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Analysis of the Occurrence and Statistics of Hazardous Materials Spill Incidents along Texas Highways and Suggestions for Mitigation of Transport-Related Spills to Receiving Waters

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16. Abstract:

The purpose of this report is to present results from research on the occurrence and distribution of hazardous materials spill incidents along Texas highways during the period of record from 2002–2006. In addition to the analysis of recorded incident data, a literature review and interpretation of methods for mitigating hazardous materials spills was conducted and the results are presented. Finally, a set of proposed design guidelines for implementing hazardous materials traps in three settings is presented. The first setting occurs where no requirement for detention or water-quality treatment is required, the second where detention is required but not water-quality treatment, and the third occurs where both detention and water-quality treatment are required.

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Transport Spill Containment for Texas Highways

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1. Introduction

The purpose of this section of the report is to establish the background for the project and to define project scope and objectives.

1.1. Project Background

Every year thousands of tons of hazardous materials are transported over Texas highways. The Bureau of Transportation Statistics (BTS) tracks and catalogues national and state shipment commodity codes. Tons of material transferred and ton miles for selected hazardous constituents transported in Texas during 2002 are listed on Table 1.1. Although Table 1.1 includes all modes of transport, BTS records indicate that approximately 96 percent of the commodities transported in Texas were conveyed by truck (either for-hire or private).

Table 1.1: Shipment characteristics by commodity for 2002 (Bureau of Transportation Statistics, 2004).

Commodity	Tons (thousands)	Ton-miles
Gasoline	190,490	26,997
Gaseous hydrocarbons	19,268	2,016
Fuel oils	103,736	10,302
Sodium hydroxide/potassium hydroxide	2,250	168
Cyclic hydrocarbons	16,296	2,739
Insecticides, rodenticides, fungicides, herbicides	–	344

Although hazardous materials can be gaseous, liquid, or solid, the main interest associated with the research reported herein is material in the liquid and solid forms that might become mobile under wet-highway conditions. Transporters of hazardous materials carry volumes ranging from a few gallons up to 10,000 gallons of materials or more. Hazardous material shipment by hazard class transported by trucks in 2002 as well as the percent of the commodity transported by trucks (Bureau of Transportation Statistics, 2004) is presented on Table 1.2.

In addition, every vehicle carries a small amount of hazardous materials. In particular, fuel and

Table 1.2: Amount of hazardous materials transported and percent transported by truck for 2002 (Bureau of Transportation Statistics, 2004).

Hazard Class	Tons (thousands)	Percentage
Class 1, Explosives	4,631	92.6
Class 2, Gases	96,895	45.4
Class 3, Flammable liquids	948,619	53
Class 4, Flammable solids	6,711	59.4
Class 5, Oxidizers and organic peroxides	9,870	77.9
Class 6, Toxic (poison)	2,255	26.7
Class 7, Radioactive materials	52	91
Class 8, Corrosive materials	51,385	56.7
Class 9, Miscellaneous dangerous goods	39,126	64.1

lubricants can be released in small amounts should the vehicle be involved in an accident. This is a component of the study to be addressed in the larger context of transport spills.

Although vehicular accidents can occur under any condition, wet-weather conditions provide the combination of poor visibility and reduced traction that exacerbate the probability of an accident. Reported national hazardous material incidents from 1983 to 2004 are shown on Figure 1.1, indicating highway incidents exceed all other incident modes (such as rail, air, and so forth); however, weather conditions at the time of the incident are not presented. Furthermore, wet-weather conditions provide the opportunity for liquid- and solid-phase hazardous materials to mobilize from the accident site and migrate to areas that present either a hazard to local residents, surrounding ecosystem, or an impact to surface- or ground-water resources.

Significant research resources were invested in stormwater management (stormwater pollution prevention plan, or SW3P) structures over the last 20 years or more (See, for example, Landphair and others, 2000). The focus of SW3P research was development of methods to mitigate transport of constituents from source areas to sensitive receiving waters during storm events. The intent of SW3P structures is to treat relatively slow moving, low-concentration constituents to reduce long-term degradation of receiving waters.

In the case of an accident involving hazardous materials, significantly different processes operate. An accident can cause the release of a substantial volume of material over a very short period of time. As such, the capability of standard stormwater management structures (best management practices, BMPs) to trap and treat such releases is insufficient and might be overwhelmed. In addition, a difference exists between the materials present during a spill incident and typical stormwater. Stormwater management structures are designed to trap and collect suspended material or immiscible liquids in the runoff whereas incident releases will typically consist of immiscible hazardous materials with loads that far exceed those normally associated with stormwater. Thus, the problem described by the problem statement for Project 0–5200 is acute and not addressed by structures associated with stormwater management. That is, the need addressed by Project 0–5200

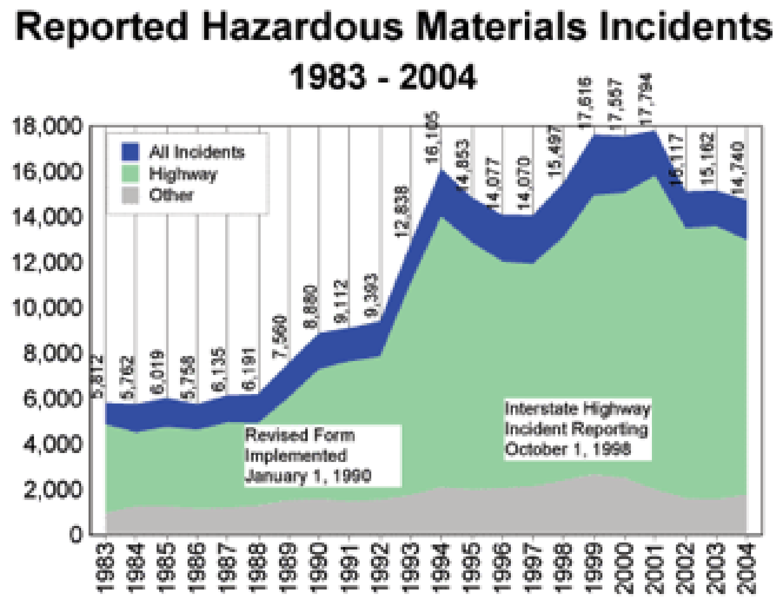

Figure 1.1: Hazardous material spill incidents in the United States (see `http://hazmat.dot.gov/enforce/spills/spills.htm` for additional details).

is for emergency use only.

A significant component of spill containment is the volume of material to be stored in the event of a spill plus any local runoff that occurs during a contemporaneous runoff event. Substantial work on the statistics of precipitation, specifically the intensity-duration-frequency relation (Asquith and Roussel, 2004), and more generally on the inter-occurrence intervals of precipitation (Asquith and Roussel, 2003), has been published. These relations are an important component in the development of design methodology for spill containment. Information from these hydrometeorologic studies is useful for design of incident containment structures such that sufficient storage volume is provided to store the spill plus runoff for a specified or assumed level of risk. For example, a design might contain a large volume release plus the runoff from a rainfall event with a duration of 12 hours and a return interval of 10 years.

Permanent facilities where hazardous materials are used and stored have rigorous containment requirements. These requirements are documented and design guidelines exist and are well defined. However, a search of Google[1] for structures appropriate for transport spills returned no significant results. Clearly this topic is prime for study.

A number of questions arise when considering the impact of a hazardous materials spill. *How would a standard SW3P structure behave if subjected to a spill? Can standard designs of best management practices be modified to include spill protection? What additional measures are required to prevent hazardous materials migration to receiving waters in event of a spill? When is mitigation justified,*

[1]See `http://www.google.com`.

that is, are there specific locations or instances where mitigation is justified and others where it is not?

The overall goal of the project is to collect information regarding roadway hazardous material spill incidents associated with transportation on Texas highways, including the types and volumes of hazardous materials released. The focus will be on both transported materials (those carried as cargo) and loss of vehicular fluids (fuel, lubricants, and etc.). These results are to be used to develop design guidelines and parameters to reduce the risk of exposure to travelers and individuals responsible for spill cleanup. The specific objectives of this project are to:

- Evaluate existing literature for information relating to design, performance, and applicability of existing hazmat spill protection systems,
- Evaluate historical spill records for Texas to develop risk-assessment and protection needs,
- Develop a Texas-specific database of contaminant types and characteristics, and
- Develop design guidance procedure for containment of hazardous materials spills considering the following issues:
  - The maximum load of materials transported by Texas carriers,
  - Regulatory tolerance of accident-related spills,
  - The range of hydrologic characteristics expected at potential spill sites,
  - Designs for existing structures (retrofit) versus designs that may be incorporated in new roadway projects.

1.2. Purpose

The purpose of this report is to presents results of efforts by researchers at Texas Tech University.

2. Procedure

2.1. Literature Review

A review of the professional literature was undertaken by members of the research team and the graduate students supporting those researchers. Results of the literature review were not presented as a separate report, but as a technical memorandum[1]. A summary review of the literature is included in this report as Chapter 3 and additional information is presented in Appendices A and C.

2.2. Data Collection

Data records from hazardous materials spill incidents in Texas were obtained from TCEQ for the period of record 2002–2006, a period spanning five years. These data were obtained from reports from first responders to accidents where materials were spilled.

2.3. Analysis

The analyses of spill data comprised two components. The first was a statistical analysis of the spill events to determine the distribution of spill materials and the potential volume of spilled materials. These results were of interest because the statistics provide documented estimates of the spill volume that can be expected on Texas highways. That information is of interest if a spill trap is required at a particular site because the expected volume of a spill can be used to estimate the required trap volume. That is, if 99 percent of spill events are less than or equal to a particular volume, then a trap designed to contain at least that volume should capture the spilled materials from 99 percent of incidents. Of course, a different design guideline (level of risk) can be selected.

The second statistical analysis was to determine whether spill events are more likely during rainfall events (or not). This result provides insight into how a potential spill trap should be designed to handle storm runoff in addition to the volume of spilled materials in areas where stormwater management facilities are required.

Finally, the location of spill incidents was examined in an *ad hoc* manner to determine the possible

[1] The technical memorandum documenting the results of the literature review was dated 31 August 2007.

presence of sites with a relatively large number of spill incidents. The question was whether such locations could be determined from available data. A number of areas were identified that exhibited a relatively large number of spill incidents. These are presented and discussed in the results section of this report.

2.4. Development of Design Protocol

Based on the results of the statistical analysis and a review of hazardous materials trap designs, a general design approach for spill traps was developed. The protocol was general in nature because the exact design solution depends on site particulars, such as land surface area available to develop a holding area and the hydraulics that are dependent on site-specific details. Supporting material is included in the appendices.

3. Literature Review

Hazardous material spill incidents occurring on Texas highways are a concern because of the nature of the materials released and the required remediation of contaminated areas. During the five-year period 2002–2006, more than 900 hazardous material spills of varying volumes were recorded and those records stored by TCEQ. The main concerns associated with hazardous spill events are public safety and contamination of surrounding land and water resources. In the event of a spill, released materials might migrate to the surrounding landscape and infiltrate into the soil profile. The potential for contamination of the spill site is both an acute and chronic problem. However, the release of hazardous materials pose an imminent threat to the public and first responders present at the incident site.

In the context of the literature review, specific objectives include:

- Evaluating literature for search of existing hazardous materials spill containment systems and new techniques for the same;
- Evaluating historical spill records for assessing level of risk and obtaining information pertaining to sizing, selection and development of containment structures;
- Developing Texas-specific database of contaminant types for future reference; and
- Developing design parameters, guidelines and conceptual designs of spill containment structures.

3.1. Description of Database

Historic spill data obtained from TCEQ were reviewed and prepared for analysis. The assumption is that the historic data will represent potential future events, at least from a statistical perspective. TCEQ records were used as a source of detailed information on type and volume of spills encountered along with incident site descriptions. The materials released were categorized[1] based on the material hazard class. Details are discussed in the following chapter.

[1] The *ToxNet* database, located at `http://www.toxnet.nlm.nih.gov` at the time of this writing, was used as a resource in identifying and understanding some of the chemicals reported in the spill incident database.

3.2. Basic Spill Cleanup Technologies

The approach of TxDOT (and other state departments of transportation) personnel to spill incidents was reviewed. The search for spill contingency plans returned only general emergency response information.

3.2.1. Emergency Response Handbook

Several organizations offer procedures to contain spills and the equipment needed to clean up spilled materials. One of the most useful tools for emergency spill response is the *Emergency Response Guidebook* (Pipeline and Hazardous Materials Safety Administration, 2005). The guidebook is produced by the Pipeline and Hazardous Material Safety Administration and was developed jointly by the U.S. Department of Transportation, Transport Canada, and the Secretariat of Communications and Transportation of Mexico for use by firefighters, police, and other emergency services personnel who may be the first to arrive at the scene of a transportation incident involving a hazardous material[2]. The guidebook was developed to assist emergency responders to quickly identify the specific or generic classification of the material involved in an accident and to protect themselves and the public during the initial response phase of an incident. The most common steps to follow in the event of a spill include the following.

- Immediately alert the necessary officials and evacuate the area if necessary.
- Call 911 if there is a fire or if medical attention is needed.
- Attend to any people that may have been contaminated first.
- Control sources of ignition if a flammable material was spilled.
- Put on any personal protective equipment that is appropriate for the type of hazard.
- Determine the extent and type of spill.
- Protect drains or other means of environmental release.
- Contain and clean-up the spill.
- After the spill is cleaned up, place the cleaning materials in the appropriate type of container and label the container as hazardous waste (Princeton University Environmental Health, 2007).

Basic spill cleanup briefly describes the measures currently adopted by the states to manage spills. There is a need for implementing faster and more efficient actions for enhancing cleanup. The following paragraphs briefly explain cleanup methodologies adopted by some states.

[2] `http://www.phmsa.dot.gov/portal/site/PHMSA/menuitem.ebdc7a8a7e39f2e55cf2031050248a0c/?vgnextoid=ebfeca57e196d110VgnVCM1000009ed07898RCRD&vgnextchannel=d248724dd7d6c010VgnVCM10000080e8a8c0RCRD&vgnextfmt=print`, visited October 14, 2010.

3.3. Current Emergency Spill Prevention and Cleanup Methods

Spill cleanup technologies were reviewed to obtain information on use of permanent containment structures (if any), for spill containment. TxDOT regional offices were contacted to obtain information on current strategies. Other state DOTs were also contacted to learn their spill containment plans and strategies.

3.3.1. Texas and TxDOT Current Cleanup Strategies

In the event of a spill, the primary concern of TxDOT personnel is public safety. Although procedures might vary between districts, the usual procedure is for the local fire department to be one of the first responders to a spill site. Law enforcement, fire department, and TxDOT personnel work together to clear and divert traffic from the incident site. Once the site is secured, then the secondary concern of TxDOT and other first-responder personnel is to prevent the spread of spilled materials from the site into the nearby landscape and potential receiving waters. The exact protocol depends on district policy. TxDOT personnel might clean up small spills of fuels and lubricants. However, the usual procedure is for either the transport company or TxDOT to contract a spill cleanup specialist to manage and clean up the site. All spill incidents are reported to TCEQ through a detailed report that includes the type of material(s) released, the volume of the spill, the cleanup technique, the area affected, and the action taken.

A series of case studies are reported in the following paragraphs. Although these case studies do not represent all possible approaches to spill response, a number of potential response strategies are presented.

TxDOT, Wichita Falls

A spill incident of about 800 gallons of oil occurred in the Wichita Falls TxDOT district. Temporary dikes were built in the road ditches to contain the spill. An additional dike was placed in line with the first dike to ensure containment in the event of the breakdown of the first dike. Oil adsorbent pads, socks, and adsorbent clays were used to absorb the remaining oil on the roadway. Bioremediation was accomplished with Microblaze[3] or Petroclean[4], however, these products were used sparingly because of the potential affects on asphaltic cement.

In the case of small spills that are less than 25 gallons, TxDOT personnel clean up the spill[5].

[3] Used for example only; not a product recommendation or endorsement.
[4] Used for example only; not a product recommendation or endorsement.
[5] Michael Pettibon, environmental specialist, personal communication undated.

