}{s}}$$

BRAUN SM
INTERTEC

MTBE

MW = 88.15

$H = 5.87 \times 10^{-4}$ atm-m^3/mole @ 25°C

$$H' = \frac{H}{RT} = \frac{5.87 \times 10^{-4} \frac{\text{atm}-m^3}{\text{mole}} \cdot 10^6 \frac{cm^3}{m^3}}{\left(82.057 \frac{cm^3 \cdot \text{atm}}{{}^\circ K \text{ mole}}\right) 298\ {}^\circ K}$$

unitless Henry's Law Constant

$$= \frac{587}{2.45 \times 10^4}$$

$H' = 0.0240$ @ 25°C

$$D_{cap}^{eff} = D^{air} \frac{\theta_{a\,cap}^{3.33}}{\theta_T^2} + D^{wat} \frac{1}{H} \times \frac{\theta_{w\,cap}^{3.33}}{\theta_T^2}$$

$$= 7.23 \times 10^{-2} \frac{(0.038)^{3.33}}{(0.38)^2} + 5.95 \times 10^{-6} \frac{1}{0.0240} \times \frac{(0.342)^{3.33}}{(0.38)^2}$$

$$\boxed{D_{cap}^{eff} = 5.76 \times 10^{-5} \frac{cm^2}{s}}$$

$$D_{crack}^{eff} = D^{air} \frac{\theta_{a\,crack}^{3.33}}{\theta_T^2} + D^{Wat.} \frac{1}{H} \times \frac{\theta_{w\,crack}^{3.33}}{\theta_T^2}$$

$$= 7.23 \times 10^{-2} \frac{(0.26)^{3.33}}{(0.38)^2} + 5.95 \times 10^{-6} \frac{1}{0.0240} \frac{(0.12)^{3.33}}{(0.38)^2}$$

$$\boxed{D_{crack}^{eff} = 5.66 \times 10^{-3} \frac{cm^2}{s}}$$

$$D_s^{eff} = D^{air} \frac{\theta_{as}^{3.33}}{\theta_T^2} + D^{wat.} \frac{1}{H} \times \frac{\theta_{ws}^{3.33}}{\theta_T^2}$$

$$= 7.23 \times 10^{-2} \frac{(0.26)^{3.33}}{(0.38)^2} + 5.95 \times 10^{-6} \times \frac{1}{0.0240} \frac{(0.12)^{3.33}}{(0.38)^2}$$

$$\boxed{D_s^{eff} = 5.66 \times 10^{-3} \frac{cm^2}{s}}$$

BRAUN SM
INTERTEC

Fuller, Schettler and Giddings Method

$$D_{AIR} = \frac{10^{-3}\, T^{1.75} \sqrt{M_r}}{P\left(V_{AIR}^{1/3} + V_{MTBE}^{1/3}\right)^2}$$

$$= \frac{10^{-3}(298)^{1.75}\sqrt{0.0459}}{(1)\left[(20.1)^{1/3} + (144.74)^{1/3}\right]^2}$$

D	diffusion coefficient cm^2/s
T	temperature °K
M_r	reciprocal of reduced mass
p	pressure atm
V_{air}	molar volume for air
V_{MTBE}	molar volume for MTBE

$$D_{AIR} = 7.23 \times 10^{-2}\ cm^2/s$$

where:

$$M_R = \left(M_{AIR} + M_{MTBE}\right) / M_{AIR} M_{MTBE} = \frac{\left(28.97\frac{g}{mol} + 88.15\frac{g}{mol}\right)}{\left(28.97\frac{g}{mol}\right)\left(88.15\frac{g}{mol}\right)} = 0.0459\frac{mol}{g}$$

P = 1 atm T = 298°K

$V_{AIR} = 20.1\ cm^3/mol$

$V_{MTBE} \Rightarrow$ MTBE $C_5H_{12}O$

5 (C)	=	7 (16.5)
12 (H)	=	12 (1.98)
1 (O)	=	1 (5.48)
V_{MTBE}	=	$144.74\ cm^3/mol$

BRAUN SM
INTERTEC

Haydok and Laudie Method

D_W = diffusion coefficient cm^2/s

$$D_W = \frac{13.26 \times 10^{-5}}{\eta_{Water}^{1.14} V'^{0.589}_{MTBE}}$$

η = viscosity (cp) = 1.169 cp @ 14°C

V'_B = molar volume of MTBE
= 144.74 $cm^3/mole$

$$= \frac{13.26 \times 10^{-5}}{(1.169)^{1.14}(144.74)^{0.589}}$$

$$D_W = \frac{13.26 \times 10^{-5}}{(1.19)(18.73)}$$

$$= \frac{13.26 \times 10^{-5}}{22.29}$$

$$D_W = 5.95 \times 10^{-6} \ cm^2/s$$

REFERENCE: Lyman, W. J., Reehl, W. F., Rosenblatt, D. H., Handbook of Chemical Property Estimation Methods, McGraw Hill, New York, NY, 1982