TxDOT, Waco District

TxDOT personnel in the Waco district are considering a type of detention basin for use as hazardous materials traps to be put in-place for future construction. Catch basins are incorporated in roadways under construction[6].

TxDOT, Tyler District

TxDOT personnel in the Tyler district are considering catch basins and detention basins for future installation along roadways for hazardous materials traps[7]. Detention basins are sited in the Tyler district at certain locations for potential spill containment.

TxDOT, San Antonio District

TxDOT personnel in the San Antonio district use a number of hazardous materials traps near the Edwards Aquifer recharge zone to reduce the potential for spilled materials to reach the aquifer[8]. Water and spill materials are conveyed by roadway ditches to the hazardous materials trap. A central valve is a component of the trap design. The valve is normally open such that incoming runoff is allowed to discharge. In the event of a spill, the valve must be closed to retain inflow that is later treated and discharged properly. Ditches intended to receive spills are lined to reduce or prevent infiltration. For the attachment of booms and others structures, anchors or hooks may be provided so that the hazardous materials contractors save time installing such hooks. Another suggestion offered was installing signs that indicate the location of hazardous materials traps, catch basins or concrete lined ditches. Such signs are needed to aid the fire department crew who are not familiar with the position of such containment structures.

Other TxDOT installations

Personnel from the Austin office stated that they use hazardous materials traps to protect the Edwards aquifer[9]. Terry Dempsey[10] mentioned that in certain areas Stormceptors were used. Steven Ashley[11] stated that when spills are less than 25 gallons, TxDOT uses adsorbents, socks, and pads to clean up the spill (in addition to controlling and diverting traffic). If the spill exceeds 25 gallons, TCEQ, the General Land Office, and National Resources Conservation Service personnel are informed. If the transport is such that coastal waters are threatened by a spill incident, the U.S. Coast Guard is also informed of the spill.

[6] Jim Busby, Safety-HAZMAT Coordinator, personal communication, undated.
[7] Jay Tullos, environmental co-coordinator, personal communication, undated.
[8] Ricardo Flores, San Antonio district office, personal communication, undated.
[9] Rodney Concienne, Pollution, Prevention, and Abatement branch, personal communication, undated.
[10] Environmental Specialist, Environmental Affairs Division, undated personal communication.
[11] Environmental co-ordinator, Corpus Christi District, undated personal communication.

In general, if a hazardous materials spill incident occurs, TxDOT personnel divert traffic, ensure safety of the first responders, and attempt to prevent migration of spill materials. If the spill exceeds the capacity of TxDOT personnel and other first responders to contain (or policy prevents TxDOT action), then hazardous materials contractors are contacted to do the cleanup. Some TxDOT districts use hazardous materials traps and catch basins as permanent containment options. Other TxDOT districts are not currently using hazardous materials traps.

3.3.2. Other States

Other states have taken steps to plan for emergency road spills. However, they do not have permanent solutions for the same. Some of these states are listed below.

California

The California Department of Transportation (CalTRANS) requires each district to have a contingency plan for hazardous spill response. The contingency plans must include: steps for organization of response at the scene of a spill, reporting and notification procedures, emergency response personnel, response to news media, plans for incidents involving flammable or toxic vapors, and the district's hazardous materials spill site safety plan and cleanup safety plan (California Department of Transportation, 2006).

Colorado

The Colorado Department of Transportation (CDOT) website has procedures for hazardous material spills. The document contains lists of state and local contacts, state rules, statutes, and procedures. Contacts include the sewer authority if the sewer system is threatened, the Department of Public Health and Environment (CDPHE) if downstream water users are threatened, and the Colorado State patrol. CDOT offers the following suggested actions to control spills (Colorado Department of Transportation, 2007):

- Cover the spill with plastic;
- Place absorbent booms in affected water;
- Place soil booms downhill of the spill or between the spill area and nearest waterway;
- Neutralize or stabilize the chemical if appropriate;
- Divert surface or stormwater, if necessary.

New York

The New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation maintains the "Spills Database" with information on over 10,000 spills and releases within the state. If a spill occurs and is reported, the NYSDEC enters the spill into the database. NYSDOT uses the database for assessing whether a construction area has been affected by a spill (New York State Department of Transportation, 1999).

North Carolina

The North Carolina Department of Transportation (NCDOT) has a spill prevention program, which includes training for first responders[12]. The training includes spill response techniques, risk assessment, appropriate personal protective equipment, terminology, control, containment and decontamination procedures, and the NCDOT policy on hazardous spill response.

Oregon

The Oregon Department of Environmental Quality (ODEQ) website[13] describes actions that the entity responsible for the spill should take for spill cleanup. The individual who caused the spill is responsible for the immediate cleanup of the spill, and the ODEQ will oversee the cleanup.

Utah

The Utah Department of Transportation maintains an Oil Spill Response Resource List[14]. The list offers the names of companies that clean up spills, their phone number, location, the type of spills they handle, and their typical response times.

Washington

The Washington Department of Transportation (WSDOT) requires all contractors to prepare a Spill Prevention Control and Countermeasure (SPCC) Plan before beginning a construction project[15]. WSDOT also offers training classes on spill prevention and hazardous material for employees and contractors.

[12] The 2010 training schedule (and other information) is presented on the NCDOT website, `http://www.ncdot.gov/doh/operations/materials/tschedule10/nsahmtschool.html`, visited October 15, 2010.

[13] `http://www.deq.state.or.us/pubs/reports.htm` visited October 15, 2010.

[14] The document comprises one page of response contractors, and is located at `http://www.superfund.utah.gov/docs/resource.pdf`, visited on October 15, 2010.

[15] Templates and guidance documents are available on the WSDOT website, `http://www.wsdot.wa.gov/Environment/HazMat/SpillPrevention.htm` visited on October 15, 2010.

Summary of Other Organization's Spill Mitigation

Although a number of state departments of transportation have response plans that are formalized to varying degrees, there was no single unifying theme other than the general control of traffic for first responders, provide for public and responder safety, and try to contain the spill.

3.4. Treatment and Containment Strategies

There are two approaches to spill mitigation: 1) permanent trap structures and 2) on-site temporary response to a spill incident. Regardless of approach, once a spill occurs, the cleanup process begins. The general process involves: 1) spill containment, 2) separation from storm runoff (if present), and 3) removal of spill materials.

3.4.1. Permanent Containment Solutions

Permanent containment structures used for spill containment require detailed sizing and design considerations. Catch basins and oil/water separators are examples of structures that are installed at a particular location for water-quality treatment and can serve as hazardous materials traps, in addition to their primary function. The best management practices (structural measures) require modification to their design to add spill containment capabilities. Advantages and limitations of the permanent containment devices are listed in Table 3.1.

Table 3.1: Characteristics of commonly used permanent containment solutions.

Device	Description	Advantages	Disadvantages
Catch Basin	Collect water, sediments and debris in an oversized sump	1. Use existing catch basins 2. Available prefabricated 3. Store water temporarily before clean up	1. Reduced treatment efficiency compared to wet ponds and filters 2. Require regular maintenance
Catch Basin Inserts	Inserts capable of accommodating oil/water separators and media filtration units.	1. May be retrofitted in an existing basin 2. Media filtration may be optimized to remove specific pollutants	1. High installation and maintenance costs 2. Require regular maintenance
Detention Basins	Impoundments storing stormwater runoff for short durations	1. Simple design 2. Inexpensive to operate and maintain 3. Capture sediments and pollutants 4. Store water temporarily before clean up	1. Inlet/outlet clogging 2. Presence may decrease property value
Retention Basins	Long-term storage of water and reduces maximum flow rate of stormwater into systems	1. Prevent shock loads to stormwater systems 2. Can contain pollution separation devices 3. Biological treatment may be achieved 4. Water course may be aesthetically pleasing	1. Regress concern for steep sloped basins 2. Mosquito breeding grounds 3. Regular trash clean up 4. Require liner to prevent contamination groundwater
Underground Concrete Basins	Below ground detention basins	1. Provides odor control 2. Minimal public access 3. Good for areas with limited or non-existent right-of-ways	1. Methane gas production may result in explosion concerns 2. Ventilation provisions required 3. Complex piping and pumps increase system cost
Stormceptor	Proprietary unit removing fine sediments and hydrocarbons	1. Can serve as a stand-alone treatment process 2. Removes hydrocarbons, oil, grease, heavy metals and sorbed nutrients 3. Do not require pre-treatment	1. Incapable of handling large flows 2. A system bypass may result in hazardous spill release
Oil/Water Separators	Gravity separation of oil from incoming stormwater flow	1. Excellent for oil spills 2. Simple design and operation 3. Suitable in absence of stormwater event	1. High maintenance requirements increasing operation costs 2. Limited ability to work with light hazardous materials
Dikes	Earthen structures to contain spills and prevent erosion	1. Temporarily contain water 2. May work in conjunction with detention basins or ditches for spill containment	1. Must avoid trees and other obstructions
Pervious Concrete	Concrete allowing water to percolate through	1. Allows for quick draining 2. Durable 3. Lower life cycle cost compared to asphalt	1. Clogging of pores prevents percolation 2. Freeze-thaw conditions may affect performance

3.4.2. Secondary Containment Devices

Secondary containment devices are those that can be used alone (if no permanent structure is located at the site) or in conjunction with a permanent trap. If storm runoff is present, the spill materials should be separated from the runoff (if possible). Devices useful for separating storm runoff from spill materials include booms, pads, and socks. Proprietary materials[16] are often used to cleanup spill materials after containment. A brief list of secondary containment devices is presented in Table 3.2.

[16] Such as BioSolve and other materials.

Table 3.2: A list of commonly used secondary containment devices.

Device	Description	Advantages	Disadvantages
Booms	Deployable barriers to confine spills lighter than water	1. Boom selection based on material released	1. Not a containment device 2. Placed at spill site
Skimmers	Mechanical devices used for removing materials lighter than water	1. Used to recover spill materials in local permanent structures 2. A sorbent might be used to improve clean-up efficiency	1. Maintenance if a permanent structure 2. Unsightly as a permanent structure
Biosolve	Water-soluble proprietary agent used to cleanup hydrocarbons	1. Accelerates natural biodegradation of hydrocarbons 2. Useful as a vapor suppressing agent 3. Does not require special equipment	1. Operations cost 2. Not recommended for use in detention basins because degradation time increases with storage volume
Rubberizer	Transforms hydrocarbon spills into a rubber-like substance	1. Applicable for jet fuel, gasoline, diesel, hydraulic oil, and lube oils spills 2. Remains buoyant 3. Does not leach 4. Usable in detention structures	1. Must be retrieved 2. Operations cost
Socks and pads	Preferentially absorb materials lighter than water ($S_g < 1$)	1. Effective for water- and land-based spill incidents 2. Absorption capacity greater than weight of the sorbing material 3. Absorbents float	1. Must be deployed 2. Operations cost
Go Filters	Mobile proprietary unit for the treatment of water	1. Can handle high flow rates 2. Removes TSS 3. May be fitted with filter to remove hydrocarbons 4. Maintenance easy and inexpensive	1. Expensive 2. Must be deployed

4. Results

The purpose of this section of the report is to present data concerning historical spills and an analysis of those spill records.

4.1. Literature Review

The review of the literature is summarized in Chapter 3 and Appendix C. From a design perspective, specific requirements by jurisdictions concerning design of hazardous materials traps is of interest. Some literature of interest is presented in the following subsection of this report.

4.1.1. Hazardous Materials Trap Design Requirements

From the San Antonio Uniform Development Code (Section 34–965[1]),

> All roadway projects with anticipated, or actual Average Daily Traffic (ADT) volumes in excess of 1,500 vehicles per day shall be required to design, construct, operate, and maintain sedimentation and filtration basins to capture and treat the first flush runoff from the roadway. In addition, all roadway projects with anticipated or actual ADT volumes in excess of 30,000 vehicles per day shall be required to design, construct, operate, and maintain hazardous materials traps (HMTs) that will capture, contain and isolate a hazardous spill on the roadway facility. The minimum volume of the HMTs shall be 10,000 gallons and they shall contain a self-draining outlet and an emergency cut off to contain any spilled materials.

The quoted segment of the San Antonio code is one of the few published guidelines for hazardous materials traps. It includes a selection criterion (based on ADT) and a recommended storage volume. The source of these guidelines is not provided in the code. However, as is developed in subsequent sections of this report, the selection of the trap volume is reasonable.

[1]Additional discussion is presented in Appendix A.

4.2. Data Collection

Review of historic spill records revealed information necessary to determine the frequency of spills, spill volume, geographic locations, and hazardous class of the spilled materials. TCEQ is charged with collecting and archiving detailed spill-incident reports. TCEQ was contacted and records were retrieved for the period of record from 2002 to 2006[2]. These data were used for further analysis.

Information included in the spill incident reports included:

1. Type of material released,
2. Whether rainfall occurred,
3. Volume of spilled material (mixed units), and
4. Location of spill.

The location was used to develop approximate values of the latitude and longitude for generating maps of the spill locations. A few areas, located near major metropolitan areas in Texas, seemed to be subject to a relatively greater number of incidents than other areas. These areas were used for additional analysis[3].

4.2.1. Hazardous Materials and Their Classification

About 300 spill incidents were recorded in Texas in 2006. Although this number is not very large when compared to the number of vehicles present in Texas, the impact of hazardous materials spills on the area near the location of the incident is significant to transportation and other government officials and private citizens. The researchers concentrated efforts on liquid spills because solid materials are more difficult to mobilize and gaseous spills are not amenable to containment. Spills in wet weather situations require special considerations because the materials have the potential to be mobilized by contemporaneous storm runoff, leading to spread of spill materials into the surrounding landscape. Dilution of spill materials increases the magnitude of the volume of material to be trapped and cleaned up, exacerbating the problem.

The properties of hazardous materials subject to spill during transport dictate the use of special measures necessary to separate the pollutants from the water or environment. The spills recorded during 2002–2006, were evaluated and their properties were tabulated for future reference. Some of the materials spilled and a partial list of their physical properties are listed in Table 4.1.

[2] TCEQ maintains spill incident records back to 1972. However, analysis of the entire historical record was beyond the scope of this project. Therefore, analysis was limited to the record years from 2002–2006, a period of record of five years.

[3] During discussions with the project management team, these areas were termed "hot spots" — however, that terminology was not used in this report because of the negative connotation of the term.

Table 4.1: Hazardous materials spilled and their physical properties.

Material	**Properties**
Benzene	Colorless; density: 0.8787; highly flammable; soluble in water; toxic at 10% concentration
Sodium Hydroxide	White deliquescent pellets; S_g: 2.13; non-flammable; solubility: 111gm/100g water; severely toxic (whether inhaled or ingested)
P-dichlorobenzene	White crystalline powder; S_g: 1.241; flammability rating 2; insoluble in water; hazardous decomposition products: toxic gases and vapors such as hydrogen chloride, carbon dioxide and carbon monoxide may be released in a fire involving p-dichlorobenzene
Hydrogen Peroxide	Colorless; density: 1.46g/ml; non-flammable; is not absorbed by the skin, but can cause systemic toxicity when inhaled or ingested
Mineral Oil	Clear, oily liquid; heavy: 0.845 to 0.905; Light: 0.818 to 0.880; insoluble in water; combustible liquid; non-soluble in water; toxic (harmful if swallowed or inhaled-eyes, skin, respiratory tract)
Xylene (Mixed Isomers)	Colorless; Density: 0.87kg/L; very flammable; insoluble; affects brain (on longer exposure): skin eyes nose throat
Diethylamine	Colorless liquid; S_g: 0.707 @ 20C/4C; highly flammable (rating 3); soluble in water; severely toxic (eyes, skin, internal organs)
Vinyl Chloride	Colorless; density: 0.91g/ml; insoluble in water, at room temperature; VCM (Vinyl Chloride Monomer) is a toxic (affects CNS), colorless gas with a sickly sweet odor
Ethylene Oxide	Colorless gas or refrigerated liquid; Density: 0.899 gm/cm^3 flammable gas; miscible with water. Toxicity: Acute effect: lung irritations, convulsions, chronic effects: CNS damage, potential carcinogen
Sulfuric Acid	Colorless liquid; Density: 1.84 g/cm^3; highly explosive when mixed with water; fully miscible in water; Toxicity: irritation of eyes, skin and lungs

The spilled materials are categorized into different classes on the basis of their characteristics, as listed in Table 4.2. It is required by law to state the hazard class of the material being transported on the container. The hazard class aids the first responders in identifying the type of material encountered, allowing them to take the necessary precautions to ensure their own safety and the safety of the public. The hazard class also aids the hazardous materials group in selecting appropriate strategies for cleanup.

Table 4.2: Hazardous materials classification (from BTS 2004).

Hazard Class	**Characteristics**	**Example**
Class 1	Explosives	Xylene
Class 2	Gases	Vinyl Chloride
Class 3	Flammable Liquids	Diethylamine
Class 4	Flammable Solids	p-dichlorobenze
Class 5	Oxidizers and organic peroxides	Hydrogen peroxide
Class 6	Toxic (poison)	Ethylene Oxide
Class 7	Radioactive materials	Radium
Class 8	Corrosive materials	Sodium hydroxide
Class 9	Miscellaneous dangerous goods	Sulfuric Acid

Detailed information on spills is tabulated in the Texas-specific database of contaminant types and characteristics. It consists of the following details:

- Date of occurrence of the spill;
- Material released;
- Volume of material released;
- Location of the spill (county, nearest city and geographic coordinates);
- Hazardous class as per TCEQ guidelines; and
- Geographic coordinates of spill sites.

4.3. Analysis of Spill Records

The database of Texas spill incidents is presented in Appendix F for each year as Tables F.1–F.5. Interpretation of the raw data was effected using a statistical analyses. These analyses are documented in the following sections of this report.

4.3.1. Statistics of Spills 2002–2006

A total of 899 incidents were obtained for calendar years 2002–2006 (a five-year period of record). A summary of the number of events in the dataset is presented in Table 4.3. Of the events, 43 spills were of an unknown or unrecorded material, 55 comprised solid materials, and 50 were gaseous and irrelevant for the subsequent analysis. Of the 751 liquid spills, the records for 582 included an estimate of the volume of material spilled.

Table 4.3: Summary of Texas hazardous materials spill incidents for the period 2002–2006.

			Material			
		Unknown	Liquid	Liquid	Solid	Gas
Year	Count	Material		with Volume		
2002	171	6	147	125	10	8
2003	255	13	212	164	17	13
2004	147	6	121	96	9	11
2005	177	4	146	101	16	11
2006	149	14	125	96	3	7
Total	899	43	751	582	55	50

The number of events presented in Table 4.3 were normalized by dividing the entries in each row by the number of spills reported in each year of the study period. In addition, the last row contains percentages for the entire sample. That is, the last row is based on the number of occurrences for each column over the entire period of record. The results of this computation are displayed in Table 4.4.

Table 4.4: Percentage of recorded spills by category.

		Material			
		Liquid	Liquid	Solid	Gas
Year	Unknown		with Volume		
2002	3.5	86.0	73.1	5.8	4.7
2003	5.1	83.1	64.3	6.7	5.1
2004	4.1	82.3	65.3	6.1	7.5
2005	2.3	82.5	57.1	9.0	6.2
2006	9.4	83.9	64.4	2.0	4.7
Total	4.8	83.5	64.7	6.1	5.6

For each year in the study period the number of unknown material spill events was a relatively small fraction of the sample. The fraction of spills recorded that were liquid and that included an estimate of volume recorded as part of the reporting process was greater than 50 percent for all years in the study period. Less than 20 percent of recorded spills constituted solids or gases. Solids are relatively easy to confine to the spill site and gases cannot be confined to the spill site. This result reinforces the decision of the project management committee to focus the research on liquid spills.

Liquid spill materials were separated into two groups — those with a specific gravity, S_g, less than one and those with a specific gravity exceeding one. Those materials less dense than water were termed "lights" and those materials more dense than water were termed "heavies[4]." A separate group comprising oils ("oils") was established in addition to the "light" and "heavy" groups[5].

The spill volume from each event associated with each group (type of material) was used to examine the distribution of spill volume by type of material. The volume of material spilled associated with percentiles of 50-, 66.7-, 83.3-, 90-, 95-, and 99-percent were estimated using `R` (R Development Core Team, 2006). Results are displayed in Table 4.5. In addition, the spill volume from each event in the entire dataset was also used to examine the distribution of all liquid spill volumes. Boxplots of the spill volumes are presented in Figure 4.1. This graph illustrates the range of spills sites encountered over the study period.

Table 4.5: Volume of liquid spills sorted by specific gravity by percentile. Volumes are presented in gallons of material spilled. The percentile indicates the fraction of the sample with a spill volume less than or equal to the amount presented in the table.

		Percentile					
Material	Count	50%	66.7%	83.3%	90%	95%	99%
Heavies	146	80	229	979	4015	8888	383260
Lights	436	60	100	200	400	1401	7150
Oils	410	60	100	200	400	1200	6444
All	582	60	100	300	820	2525	19448

When taken as an entire group, 95 percent of the spills observed during the period of record (2002–2006) were 2,500 gallons or less and 99 percent of the spills were about 20,000 gallons or less. Therefore, a design volume for spill traps of 10,000–20,000 gallons is reasonable[6]. This is an important result because it allows development of a design guideline based on the observed spill events such that:

1. About 99 percent of all liquid spills would be trapped, or
2. Between 95 and 99 percent of "heavy" liquid spills would be trapped, or
3. More than 99 percent of "light" liquid and oil spills would be trapped.

4.3.2. Spills and Rainfall Events

In addition to the data listed in Tables 4.3–4.5, the database contains information on precipitation events that accompanied the spill. Precipitation data are necessary for sizing permanent spill con-

[4] Liquids with a specific gravity of about 1 (comprising mostly water) were included with the *heavies* for statistical analysis.
[5] *Oils* are also less dense than water.
[6] A volume of 10,000–20,000 gallons corresponds to between about 1,350–2,700 ft^3.

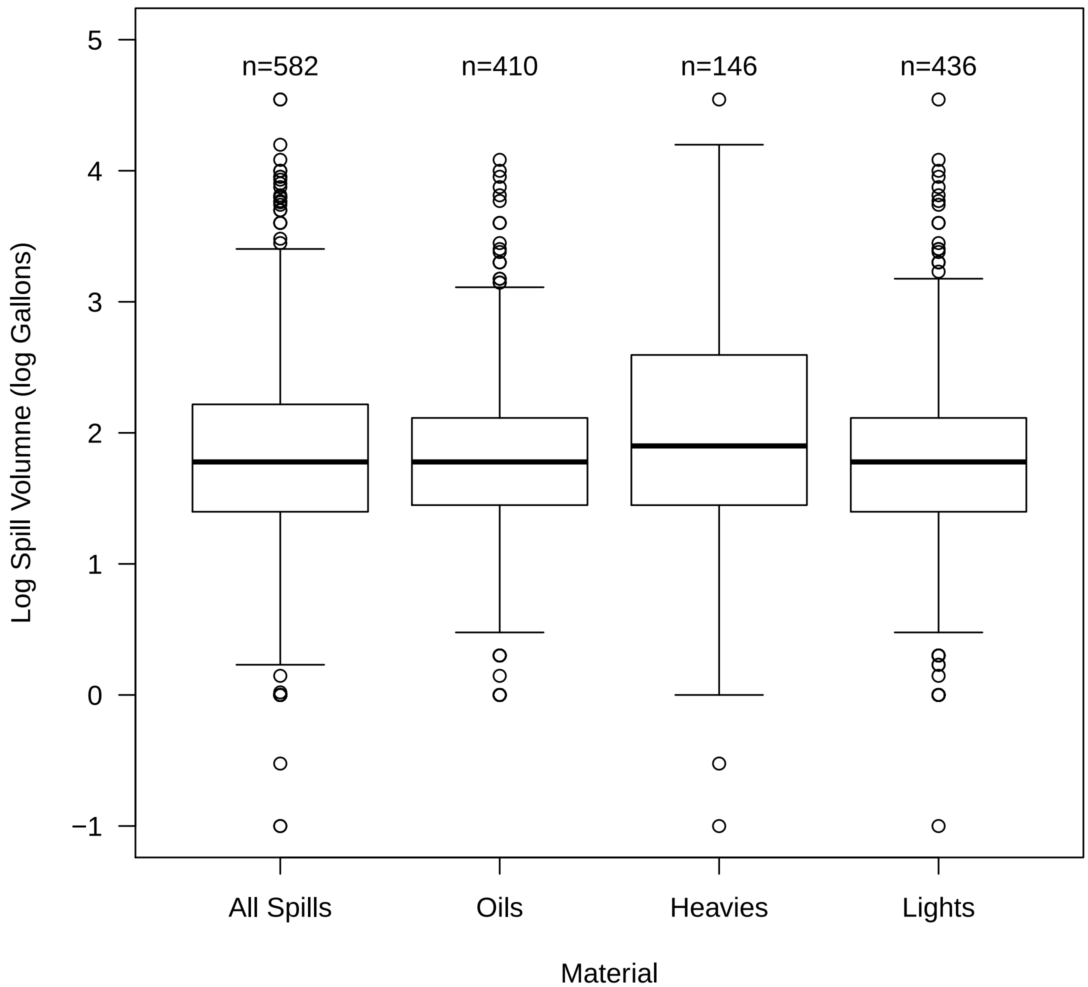

Figure 4.1: Boxplot of the spill size distribution. Spill categories are as defined in the text. The number of observations are included at the top of each box in the plot. The ordinate is the logarithm (base 10) of the spill volume.

tainment structures if runoff from the protected area might enter the trap. Rain data were obtained from the National Climatic Data Center, which records precipitation in inches for their stations. For some events it was difficult to determine the appropriate meteorologic station. Judgement was required to choose the best estimate for rainfall depth in those cases.

A subset of the 2002–2006 spill records was extracted to analyze the potential impact of rainfall events on the probability of an accident resulting in a hazardous materials spill. The database was broken into geographical regions so that rainfall records could be associated with spill sites. Six Texas counties were selected for further analysis. They are: Harris, Jefferson, Travis, Bexar, Orange, and Tarrant Counties. Counts of total days in the study period, the numbers of wet and dry days, and incident counts are presented in Table 4.6.

Table 4.6: Counts of spill and rainfall events by geographic area for the period of record 2002–2006.

Location	Total Days	Dry Days	Wet Days	Incidents	Wet Incidents	Dry Incidents
Harris	1585	1052	533	96	35	61
Jefferson	1587	1044	543	194	55	139
Travis	257	181	76	3	2	1
Bexar	1453	1065	388	36	13	23
Orange	1499	1183	316	47	13	34
Tarrant	1650	1258	392	23	6	17

The number of observed spill events in Travis County was only three events. Because of the small sample size, further consideration of spill events in Travis County for assessing the joint probability of a spill event and a rainfall event was eliminated.

A proportions test (Dalgaard, 2002, p. 131) is a statistical comparison between two samples to assess whether the samples are from different populations. The question is whether there is a measurable difference in the likelihood of a spill event occurring based on whether the weather was rainy or dry. The count of spill events when the weather was dry is one sample and the count of spill events when the weather was rainy is the second sample.

Therefore, if there is a difference between the likelihood of a spill event conditioned on whether the event occurred under dry or rainy conditions, a proportions test should provide insight into the process. A proportions test was used to compare the counts of spill events given a spill occurred on a dry day or a wet day. The results are presented in Table 4.7. For the proportions test, two alternative hypotheses were used: 1) That the proportions were different (two-sided) and 2) that the proportion of spills occurring on a dry day was less than the proportion of spills occurring on a wet day (less than). The *p-value* is an indication of the level of significance of the test. A large p-value indicates that there is little significance (confidence) that the alternative hypothesis is true; a small p-value indicates there is greater significance (confidence) associated with the alternative hypothesis.

Based on the results presented in Table 4.7, there is no statistically-significant difference between

Table 4.7: Results of applying a proportions test to the counts of events presented in Table 4.6 based on a wet-day or dry-day occurrence. [*P(E&D)* denotes the probability of an event and a dry day, *P(E&W)* denotes the probability of an event and a wet day, p denotes the p-value of the resulting proportions test.]

Location	P(E&D)	P(E&W)	p: Two-Sided	p: Less Than
Harris	0.058	0.066	0.545	0.272
Jefferson	0.133	0.101	0.066	0.967
Bexar	0.022	0.034	0.196	0.098
Orange	0.029	0.041	0.261	0.131
Tarrant	0.014	0.015	0.792	0.396

the proportions of spills occurring on wet days and dry days, for reasonable levels of significance[7]. On comparison of the raw proportions, there is a slightly smaller likelihood of a spill on a dry day in comparison to the probability of a spill event on a wet day. However, given the sample size, the differences are not statistically significant for a five percent level of significance. That is, there is not a striking difference between the occurrence of a spill on a wet day or dry day.

4.3.3. Geographic Areas of High Spill-Incidents

Geographic coordinates from records of spill incidents were used to develop maps to highlight geographic areas with an apparent greater frequency of spill incidents[8] on the basis of frequency of spills encountered over the 5-year study period (2002–2006).

The locations of spill incidents were examined to determine if clustering of such incidents could be determined in an informal manner. It was the intent to identify *locations* or segments of highway where additional review by designers and planners might indicate candidate locations[9] for installation of permanent structures because spill incidents appear to be more likely, or at least more numerous, than other areas of Texas. Geographic areas with high incidence of spills were identified when "clusters" of spills within a 10-mile radius occurred. Based on the analysis, a number of areas in or near Austin, Beaumont, Dallas-Fort Worth (DFW), Houston, and San Antonio were identified. If indicated, a transportation planner/engineer could study spill sites at individual clusters and choose appropriate locations for installing basins or other containment structures to capture a substantial fraction of future spills. The exact location and number of traps required to reduce the likelihood of spill migration off site will depend on site conditions and making such a determination is outside the scope of this report. Such determinations will be made

[7] In general, a reasonable level of significance is on the order of five percent.

[8] Areas with apparent greater frequency of spill incidents were originally termed "hotspots" during the duration of the project. This term is probably not appropriate and no analysis was done to determine whether identified areas were subject to an increased frequency of spill incidents based on traffic loads or other metrics. Such an analysis would probably be useful if data are available for analysis. However, such data were not available during the course of this research project.

[9] "Location" is not a precise term in this context. The locations mapped in this section of the report are more appropriate for additional study for application of hazardous materials spill traps as appropriate.

by the planner or designer tasked with development of required structures.

Austin

The locations of spill events near Austin are shown on Figure 4.2. In general, spill events located near Austin were not concentrated near a specific geographic location. An area north from downtown Austin is labeled Site A1, although there were only five events recorded in this area. General details of the events are listed in Table 4.8[10]. There does not appear to be a particular area in Austin that is subject to a concentration of spill incidents.

Table 4.8: Summary of frequent spills for Austin sites.

Location	Volume (gal)	County	Lat. (deg)	Long. (deg)	Number of Spills
Site A1	250–5,880	Williamson	30.5	-97.7	5

Beaumont

Locations of Beaumont spill sites are shown on Figure 4.3 and notes concerning the spills associated with the Beaumont sites are listed in Table 4.9[11].

Table 4.9: Summary of frequent spills for Beaumont sites.

Location	Volume (gal)	County	Lat. (deg)	Long. (deg)	Number of Spills
Site B1	1–6,300	Jefferson	30.0	-94.0	65
Site B2	5–600	Jefferson	29.9	-93.9	33
Site B3	1–120	Jefferson/Orange	30.1	-94.1	35
Site B4	1–1,147	Orange	30.1	-93.8	15
Site B5	1–10,000	Jefferson	29.7	-93.9	21

Several locations in or near Beaumont appear to have a relative large fraction of spill-related incidents. In fact, all five identified areas were subject to numerous events. In addition, the maximum spill volume was substantial, with one event of approximately 10,000 gallons.

Dallas

Locations of frequent spill areas for the Dallas-Fort Worth (DFW) metropolitan area are displayed on Figure 4.4. A summary of the spills occurring at the DFW sites is presented in Table 4.10[12].

[10] A more detailed table is presented in Appendix B as Table B.1.
[11] A more detailed presentation of spill-site data is presented in Appendix B in Tables B.2–B.6
[12] More detailed information about the spills in the DFW spill areas are presented in Appendix B in Tables B.7–B.13.

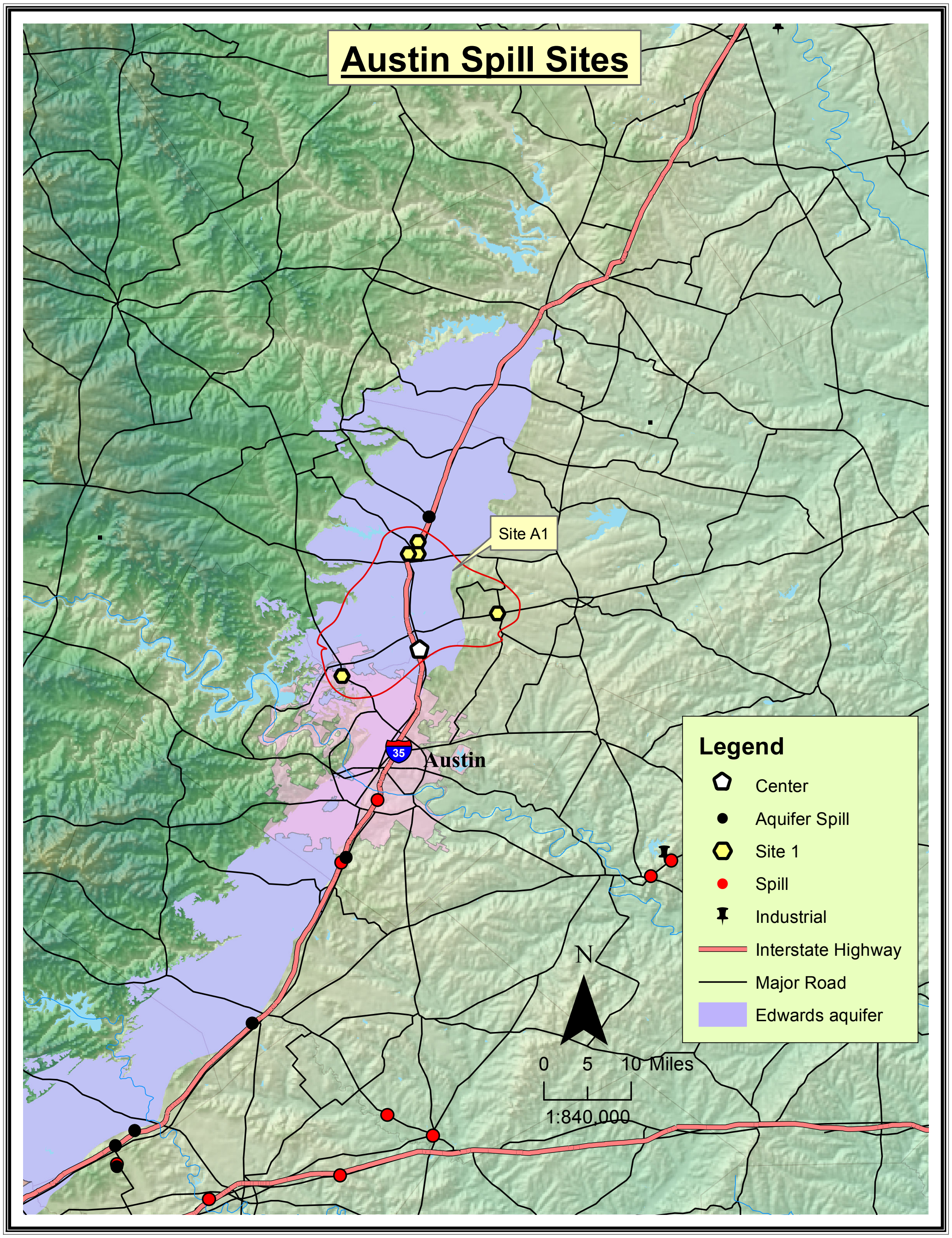

Figure 4.2: Austin spill sites.

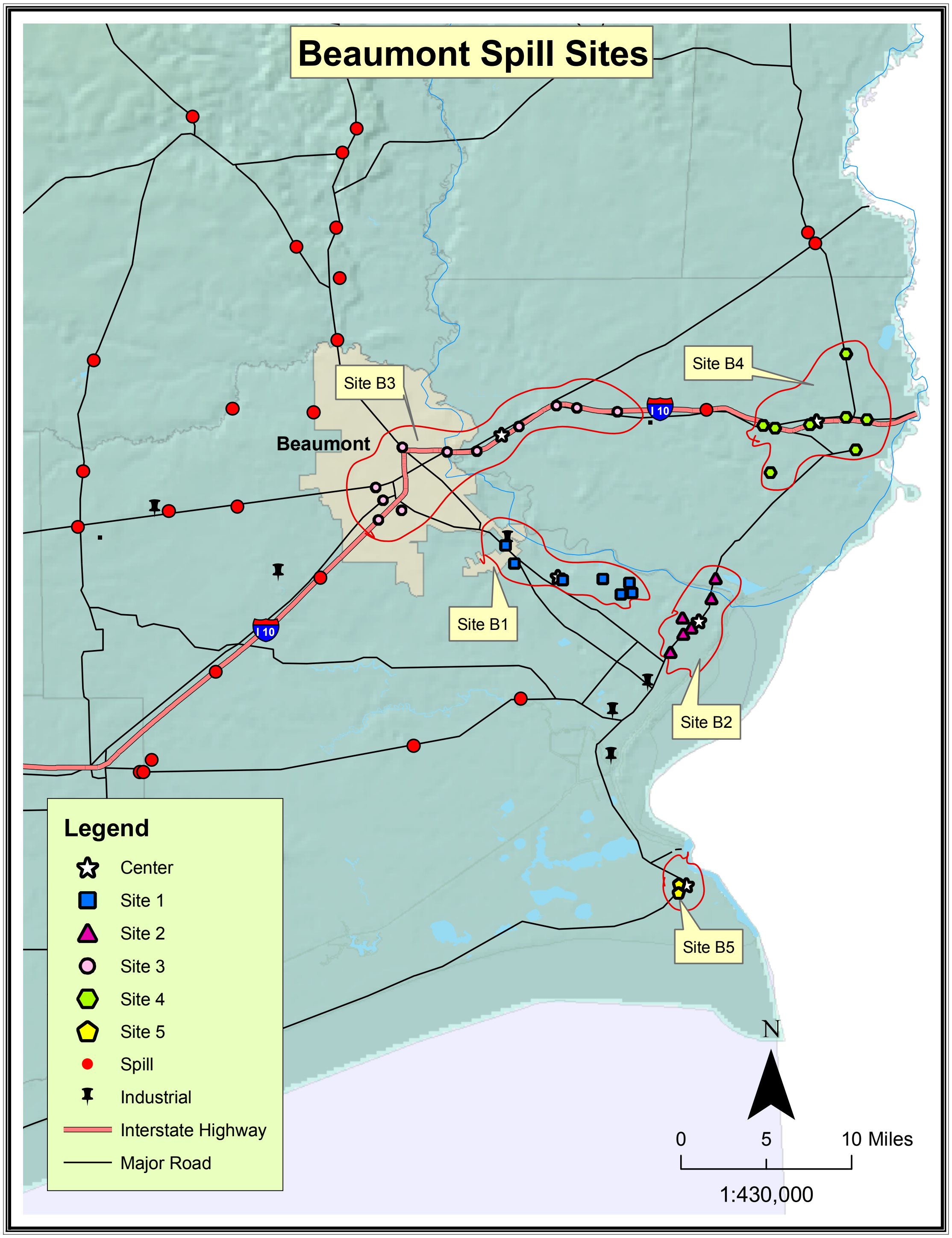

Figure 4.3: Beaumont spill sites.

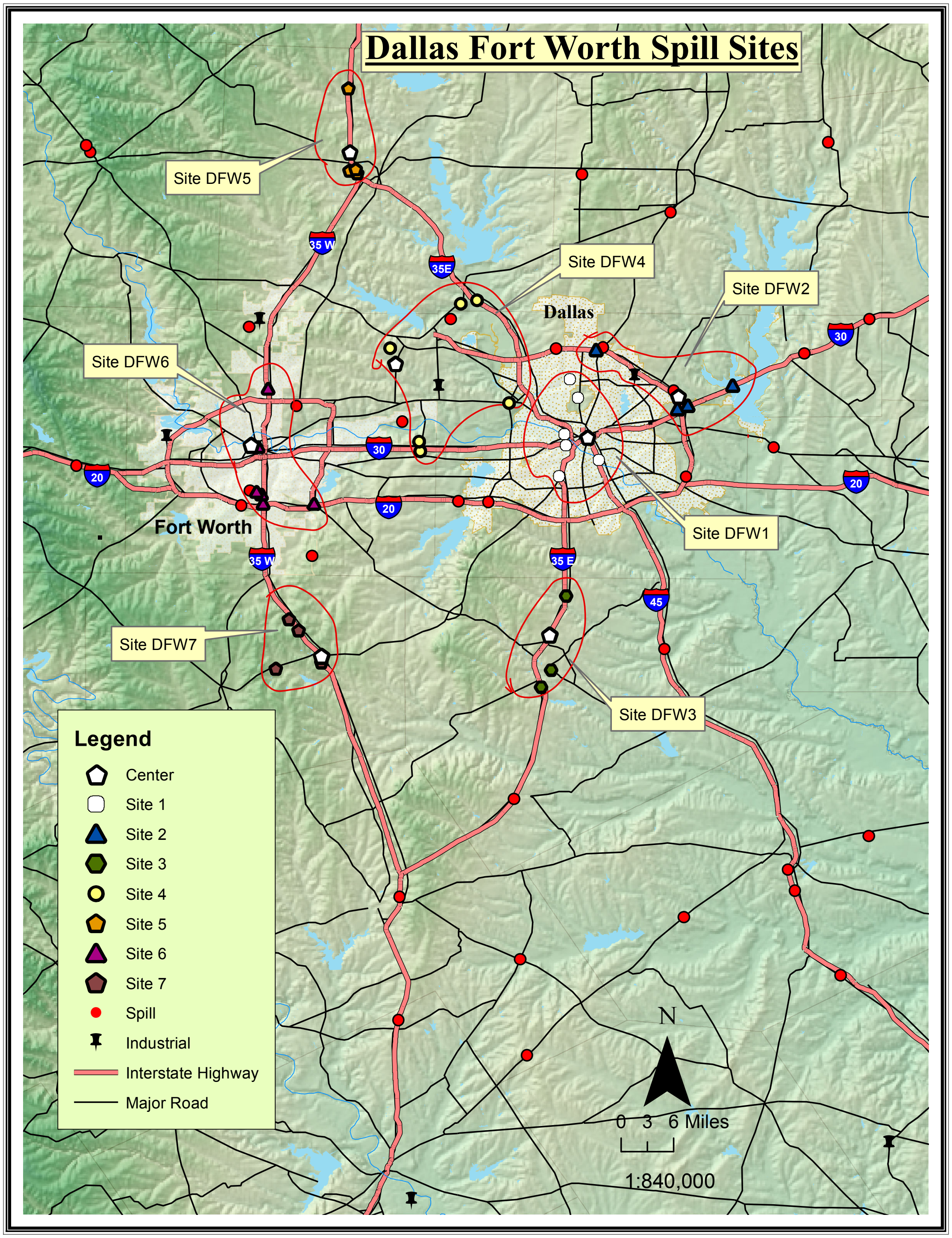

Figure 4.4: Dallas-Fort Worth spill sites.

Table 4.10: Summary of frequent spills for Dallas-Fort Worth sites.

Location	Volume (gal)	County	Lat. (deg)	Long. (deg)	Number of Spills
Site DFW1	3–100	Dallas	32.8	-96.8	7
Site DFW2	1–340	Dallas	32.8	-96.6	9
Site DFW3	1–155	Ellis	32.4	-96.8	4
Site DFW4	1–350	Tarrant/Denton/Dallas	32.9	-97.0	11
Site DFW5	1–341	Denton	33.2	-97.2	6
Site DFW6	1–2,000	Tarrant	32.7	-97.3	6
Site DFW7	8–200	Johnson	32.4	-97.3	4

Site DFW4 is located between Dallas and Fort Worth. The greatest number of spill incidents occurred in this area. However, the total count was significantly less than those observed near Beaumont.

Houston

Locations of frequent spill areas for the Houston metropolitan area are displayed on Figure 4.5. A summary of the spills occurring at the Houston sites is presented in Table 4.11[13].

Table 4.11: Details of Frequent Spills at Houston Spills

Location	Volume (gal)	County	Lat. (deg)	Long. (deg)	Number of Spills
Site H1	20–6,500	Harris	29.7	-95.2	33
Site H2	10–310	Harris	29.7	-95.0	10
Site H3	0–150	Harris/Chambers	29.8	-94.9	5

In Houston, Site H1 exhibited the greatest number of spill-related incidents. Site H1 is probably an area of interest for installation of hazardous materials traps, provided the site conditions are conducive to use of the facilities.

San Antonio

San Antonio area spills are illustrated in Figure 4.6 and the details are listed in Table 4.12[14].

Of the San Antonio spill site, Site SA4 exhibited the greatest number of spill incidents. As for the other metropolitan areas, if there is interest in installation of hazardous materials traps, the

[13] More detailed information about the spills in the Houston spill areas are presented in Appendix F in Tables B.14–B.16.

[14] More detailed information about the spills in the San Antonio spill areas are presented in Appendix F in Tables B.17–B.20.

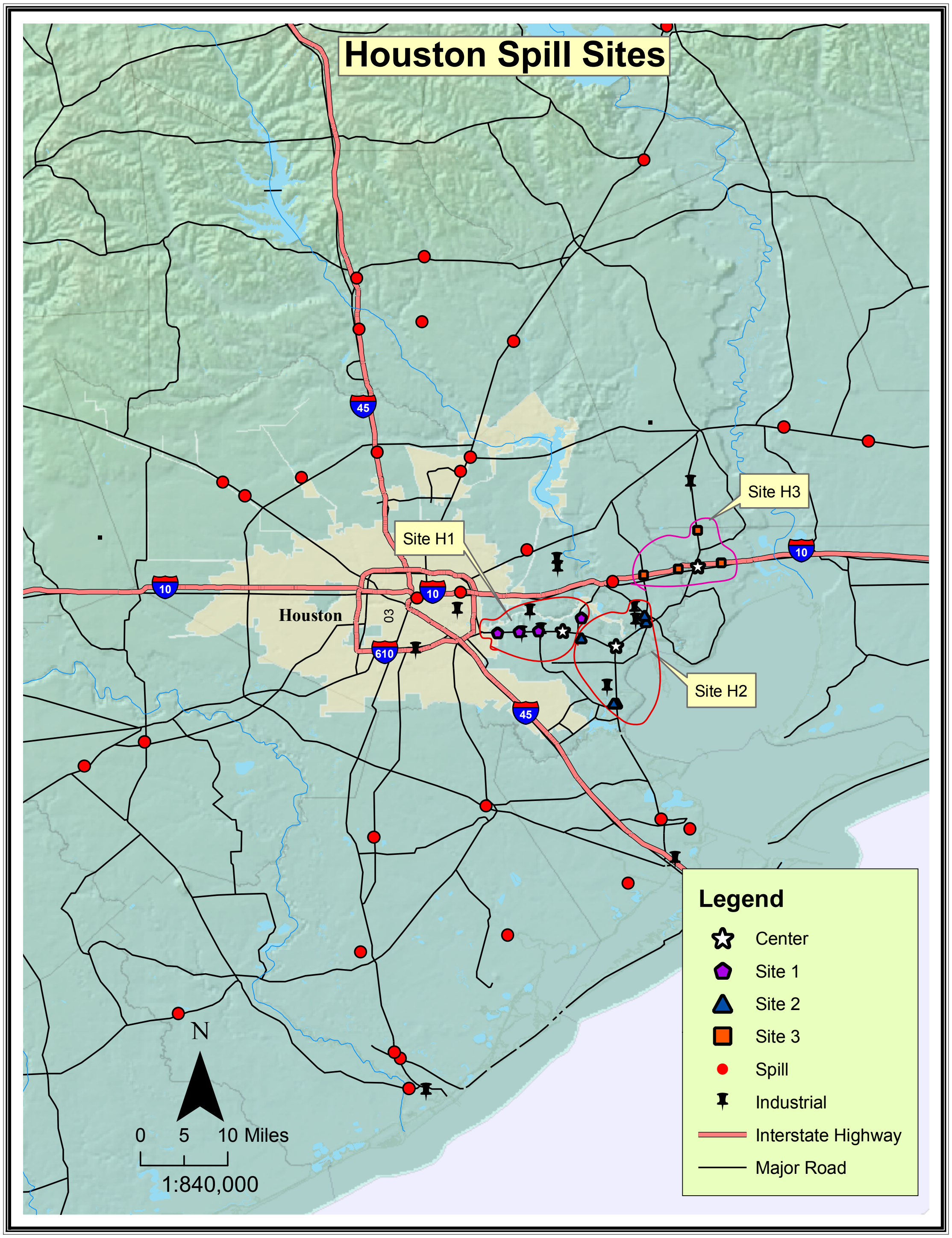

Figure 4.5: Houston spill sites.

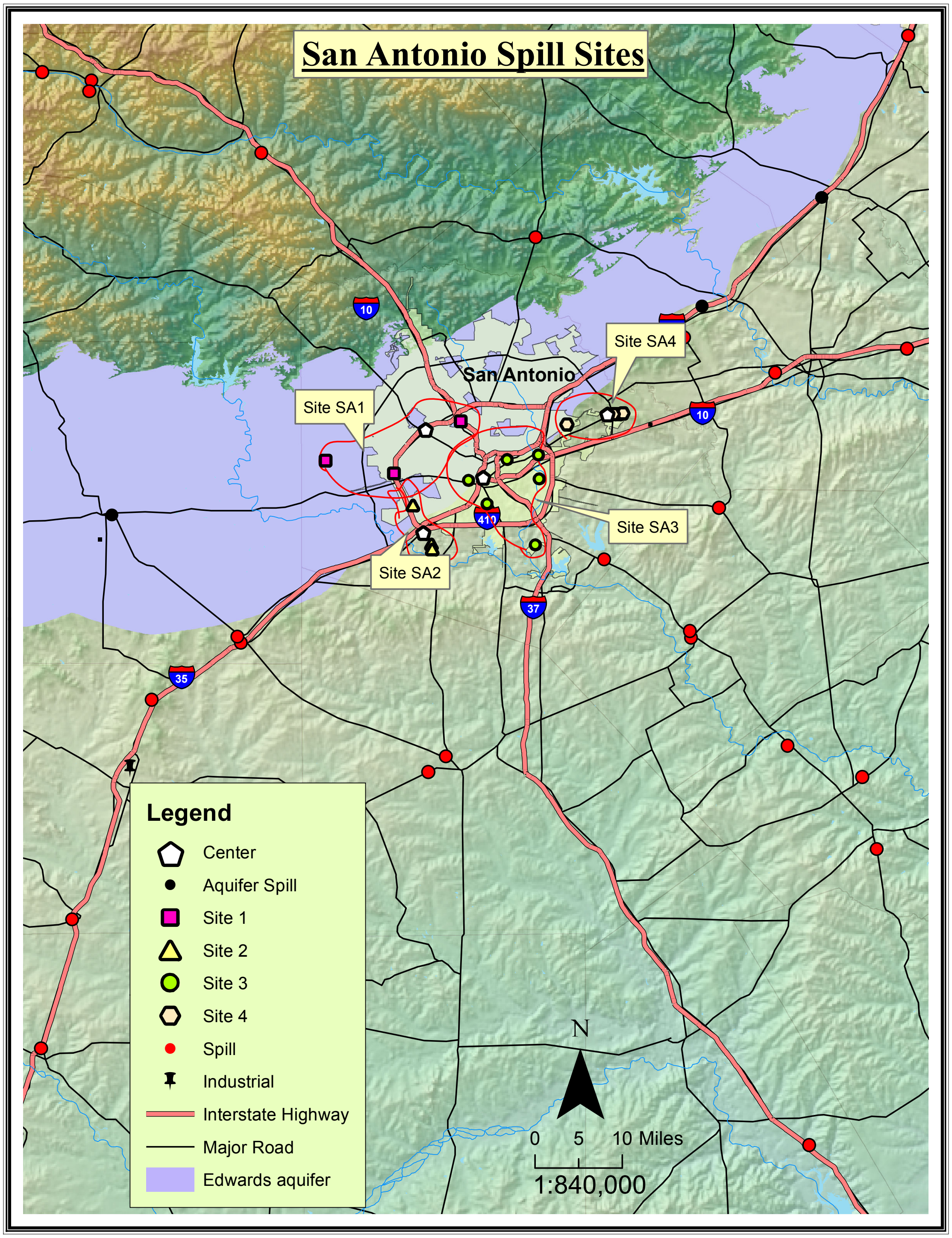

Figure 4.6: San Antonio spill sites.

Table 4.12: Details of Frequent Spills in San Antonio Area

Location	Volume (gal)	County	Lat. (deg)	Long. (deg)	Number of Spills
Site SA1	15	Bexar	29.5	-98.6	5
Site SA2	60	Bexar	29.3	-98.6	4
Site SA3	35–35,000	Bexar/Guadalupe	29.4	-98.5	6
Site SA4	40–2,325	Bexar	29.5	-98.3	15

highways near Site SA4 might provide a location for such structures, again provided that site conditions were conducive to such installations.

Comments on Geographic Locations of Recorded Spills

For the geographic areas discussed in Section 4.3.3, the location of some spill sites were approximated because incomplete descriptions of the spill locations were contained in the TCEQ records. Given that the sites of greatest interest (greatest number of spill incidents) exhibit multiple spill events, this approximation is not considered detrimental to the results reported herein.

It is understood that the size of the locations reported in this section of the report is too large for application of a single hazardous materials trap for each spill site. That is not the intent. However, with application of the information presented herein, a designer or planner should be better able to determine appropriate or potential sites for installation of one ore more traps for regulatory purposes, providing economic and technical feasibility criteria are satisfied.

A number of areas near Beaumont, Dallas-Fort Worth, Houston, and San Antonio were the sites of multiple hazardous materials spill incidents during the 2002–2006 period of record. Those with the greatest number of events are Sites B1–B5, DFW4, H1, and SA4. These sites (as well as some of the others) represent candidates for additional study by TxDOT to determine whether there is a systemic problem in these areas that result in an apparent greater number of incidents or if they are the result of heavy traffic loads. Furthermore, these sites represent candidates for installation of hazardous materials traps, provided site conditions are amenable to such installation.

4.4. Design Protocol

No formal design protocol was identified during the literature review portion of this project. Because hazardous materials traps and water-quality treatment structures are generally not required to handle the hydraulic loads from relatively rare hydrologic events, they are sometimes placed offline with respect to the drainage path for the hydrologic design event. This requires use of a hydraulic splitter that will isolate the trap/treatment structure(s) from the larger detention facility (if one is used).

There are a number of approaches to splitting incoming flows to a system. One option is use of a valve or gate. Although simple, the disadvantage of valves and gates is that they must be operated manually. A second approach that does not require manual intervention is the use of a weir. The weir can be designed so the trap is filled before flows are directed to the water quality treatment device and/or detention storage. A low-flow conduit and valve could be installed so that the trap drains to other components of the system, but with reduced capacity so that trapped material could be blocked (by manual operation of the valve) by first responders in the event of a spill.

The following decision tree is suggested:

1. No detention or BMP required?
    (a) Trap placed off-line of the main discharge.
    (b) Hydraulic splitter used to direct spill materials to the trap.
    (c) Sufficient hydraulic capacity (storage) in the HMT such that trapped materials will not escape if a hydrologic event occurs during or before spill clean-up is complete.
2. Only detention required?
    (a) Separate trap and detention structures
        i. Place trap off-line with respect to the detention facility using a hydraulic splitter to direct a spill to the trap prior to the detention facility.
        ii. Provide sufficient storage capacity in the trap such that spill materials will not escape should a hydrologic event occur during or prior to completion of clean-up.
    (b) Combined trap/detention structure
        i. An alternative approach would be to provide additional storage in the detention/retention structure equal to (or greater than) the design spill volume.
        ii. Structure the outlet such that the standard condition is either closed (no discharge) or open (free discharge).
        iii. Either condition requires intervention during a storm runoff event or a spill event.
3. Detention and water-quality treatment required?
    (a) Assume water-quality treatment and detention are in-line.
    (b) Place trap off-line from water-quality treatment and detention system.
    (c) Use a hydraulic splitter to direct first flows to trap.
    (d) Provide sufficient storage in the trap such that when the splitter is bypassed by incoming storm runoff no discharge from the trap is allowed.
    (e) Provide drainage from the trap to the water-quality treatment/detention system after runoff event passes.

Problems with this approach stem from the observation that some spills are materials with an $S_g < 1$ (should float) and some spills are $S_g > 1$ (should sink). Non-soluble solids with $S_g < 1$ will probably be transported as either suspended sediment or bedload and caught by detention or BMP structures. Lighter solids and liquids will probably be transported on top of any runoff (unless the constituents are soluble) and are a problem. An emergency shutoff of an outlet works for structures might be required in sensitive areas to reduce the probability of an off-site migration of spill materials when runoff occurs.

In the case where water-quality treatment and detention are not required (Case 1), a spill trap could be placed near the outfall from local highway drainage to provide the trap design storage volume should a spill incident occur. These structures could be established with the standard condition either a no-discharge (outlet works closed) or in an open-discharge condition (required closure by first responders if a spill incident occurred).

Determination of closed-discharge or open-discharge is a policy decision. Factors to consider are the probability of a runoff event (greater in the eastern part of the state and lesser in the western part of the state). A closed-discharge standard condition requires an operator to open the discharge if a storm runoff event occurs. An open-discharge standard allows storm runoff to pass without operator intervention, but requires first responders to close the discharge in a spill event. The latter means that first responders will need information that 1) the discharge must be closed to prevent/reduce migration of spill materials off the highway right-of-way and 2) requires the first responders to have direction and presence of mind to close the discharge. Furthermore, the discharge should be operated periodically, regardless of whether the standard is open or closed, to maintain viability of the valve or gate.

5. Summary and Conclusions

The purpose of this chapter of the report is to provide a summary of research work accomplished and a synopsis of the research findings. In addition, suggestions for further research into issues associated with hazardous materials spill traps are provided.

5.1. Project Findings

1. One of the goals of this project was to identify the existence of a hazardous materials spill trap technology that does not rely on human intervention to perform effectively. More specifically, if a reliable technology that would allow stormwater runoff to pass but intervene to trap spill materials in the event of a spill event, that would be of benefit to TxDOT. However, no such technology was identified.

2. Records of hazardous material spill incidents on Texas highways for the period 2002–2006 were obtained from TCEQ for review. A total of 899 spill incidents were available for analysis. Materials comprising gases, solids, unknown materials, and liquid spills with no reported volume were eliminated from further analysis. The remaining 582 spill incidents were examined in detail.

3. Spill materials were categorized as "light" (specific gravity less than one), "heavy" (specific gravity greater than one), and "oils" (which overlaps with the "lights" to a significant extent). The 95th percentile of spill volume for the lights was about 1,400 gallons, for the heavies was about 8,900 gallons, and for the oils was about 1,200 gallons. If all incidents were considered together, then the 95th percentile spill volume was 2,500 gallons. The San Antonio development code requires a capture volume of at least 10,000 gallons for roadway projects with ADT of 30,000 vehicles per day or more. A reasonable target for capture volume is between 10,000 and 20,000 gallons (1,300–2,600 cubic feet) because this volume range will capture the volume of between 95–99 percent of historical spills. The proposed trap volume is a relatively small volume in comparison to typical stormwater runoff detention structures.

4. The potential impact of rainfall on spill likelihood was examined using a proportions test. The presence of rainfall on a spill-incident day was not statistically significant at a reasonable level of significance. This does not mean that the occurrence of a spill incident and a rainfall event are statistically unrelated; it means that the statistical relation could not be established given the amount of data available. Therefore, although it seems reasonable to connect a rainfall

event and a spill incident, the relation is not strong enough to be sensed with the dataset available.

5. The potential for locations where clusters of hazardous materials spills are more likely to occur was examined using the database assembled as part of this project. Certain areas in Austin, Beaumont, Dallas-Ft. Worth, Houston, and San Antonio were identified as locations where more spill incidents occurred than at other areas of Texas. Although a greater number of events occurred near these locations, the events were still spread over a large distance, with clusters being defined as occurring in a 10-mile radius of a central location. The analysis is useful in that it revealed the general location of concentrations of spill incidents, but is not useful in defining the precise location of potential spill traps.

6. A large body of literature pertaining to storm water quality structures that are used to improve stormwater quality was reviewed. The intent of this task was to identify potential applications of stormwater treatment technology in a spill treatment role. That material is summarized in this report. The most likely candidates for such a dual-purpose role remain those structures that capture stormwater runoff for treatment or for runoff rate control.

7. If neither detention nor stormwater water-quality treatment is required, then a spill trap could be placed at outfalls from local highway drainage to impound the design volume should a spill occur. These structures could be placed in either a no-discharge condition (outlet works closed requiring maintenance to release stormwater after an event) or in an open-discharge condition (requiring first responders to close the outlet work if a spill incident occurred).

8. If detention is required, then the detention/retention structure with the outlet structured such that a certain volume must be exceeded before discharge occurs could serve as a spill trap. The outlet works consideration defined in Item 7 would apply.

9. If stormwater runoff water-quality treatment is required, then a portion of the incoming volume could be set aside to act as a spill trap. Again, the criteria presented in Item 7 would apply.

10. An alternative is to place a spill trap off line of either detention or water-quality treatment (or both) with initial flows directed to the trap by a hydraulic splitter.

11. The variety of approaches for spill traps presented in Items 7–10 should provide TxDOT designers flexibility in achieving reasonable designs should it be determined that a spill trap is required.

12. An agency-wide decision should be made concerning the outlet works for spill traps. It is important that there be uniformity in protocol so that both TxDOT personnel and first responders know whether the spill-trap outlet works are open or closed by default.

5.2. Recommended Work

During the course of this project a few ideas for further research were developed. A listing of these ideas follows.

1. The application of hazardous materials spill traps is not generally required by other jurisdictions. This might be attributable to relative rarity of spills and the potential impact on receiving waters. However, an issue that was not examined was the economics of hazardous materials spills and traps. This topic is one that would benefit from significant study because the relation between trap cost and spill cost should be used to determine what locations would benefit from use of traps, if any.

2. A review of the CRIS[1] accident database is appropriate. The CRIS database became available late in this project and there was insufficient time and resources to do an appropriate analysis. The CRIS database could be useful to TxDOT designers tasked with selecting sites for potential hazardous material spill structures.

3. A few prototype structures at locations where spill incidents are most likely would be useful to determine the utility of the structures. Records of spills at those locations, whether the structures performed as designed, and the interaction between TxDOT personnel and first-responders in operating the structures would be beneficial.

4. Review of the structures used in the San Antonio District was not considered as part of this research project. It might be that Recommendation 3 has already been accomplished by San Antonio District personnel and results from their experience are available.

[1] The Crash Records Information System database is managed by the Traffic Operations Division, Crash Records Section of TxDOT. It is appropriate for this newly available database to be reviewed to determine whether it contains data appropriate for analysis of spill incidents.

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A. Select Water-Quality Design Standards

A number of Texas jurisdictions present formal water-quality design standards. A summary of these documents is presented in the subsequent sections of this report. Although these do not directly address the design of hazardous materials traps, such designs are by nature interrelated because of the physical proximity that is likely. Therefore, this information is considered germane.

A.1. San Antonio, Texas Water Quality Standards

The City of San Antonio requires installation of detention, sedimentation, and filtration systems for water-quality control for runoff from multi-family and commercial developments wherever the impervious cover exceeds 15 percent[1]. The standard is for a trap-and-treat of the first 0.5-inches of runoff[2], separately from any detention provided. In addition, roadways with an average daily traffic of 1,500 vehicles per day or more are to have sediment and filtration basins to trap and treat the "first flush" of runoff from a storm event. Roadways with ADT exceeding 30,000 vehicles per day are also to have hazardous materials traps with a minimum volume of 10,000 gallons with a self-draining outlet and an emergency cut-off to contain any spilled materials[3].

The City of San Antonio design criteria contain a recommendation for extended detention. The design recommendation is for use of extended detention ponds when wet ponds, vegetated treatment ponds, or vegetated swales and strips are not practical because of irrigation requirements, or where mosquito control would be a problem. Basin design is based on

1. Drawdown time of 24–40 hours (40 hours is preferred),
2. Shallow basin with large surface area preferred,
3. Basin length should be at least three times the width,
4. Basin inlet and outlet at opposite ends of the basin, or baffles required,
5. Energy dissipator at the inlet to reduce turbulence and potential resuspension,
6. Vegetation of side slopes,

[1] Sec.34–960, City of San Antonio Uniform Development Code, available on the internet at `http://www.municode.com/resources/gateway.asp?pid=14228&sid=43` at the time of this writing.

[2] Design criteria for stormwater treatment vary from jurisdiction to jurisdiction, with some specifying the design criteria in terms of the likelihood of the precipitation event and some in terms of first flush. The former sometimes specify that the runoff from 90 percent of events be trapped and treated. The latter typically specify a depth of runoff or the runoff from a specific depth of precipitation. The intent is generally to trap and treat the runoff from the most common hydrologic events.

[3] Sec.34–965 and following.

7. Paving or soil stabilization where side erosion is a problem, and
8. Submerge the outlet if floatables are present.

A.1.1. Design Approach

Target removal rate is 70 percent of suspended solids (TSS). The basin area is

$$A_s = A_d \frac{H}{10}, \tag{A.1}$$

where A_s is the surface area of the pond (square feet), A_d is the contributing drainage area (square feet), and H is the design storm depth (feet). Pond sizing is in accordance with Young and Graziano (1989).

A.2. Austin, Texas Criteria

The City of Austin, Texas maintains a drainage design manual[4] and an environmental criteria manual[5]. The water quality design criteria is a minimum runoff volume of one-half (0.5) inch plus an additional one-tenth (0.1) inch for each ten (10) percent increase of gross impervious cover in excess of twenty (20) percent[6]. The impervious area includes all impervious surfaces, including roads, sidewalks, parking areas, and rooftops[7]. Rooftop drainage areas may be removed from the impervious area computation if rainfall harvesting is implemented.

Runoff from lands left in a "natural" state (greenbelts and open spaces) is not required to be treated. Such runoff from these areas is to be bypassed around the water quality structure or included in the required treatment volume.

Off-site drainage should also be routed away from any treatment structures. Commercial developments are not subject to the same requirements because on-site treatment is required for commercial developments.

A hydraulic splitter is required to separate water-quality flows from stormwater runoff. The splitter must pass the 25-year event to the treatment structure and pass the 100-year event without overtopping of the structure walls.

Basin liners to prevent or reduce bottom infiltration are required.

[4] On the internet at `http://www.amlegal.com/austin_nxt2/gateway.dll?f=templates&fn=default.htm&vid=amlegal:austin_drainage` at the time of this writing. This site works correctly only with Internet Explorer; other browsers will not display the contents.

[5] On the internet at `http://www.amlegal.com/austin_nxt2/gateway.dll?f=templates&fn=default.htm&vid=amlegal:austin_environment` at the time of this writing. This site works correctly only with Internet Explorer; other browsers will not display the contents.

[6] From Section 1.6.2 of the environmental criteria manual.

[7] In some jurisdictions, rooftops are not included in the impervious area computations. City of Austin is an exception.

A.3. Fort Worth, Texas Criteria

The City of Fort Worth, Texas maintains a drainage design manual[8]. In addition, stormwater control design protocols are also provided[9].

A.4. TCEQ Edwards Aquifer Recharge Zone

The Texas Commission on Environmental Quality (TCEQ) has an extensive set of rules for the environmentally-sensitive Edwards Aquifer Recharge Zone. The process for estimating the required design volume for a best management practice (BMP) is presented by Barrett (2005) and is summarized in the following.

The requirement is that 80 percent of the increase in TSS load (notice not concentration) over the background TSS load that results from development must be removed. The general process for development of a BMP design is

1. Calculate the required TSS removal, which is based (solely) on the net increase in impervious area,
2. Select a BMP or BMP system appropriate for the site,
3. Compute the TSS load removed by the BMP system,
4. Compute the percentage of runoff to be treated to achieve the 80 percent reduction in TSS for the increased load,
5. Calculate the capture volume/minimum flowrate necessary to achieve the target load reduction, and
6. Test the selected BMP to determine whether the target reduction can be achieved, then
   (a) If the target load reduction is achieved by the selected BMP system, conduct the detailed design,
   (b) If the target load reduction is not achieved by the selected BMP system, either select another BMP system or reduce the increase in impervious area.

[8] The web site for development design criteria was `http://www.fortworthgov.org/tpw/info/default.aspx?id=26178` at the time of this writing.

[9] The web site for the stormwater control design procedures was `http://iswm.nctcog.org/Documents/Site_Development_Manual.asp` at the time of this writing.

B. Data for the Spill-Site Analysis

The purpose of this appendix is to present more detailed data for those areas that seem to be subject to a greater number of material spill incidents. These collections of spill sites are typically located in and near the large metropolitan areas in Texas. The approximate distance of each spill site from the centroid of the spill cluster is listed in the following tables. For those areas where the distances are relatively small, it might be possible to reduce clean-up difficulty by installing a hazardous material trap, provided the site topography and other details are amenable.

In the context of the tables and maps that follow, the term centroid refers to the approximate centroid of the area defined on the associated map. The information presented in the tables is approximate, but useful in that it allows an assessment of those reaches of roadways were the installation of traps might be useful.

Table B.1: Austin area spill sites.

Location	Volume (gal)	Nearest City	County	Lat. (deg)	Long. (deg)	Rain (in)	Distance from Centroid (mi)	Number of Spills
			Site A1					
Between Mile Marker 246 & 252a on IH-35 Northbound	250	Round Rock	Williamson	30.49	-97.68	T	0.00	1
IH-35 S from Georgetown	5880	Georgetown	Williamson	30.64	-97.68	0.00	10.50	1
8600 N IH-35	5000	Georgetown	Williamson	30.66	-97.68	0.3, 0.1	10.70	1
On NE County Rd 119 & US Hwy 79	–	Hutto	Williamson	30.54	-97.54	0.00	8.80	1
551 South IH-35 Georgetown Texas	–	Georgetown	Williamson	30.64	-97.69	0.00	10.70	1

Table B.2: Detailed data for Beaumont area Site B1.

Location	Volume (gal)	Nearest City	County	Lat. (deg)	Long. (deg)	Rain (in)	Distance from Centroid (mi)	Number of Spills
Intersection of Hwy 347 and Hill St Nederland Tx	0	Nederland	Jefferson	29.99	-94.01	T	0	1
Highway 347	0	Beaumont	Jefferson	30.02	-94.05	0	3.3	4
6275 Highway 347	50–1,600	Beaumont	Jefferson	30.02	-94.05	0	3.4	7
Highway 69 South and Exit 3514	188	Beaumont	Jefferson	30.00	-94.04	0	1.9	1
Westbound Exit Ramp from Highway 69 to Ih-10	30	Beaumont	Jefferson	30.00	-94.04	T	1.9	1
0.5 Miles from Intersection of Hwy 347 and Hwy 366 on Hwy 366	3–1,400	Nederland	Jefferson	29.99	-93.97	1.66	1.9	14
6001 Highway 366	10–6,300	Port Neches	Jefferson	29.98	-93.95	1.45	3.5	30
Hwy 366	40	N/A	Jefferson	29.98	-93.95	T	3.5	1
5500 State Highway 366	1–2,400	Groves	Jefferson	29.97	-93.94	N/A	3.8	5
615 Main Street	0	Port Neches	Jefferson	29.99	-93.95	0	3.5	1

Table B.3: Detailed data for Beaumont area Site B2.

Gate 99, Intersection of Hwy 73 and Hwy 366	5, 75	Port Arthur	Jefferson	29.95	-93.89	0.63	0	2
Intersection of Hwy 366 and 32 street	10–600	Groves	Jefferson	29.96	-93.90	5.65	0.92	27
Intersection of Fm 322 and Hwy 87	300	N/A	Jefferson	29.94	-93.89	0.92	0.60	1
Hwy 87 10 Miles West from Sabine Pass	30	Sabine Pass	Jefferson	29.94	-93.89	0.89	0.58	2
Hwy 87 2.5 Mi E from Sabine Pass	70	Sabine Pass	Jefferson	29.97	-93.87	0	1.80	1

Table B.4: Detailed data for Beaumont area Site B3.

100 Old Highway 90 West	1–120	Beaumont	Orange	30.10	-94.06	N/A	0	23
IH-10 Exit 849 Near Walden Rd.	8, 15	Beaumont	Jefferson	30.04	-94.16	T	7.20	2
Highway 69 South and Old Amoco Road at the Lnva Canal	35	Beaumont	Jefferson	30.10	-94.14	0	4.50	1
IH-10 W-Bound at FM 838	1	Beaumont	Jefferson	30.10	-94.10	0.57	2.60	1
1.5 Miles West of Beaumont on Highway 90	25, 35	Beaumont	Jefferson	30.09	-94.09	0.92	1.52	3
Mile Marker 878 Eastbound IH-10 Construction Zone	40	Vidor	Orange	30.13	-94.01	N/A	4.20	1
585 IH-10 E 415 Old Hwy 90 Adj to Orange Co Bldg Materials	20	Vidor	Orange	30.13	-93.99	N/A	4.80	1
US 69 on Northbound Side, 0.5 mi Past Fannett Rd.	30	Beaumont	Jefferson	30.04	-94.13	0.75	5.60	1
IH-10 Westbound Between FM 1132 and FM 1135	120	Vidor	Orange	30.13	-93.95	N/A	7.00	1
10658 Highway 90 W	0	Beaumont	Jefferson	30.10	-94.06	0.58	3.00	1

Table B.5: Detailed data for Beaumont area Site B4.

IH-10 Between Mi Marker 873 & 879 E of Orange Tx	1	Beaumont	Orange	30.12	-93.79	N/A	0	1
Jct Hwy 62 & 105; W on 105 1 Mi	1,147	Orangefield	Orange	30.08	-93.82	N/A	3.40	1
IH-10 Eastbound Median, East of Highway 62	25	Orange	Orange	30.12	-93.82	N/A	1.95	1
Mile Marker 876 Eastbound IH-10	110	Orange	Orange	30.12	-93.76	N/A	1.54	2
IH-10 Eastbound at Cow Bayou	–	N/A	Orange	30.12	-93.74	N/A	2.70	1
Interstate Highway 10 Westbound Near Mm 870 and Cole Creek	20	Orange	Orange	30.12	-93.83	N/A	2.60	3
Highway 62 Exit Near the Flying J Truck Stop	–	Orange	Orange	30.10	-93.75	N/A	2.81	2
Hwy 87 and 1200 16th St	25–316	Orange	Orange	30.17	-93.76	N/A	4.20	4

Table B.6: Detailed data for Beaumont area Site B5.

West of Port Arthur Texas on State Hwy 87	1–10,000	Port Arthur	Jefferson	29.73	-93.89	0	0	20
Hwy 87 S Towards Sabine Pass	500	Port Arthur	Jefferson	29.73	-93.89	0	0.50	1

Table B.7: Detailed data for Dallas-Fort Worth area Site DFW1.

Location	Volume (gal)	Nearest City	County	Lat. (deg)	Long. (deg)	Rain (in)	Distance from Centroid (mi)	Number of Spills
Southbound IH-35E near 9600 Block RL Thornton Fwy	50	Dallas	Dallas	32.77	-96.80	0	0	1
IH-35E at Kiest Blvd Exit	60	Dallas	Dallas	32.71	-96.83	0.3	4.70	1
IH-30 West on-ramp at Industrial Blvd	50	Dallas	Dallas	32.77	-96.81	0	0.50	1
IH-35E south at NW Hwy Intersection	3	Dallas	Dallas	32.87	-96.81	0.6, 0.42	6.80	1
IH-35E at intersection of Jefferson Blvd	10	Dallas	Dallas	32.76	-96.81	0	0.67	1
Hwy 183 Southbound between Regal Row and Mockingbird Lane	100	Dallas	Dallas	32.84	-96.80	0	4.70	1
4200 S. IH-45	60	Dallas	Dallas	32.74	-96.76	0	2.89	1

Table B.8: Detailed data for Dallas-Fort Worth area Site DFW2.

2002 NW Hwy	1	Garland	Dallas	32.85	-96.64	0	source	1
4532 Highway 67E	70	Mesquite	Dallas	32.83	-96.62	0	2.2	1
IH-30 Eastbound at Zion Road	125	Garland	Dallas	32.86	-96.54	0.32	5.8	1
NE from intersection of Hwy 75 and IH-635	10–70	Dallas	Dallas	32.92	-96.77	1.27, 0.09	8.7	4
1145 IH-30	340	unavailable	Dallas	32.82	-96.64	T	0.5	1
Intersection of IH-30 and IH-635	50	Mesquite	Dallas	32.82	-96.63	0	0.65	1

Table B.9: Detailed data for Dallas-Fort Worth area Site DFW3.

3980 N IH-35E, Service Rd and Lofland Rd	100	unavailable	Ellis	32.45	-96.85	0	0	1
IH-35E Southbound	155	Red Oak	Ellis	32.52	-96.82	N/A	4.81	1
Intersection of IH35E at FM66	100	Waxahachie	Ellis	32.37	-96.86	0	5.40	1
Intersection of Hwy 77S and Northgate	1	Waxahachie	Ellis	32.40	-96.84	0	5.50	1

Table B.10: Detailed data for Dallas-Fort Worth area Site DFW4.

Vic intersection of State Hwy 114 and William D Tate	200	Grapevine	Tarrant	32.90	-97.10	0.36	0	1
Intersection of Hwy 26 and Kimball S.	0	Grapevine	Tarrant	32.93	-97.11	0	1.70	1
IH-30 under Hwy 360 bridge.	0	Arlington	Tarrant	32.76	-97.06	T	9.90	1
1700 North Hwy 360	25–350	Grand Rapids	Tarrant	32.77	-97.06	0	9.12	4
Near Intersection of Hwy 121 and Denton Tap Road	16 pounds	Lewisville	Denton	33.00	-96.99	0	8.96	1
Intersection of IH-35E and Hebron Parkway Exit 448	155	Lewisville	Denton	33.01	-96.97	0	10.00	1
Intersection of SH 183 at Loop 12	300	Irving	Dallas	32.84	-96.91	0	11.50	2

Table B.11: Detailed data for Dallas-Fort Worth area Site DFW5.

Near Int IH-35E and Loop 288	100	Denton	Denton	33.26	-97.18	0	0	1
IH-35N at Exit 478	341	Sanger	Denton	33.36	-97.18	0	6.80	1
IH-35E at Sam Bass Road	60	Denton	Denton	33.36	-97.18	0	7.30	1
Int US Hwy 380 at FM 159	0	Denton	Denton	33.23	-97.18	0	1.80	1
IH-35 Exit 468 (Oak Street)	1	Denton	Denton	33.22	-97.17	1.2	0.50	1
US Hwy 380 appx 5 mi W of Denton	75	Denton	Denton	33.23	-97.17	0	0.50	1

Table B.12: Detailed data for Dallas-Fort Worth area Site DFW6.

Intersection of Handley-Ederville at Randol Mill	1	Fort Worth	Tarrant	32.75	-97.34	0	0	1
IH35W near Exit 60 (Hwy 287)	0	Fort Worth	Tarrant	32.70	-97.34	0	4.20	1
vic 9400 IH35W	80	Fort Worth	Tarrant	32.69	-97.32	0	4.50	1
IH35 W southbound at Felix Street (Exit 46)	2000	Fort Worth	Tarrant	32.68	-97.32	0	4.70	1
"Intersection of IH20 West at IH820 East Fort Worth, TX 76119"	20	Fort Worth	Tarrant	32.67	-97.24	0.27, 0.3	7.80	1
IH35W southbound near Western Center Blvd exit	1200	Fort Worth	Tarrant	32.86	-97.32	0	8.30	1

Table B.13: Detailed data for Dallas-Fort Worth area Site DFW7.

1400 E Hwy 67	200	Alvarado	Johnson	32.42	-97.23	0	0	1
4001 E Hwy 67	8	Keene	Johnson	32.40	-97.30	0	5.10	1
IH-35W and FM 917, between MM 31 and 32	75	Briaroaks	Johnson	32.49	-97.28	0	5.57	1
IH-35W Southbound, between MM 554 and 555 Near FM 917 Exit	25	Joshua	Johnson	32.47	-97.27	0	4.42	1

Table B.14: Detailed data for Houston area Site H1.

Location	Volume (gal)	Nearest City	County	Lat. (deg)	Long. (deg)	Rain (in)	Distance from Centroid (mi)	Number of Spills
Hwy 225 Gate 19	50– 406	Houston	Harris	29.71	-95.22		<6	9
Int Hwy 225 & Berle	30	unavailable	Harris	29.71	-95.18		3.70	1
Hwy 225 at Battleground Rd	35	Deer Park	Harris	29.71	-95.12		0	7
5900 Hwy 225	20–6,500	Deer Park	Harris	29.71	-95.12		0	16

Table B.15: Detailed data for Houston area Site H2.

Hwy 146 & 225 Strang Rd	10	La Porte	Harris	29.69	-95.03	0	2
NE Int Hwy 146 and Port Rd	20–250	Seabrook	Harris	29.60	-95.02	5.80	6
IH-10 E Spur 330 Exit Past 2nd Light	310	Baytown	Harris	29.74	-94.98	4.80	2

Table B.16: Detailed data for Houston area Site H3.

Entrance Ramp IH0-10 W Exit 789	150	unavailable	Harris	29.80	-94.98	5.60	1
9500 IH-10 E	0	Baytown	Harris	29.82	-94.89	0	1
10404 IH-10 & Hwy 146	40	unavailable	Chambers	29.88	-94.89	3.10	2
9548 IH-10 E	30	Baytown	Harris	29.83	-94.85	2.40	1

Table B.17: Detailed data for San Antonio area Site SA1.

Location	Volume (gal)	Nearest City	County	Lat. (deg)	Long. (deg)	Rain (in)	Distance from Centroid (mi)	Number of Spills
Hwy 1560, Altatierra St, and Satillo Flat	–	Helotes	Bexar	29.57	-98.65	0	0	1
10619 S US Hwy 281	15	San Antonio	Bexar	29.51	-98.83	1.26	11.00	1
SW Corner Int Loop 1604 and Hwy 151	–	San Antonio	Bexar	29.48	-98.71	0	7.00	1
Int IH-10 at FM1516	–	unavailable	Bexar	29.58	-98.60	1.9, 1.16, 1.8	3.50	1
SE Corner IH-10 and Utsa Blvd	–	San Antonio	Bexar	29.58	-98.60	0.8	3.60	1

Table B.18: Detailed data for San Antonio area Site SA2.

Location	Volume (gal)	Nearest City	County	Lat. (deg)	Long. (deg)	Rain (in)	Distance from Centroid (mi)	Number of Spills
Int SH16 & 211	60	unavailable	Bexar	29.34	-98.63	0.59	0	1
IH-35 S at Laredo St Exit	–	San Antonio	Bexar	29.32	-98.59	0	2.80	1
IH-35 S at Jnc IH-10 & IH-410	–	San Antonio	Bexar	29.32	-98.61	0.02	2.10	1
17934 SH16 S	–	San Antonio	Bexar	29.38	-98.64	T	2.90	1

Table B.19: Detailed data for San Antonio area Site SA3.

Location	Volume (gal)	Nearest City	County	Lat. (deg)	Long. (deg)	Rain (in)	Distance from Centroid (mi)	Number of Spills
17599 N IH-35	–	unavailable	Guadalupe	29.42	-98.49	N/A	0	1
FM1516 and IH-10 E	–	San Antonio	Bexar	29.43	-98.51	0	1.30	1
IH-10 and 1604 W	35,000	San Antonio	Bexar	29.40	-98.50	T	2.10	1
17910 IH-10 W	35	San Antonio	Bexar	29.42	-98.49	0	0.10	1
19720 Hwy 281 S	50	San Antonio	Bexar	29.33	-98.41	0.68	8.50	1
Loop 410 and IH-35 North	–	San Antonio	Bexar	29.48	-98.40	0	6.00	1

Table B.20: Detailed data for San Antonio area Site SA4.

Location	Volume (gal)	Nearest City	County	Lat. (deg)	Long. (deg)	Rain (in)	Distance from Centroid (mi)	Number of Spills
2100 Blk West IH-10	203	San Antonio	Bexar	29.46	-98.32	0.12	0	1
5619 IH-10 Exit 582	40	San Antonio	Bexar	29.45	-98.38	0	4.20	2
Int 1604 & IH-10	5–71	Converse	Bexar	29.47	-98.29	0	1.45	9
IH-10 W On-Ramp FM 1604	375	unavailable	Bexar	29.47	-98.29	0	1.55	1
8957 E IH-10	2,325	Converse	Bexar	29.47	-98.29	T	1.67	1
9010 IH-10 E	75	Converse	Bexar	29.46	-98.31	–	0.60	1

C. Spill Remediation

C.1. Treatment and Containment Strategies

Spill cleanup involves containing spilled material followed by separation from runoff, which can be accomplished by two procedures. The first procedure is a permanent containment solution that involves installation of containment structures such as detention basins and catch basins. The second procedure is to contain the spill using secondary containment devices such as booms, skimmers or BioSolve. Secondary containment devices might be installed in the permanent containment structure, in ditches, or other roadside depressions that hold the spill in the absence of permanent containment structures. Secondary containment devices are transient devices that do not remain on site after the spill cleanup is complete. Both procedures may be designed to work in spill situations with or without rain events. In the case of a spill accompanying a rain event, cleanup could be more challenging due to combined volumes of spill and runoff. Both permanent containment and the secondary containment devices are discussed in detail in the following paragraphs.

C.1.1. Permanent Containment Solutions

Permanent containment structures used for spill containment require detailed sizing and design considerations. Catch basins, oil/water separators and Stormceptors are some of the permanent containment structures that may be used. Most of the permanent containment structures discussed below, are stormwater Best Management Practices, which require modifications to their design before hazardous spill containment application. Advantages and limitations of the permanent containment devices are discussed in the following section.

Catch Basins

General Description

A catch basin (Figure C.1) is an inlet to the stormwater drainage system. Components of a catch basin consist of a grate where the stormwater enters the catch basin and a sump that captures the sediment, debris and the associated pollutants as illustrated in Figure C.2. Catch basins serve as a pre-treatment step in the collection and separation of pollutants from stormwater runoff; however, these units should not be used as standalone treatment units. Catch basins collect water in an oversized sump and provide some inflow and outflow control to remove coarse sediments and debris (Oregon Department of Environmental Quality 2007).

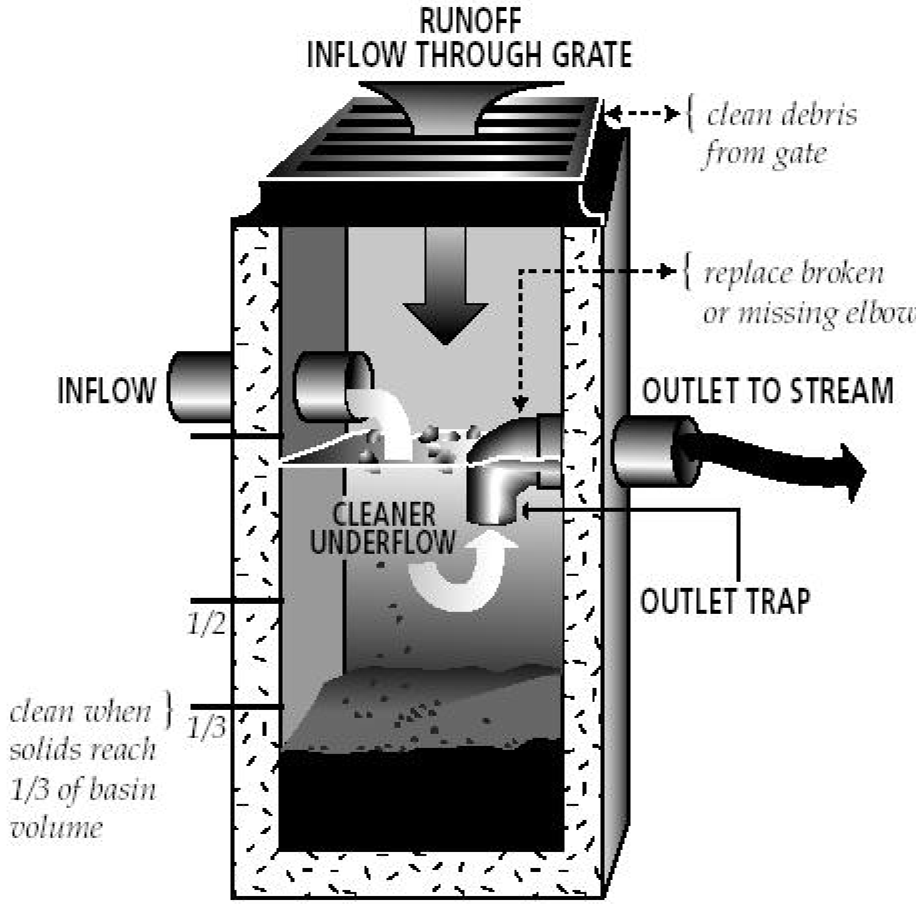

Figure C.1: Catch basin (Environmental Services — City of Portland 2007)

Applications

Catch basins may be used in most urban drainage systems throughout the U.S. and are normally located under low spots or along road curbs. Catch basins are more or less consistent with their design and do not have any regional variations (Storm Water O and M Fact Sheet 1999).

Advantages

- Catch basin units are relatively inexpensive.
- Existing catch basins might be easily modified to include catch basin inserts.
- Catch basins are available in prefabricated forms and standard sizes (Oregon Department of Environmental Quality 2007).

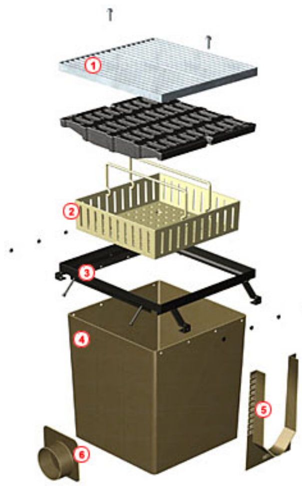

Figure C.2: Components of a catch basin (ACO Polymer Products Inc. 2007)

Disadvantages

- Catch basins do not remove pollutants at rates comparable to those of wet ponds or filters hence, catch basins should not be used as standalone treatment units.
- Regular maintenance of a catch basin is essential for efficient functioning, which constitutes a major portion of the cost (Oregon Department of Environmental Quality 2007).

Prospective Locations

- The highway segment should be selected in such a way that any spill that occurs in that segment is directed to the catch basin.
- Catch basin may be located at stream crossings on highways that are functionally classified as rural or urban arterials.
- Basins installed at the above stated locations should be installed as per site evaluations. Considerations should be included for traffic, volume and type of spill and potential for accidents based on highway geometry and receiving water quality (North Carolina Department of Transportation 2007).

Design Requirements

- The volume of the catch basin should be approximately 10,000 gallons in addition to the runoff encountered from a 2-year return period storm event.

- A means of controlling output from the basin could be provided. This might be a mechanical gate or a narrow space at the outlet blocked by bags or soil. Therefore, maintenance would be required.
- Mechanical gate option should be provided in areas where close scrutiny of the operation of the gate is possible to prevent unauthorized activity (North Carolina Department of Transportation 2007).

Applicability to Hazardous Spills

Catch basins are recommended for this project because they trap floatables at the top and sediments and settleable debris at the bottom. This increases the removal efficiency of the contaminants being separated with skimmers, booms and rubberizers, downstream of the basin (in other containment structures). In addition, catch basins remove macroscopic organics that serve as a medium for transport of pollutant particulates. Catch basins may also retain denser insoluble solids and heavier immiscible liquids in the sump.

The problem with maintenance could be overcome by developing a regular protocol performed by the highway maintenance group. Catch basins are not expensive and are the foundation for installation of catch basin inserts. When appropriately sized, catch basins are not limited by treatment capacity. Analysis of both rainfall data and spill data should be considered during sizing. Thus, catch basins reduce cost and accelerate cleanup of hazardous materials. Furthermore, in the absence of spill, catch basins remove sediments and improve the effluent water quality. Catch basins may be incorporated in the design or construction phase of the project.

Catch Basin Inserts

General Description

Catch basin inserts are capable of accommodating oil/water separators and media filtration units. However, these modifications have major drawbacks in terms of capacity to be treated and repeated clogging. A catch basin insert is a device inserted underneath the inlet to treat incoming water by adsorption, absorption, filtration or a combination of these methods. A general catch basin insert is shown in Figure C.3. A typical catch basin insert consists of the following components.

- A frame on which the pollutant removing medium is held in place.
- A means of suspending the insert in the basin.
- Inlet and outlet structures.
- A secondary outlet for bypass flows (Tennessee BMP manual Stormwater Treatment 2002).

There are several versions of catch basin inserts that might be used to contain sediment, oil, grease, litter, and debris. The inserts consist of a geotextile filter fiber and uses various sorbents to trap pollutants. The size of the insert depends on the insert manufacturer (EPA 2006).

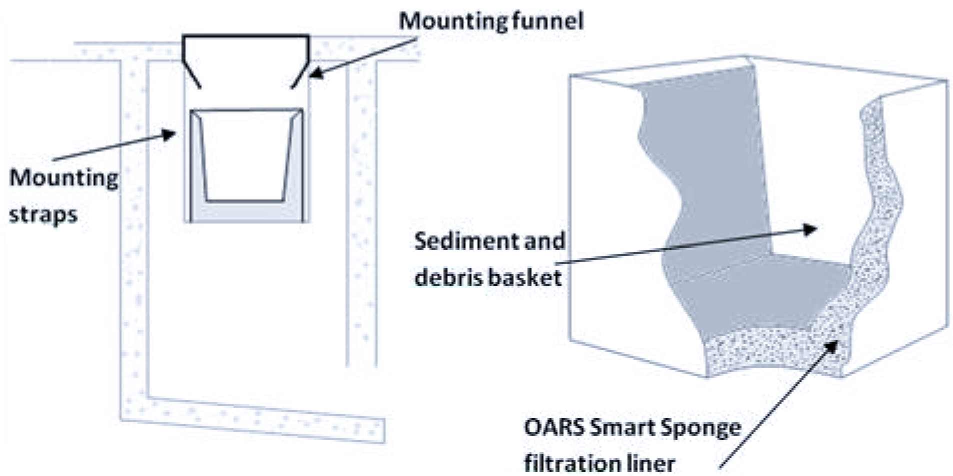

Figure C.3: Catch basin inserts (AbTech Industries 2002).

Advantages

- No regional variations.
- May be retrofitted in an existing catch basin with ease (Tennessee BMP manual Stormwater Treatment 2002).

Disadvantages

- Both installation and maintenance costs are a concern.
- Catch basin inserts require regular, consistent checkups for uninterrupted service (Tennessee BMP manual Stormwater Treatment 2002).

General Design Considerations for Catch Basins and Catch Basin Inserts

Modified catch basins have an oversized sump that aids in the removal of dense sediments and floatables. Catch basin design is site specific and the design requires careful consideration for the volume treated. The catch basin insert is used as a first flush treatment prior to a retention facility or an infiltration practice. The conditions that affect the type of insert selected include targeted contaminants (like hydrocarbons, metals, silt, organics and other particulates), area constraints, cost, and frequency of maintenance.

Inclusion of catch basin inserts has an added advantage of better treatment than using catch basins alone. A major disadvantage of inserts is limited treatment capacity. Therefore, careful consideration must be given to bypass flows in the event of large storms. A number of bypass designs are in use and one such arrangement is shown in Figure C.4.

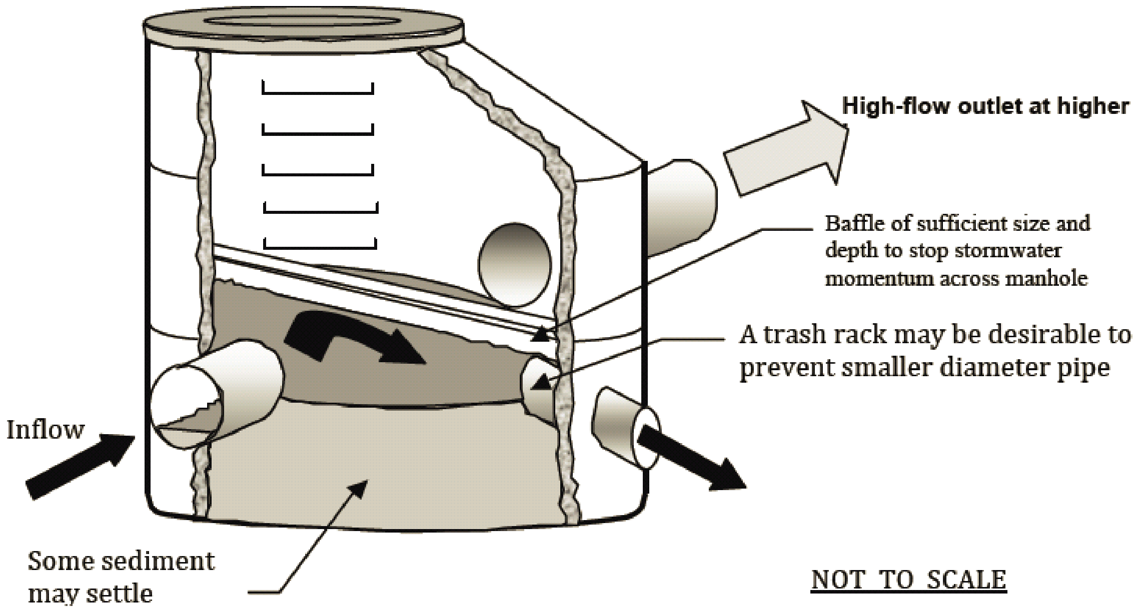

Figure C.4: Working of a catch basin insert (Tennessee BMP manual Stormwater Treatment 2002).

Such bypass structures allow the entire system to function offline rather than inline. The bypass structure protects the catch basin insert from damage and at the same time fulfills the purpose of treating the first flush of runoff. The bypass factor also prevents re-suspension of trapped contaminants. Once the total volume of runoff and spill encountered is determined, a hydrologic analysis is performed to determine the actual volume treated by the insert (Tennessee BMP manual Stormwater Treatment 2002).

Application

Catch basin inserts are capable of removing TSS, organics, and certain metals based on the type of insert employed. Major drawbacks include limited capacity and maintenance requirements. Some of the common applications are listed below.

- Oil spill cleanup at the site using a high hydrocarbon loading capacity medium that is not clogged by suspended matter.
- Inserts may be used to overcome drawbacks of undersized sumps, which reduce the amount of pollutant that may be removed in the catch basin.
- Inserts act as the final treatment unit if no further treatment operations exist.

Examples

- Ultra-urban filter with smart sponge technology (Abtech Industries) is chemically selective for hydrocarbons (EPA 2007).
- The Aqua-guard catch basin insert is capable of removing oil, grease and heavy metals like zinc and copper (EPA 2007).
- Specially designed inserts may be used for site specific applications, such as the Stream Guard inserts for oil and sediment removal (Tennessee BMP manual Stormwater Treatment 2002).

Applicability to Hazardous Spills

Catch basin inserts are used for separating specific types of pollutants and are often limited by treatment capacity and volume limitations. They are recommended for areas that have witnessed repeated spills of the same contaminant and where space considerations limit installation of other in-place structures (such as detention basins). Pollutants such as oils and greases may be removed by contaminant-specific inserts. A large number of oil and fuel spills with small volumes were observed from the spill records contained in the project database, which could be effectively contained by the use of catch basin inserts. Catch basins are an effective alternative for urban areas that cannot house other bulky structures due to space limitations. The Triton Catch Basin insert[1] removes commonly spilled materials such as hydrocarbons, metals, silt, and debris. Catch basin inserts could be easily retrofitted in existing catch basins and should be inspected regularly to address clogging concerns.

Detention Basins

Detention basins are impoundments or excavated basins that store stormwater runoff for short durations until the water may be released safely downstream at pre-determined flow rates. Dry detention basins and extended dry detention basins are common. Detention basins hold runoff and release it at a point downstream to avoid flooding. Both the basin and the outlet are sized on the basis of runoff and the service area (See design section for details). Extended detention basins drain water at a rate slower than dry detention basins and often retain a permanent pool of water.

Detention basins retain water, aid in detaining limited amounts of pollutants, and prevents flooding and water scouring downstream of the basin. A detention basin has moderate removal efficiency for sediments, oil, and grease while having low removal efficiency for nutrients. Detention basins are a cost effective alternative for handling large amounts of water. Clogging at the basin inlet and outlet can be overcome by regular maintenance, proper design, and provision of access space for repair and maintenance. Maintenance practices include regular inspections, review by a licensed professional engineer, vegetation management, embankment and outlet stabilization, debris and litter control, and sediment/pollution removal (NRCS Planning and Design Manual 1994).

[1] ConTech Construction Products, Inc. `http://www.contech-cpi.com`

Advantages

- Detention basins are simple in design and relatively inexpensive to operate and maintain.
- Detention basins provide substantial capture of sediments and toxic pollutants associated with incoming flow.
- Detention basins provide significant control of channel erosion and enlargement caused by frequent flow variations (California Stormwater BMP Handbook 2003).

Disadvantages

- Clogging of the detention basin inlet and outlet is a potential problem, which could affect detention times and pollutant removal efficiencies. This can be minimized by reducing the drainage area of the watershed draining to detention basins to ten acres.
- Dry extended basins have lower efficiency in comparison to other stormwater BMPs (Best Management Practices). In addition, dry extended basins are incapable of separating soluble contaminants.
- Presence of dry detention basins decreases the property value due to unfavorable aesthetic concerns such as bare land and the presence of inlet and outlet structures.

To solve the aesthetic problem an extended type basin may be used and the surrounding land may be landscaped to provide suitable habitat for wildlife (California Stormwater BMP Handbook 2003).

Riser

A riser is an outlet structure that allows steady outflow from detention basins to receiving streams or a stormwater system. Holes in the riser at predetermined heights dictate the release of basin contents. Crushed stone is placed at the outlet point to attenuate the energy of the water released and prevent scouring (NRCS Planning and Design Manual 1994). Other types of outlet structures include different types of weirs, outlet gate and riser and weir restrictors.

General Design Considerations of a Detention Basin

- Floor of the basin should be two feet above the high water table.
- Maximum water depth should be ten feet.
- Length to width ratio should be 2:1, with a minimum width of ten feet.
- Side slope should be a ratio of 3:1, with maximum height of side embankments limited to fifteen feet.

- Site should be located at least ten feet away from the property line and fifty feet away from private wells or septic systems.
- Fore bay (if present) should contain 10% to 15% of total pool volume.
- Compaction of the basin bottom should be avoided.
- Outlet structures must be resistant to corrosion and clogging by debris, sediment and plant material.
- Detention time should be limited to twelve hours (Dauphin County Conservation District PA 2007).

Installation and Additional Consideration for Detention Basin

A detention basin is normally constructed of earth covered with riprap to prevent erosion. For the purpose of this project, the basin should be lined to prevent seepage and subsequent groundwater pollution. Extended basins provide greater detention times compared to dry detention basins and in turn provide certain benefits of lagoon treatment.

The design of dry detention basin includes site selection, detention time calculation, calculation of treatment ranges and maintenance procedures. Additional requirements include a hydraulic detention time of at least 24 hours for maximum contaminant removal.

Basins require the use of extensive design procedures and resources. A cutoff is desired to separate relatively impervious material under the structure which should be located at the center of the structure and may extend up to the abutments as required. Dry detention basin depth should be such that it reaches the impervious layer providing a stable structure when used in conjunction with seepage control. A cutoff trench should be wide enough to accommodate equipment used for excavation, backfill and compaction operations.

Seepage control should be included if:

- Pervious layers are not intercepted by the cutoff;
- Seepage creates swamping downstream;
- Seepage control is needed to ensure a stable embankment; or
- Special problems require drainage for a stable dam.

Seepage may be controlled by:

- Foundation; or
- Embankment drains; or
- Reservoir blanketing; or

- Lining materials; or
- A combination of these measures (NRCS Planning and Design Manual 1994).

Areas that do not have an impervious layer as a foundation should be lined to prevent seepage and subsequent contamination of environment.

Safety

Safety of the public is an important consideration that needs planning. Detention basins do not need fencing all around. Steps taken to prevent accidents include limiting side slopes to 4:1 (vertical:horizontal, to prevent people from falling into the basin) and locating outlet structure away from public eye (to avoid unwanted attention). In addition, hazard warning signs can be installed to warn the public.

Applicability to Hazardous Spills

Detention basins are generally used for stormwater runoff control and should be modified for efficient spill containment. Detention basins are the key to containing spills because the basins hold the spill and any accompanying runoff in-place until further separation. Detention basins may house secondary containment devices like booms, skimmers, rubberizer pillows and particulates to facilitate separation of contained contaminants. In the absence of spill, detention basins control stormwater runoff and provide a certain amount of water treatment because they remove some sediment. Detention basins intended to serve as hazardous materials traps should be lined and incorporated in the design phase of new construction projects. The type of lining should be selected such that it can be sacrificed in the event of a spill. Concrete might not be the best choice for detention facilities that will also serve as traps. For retrofitting basins, topography and land use play a role in site selection and installation of structures. Availability of land for constructing basins and need for regular maintenance are major limitations. Maintenance drawback should be overcome by implementing regular maintenance protocols.

Retention Basins

Retention basins are similar to detention basins and differ by the amount of time runoff is held in place. Retention basins store water, in contrast to detention basins that delay the release of water (NRCS planning and design manual 1994). Retention basins are designed to reduce the maximum flow rate and runoff volume into the receiving water and can incorporate devices for containment of hazardous materials. Fencing is used to restrict access to authorized personnel (City of Elsentro, California standards for detention basins 2007).

Advantages

- Retention basins prevent shock loading to stormwater systems.
- Retention basins provide a means for pollution treatment. A number of contaminant separation steps may be installed in the basin.

- Biological treatment might be possible depending on the concentration and the ability of the microbes to survive in the presence of of the hazardous materials (Setty 2007).

Disadvantages

- Human safety is an issue if the side slopes are very steep.
- Retention basins may act as mosquito breeding grounds especially in warmer climates.
- Lack of proper construction and size could lead to embankment overtopping.
- Maintenance should be given high priority; a lack of regular maintenance may lead to trash accumulation.
- Liner is needed to prevent seepage of spilled materials.
- Area needed to construct a basin may be large (Setty 2007).

Design Considerations

The following factors should be considered in the design of detention basins.

- Shape. L:W ratio of 2:1 or greater is required. Oblong or triangular structures are recommended.
- Retention Time. Time spent by the water in the basin dictates the degree of separation achieved by the outflow. Retention time, T, is defined as

  $$T = \frac{VB}{n} VR, \tag{C.1}$$

  where:
  VB = Volume of the basin;
  VR = Volume of runoff events;
  n = number of runoff events in a year.
- Depth. Depth of the basin should be such that there is no stratification of water and algal blooms do not thrive.
- Trickle Ditch. This structure is usually a channel that directs water from the inlet to the outlet in the event of low flows to prevent stagnation.
- Inlet and Outlet. Inlet structures serve as primary treatment. Trash racks are included at the inlet to remove large objects. The inlet structure is carefully designed to dissipate energy to prevent erosion and re-suspension of settled matter. Outlet structure may constitute a rise pipe drawing water from cooler area to reduce thermal effects. Sizing the outlet structure properly controls outflow (Setty 2007).

Sizing

Larger basins with greater retention times are preferred due to a higher degree of treatment. However, construction costs and availability of space are sizing issues. Optimization between costs and degree of treatment lead to an ideal retention time of 2 to 3 weeks. Basin volume is 3 to 4 times that of a 2-year storm event. Basin area is determined by dividing the basin volume previously determined by a standard depth of six feet. The dimensions are determined by assuming a 2:1 W:L ratio for the calculated area.

Applicability to Hazardous Spills

Retention basins hold runoff for longer durations than detention basins leading to better separation of released contaminants. Retention basins have an added advantage of biological treatment; however, due to toxicity of the released contaminants, biological treatment may be limited or non-existent. The basin should be lined to prevent seepage and spread of contained pollution. Similar to detention basins, contaminant separation devices may be used to separate the released materials.

Sizing is an important factor that affects separation efficiency. Hence, basins should be sized after carefully considering runoff volume, drainage area, and spill volume. Another drawback is the area required to build retention basins. If adequate space is available, retention basins are recommended. Maintenance is a drawback that should be handled by establishing a standard protocol. Similar to detention basins, retention basins should be incorporated in the design phase of construction projects. Existing retention basins may be modified and used for spill containment in areas that have high frequency of spills.

Underground Concrete Basins

Underground concrete basins are detention basins that have the greatest amount of flexibility in terms of structure. Underground concrete basins may be located in secluded areas or may be located underground. Underground concrete basins are preferred in areas of limited rights of way. Underground concrete basins may be built in any geometrical shape and the sides may be near vertical or vertical.

The area occupied by the underground concrete basin depends on height limitations and the right-of-way availability. The basin configuration may be round, octagonal, or rectangular with sloping or flat bottoms. Each configuration has its own advantages. Design of an underground concrete basin includes.

- Horizontal or vertical configuration
- Inlet pipe
- Basin bottom configuration
- Outlet structure
- Spillway and emergency outlets (Stahre and Urbonas 1990)

Other Considerations

Electrical Equipment

Electrical power is required for lighting, pumps, gates and other mechanical equipments, all of which have to be corrosion resistant, flood proof and explosion proof (due to accumulation of methane gas in underground basins). Wherever possible, all equipments should be placed in specially ventilated and heated rooms.

Ventilation

Ventilation requires special considerations in underground concrete basins because of the underground location. Proper ventilation arrangements should be made and trapping of air between the basin ceiling and water surface should be prevented. Inflow and outflow pipes circulate air and act as secondary air suppliers.

Operation and Maintenance

Underground concrete basins are subjected to the following conditions.

- High humidity
- Organic sludge deposit;
- Corrosive gases
- Intermittent operation
- Microbial and fungal attack

Certain operational problems may be mitigated by appropriate design. However, regular maintenance and inspection is required.

Access Openings

Openings are required for ventilation, maintenance and illumination of surroundings during the day. The access space should be sufficient for cleaning and moving maintenance equipment. Inspection walkways make inspection of large detention basins easier. In addition, emergency spillways should be provided to drain flows to prevent overtopping of the basin. A skimmer may be provided at the emergency spillways to prevent floatables from clogging the outlet.

Cleaning

Occasional cleaning of the basin is required due to sedimentation. Cleaning may be accomplished by the following methods.

- Flushing
- Cleaning with scrapers

- Cleaning with mobile cleaning equipment
- Manual cleaning (Stahre and Urbonas 1990)

Advantages

- Recommended for areas with non-existent or limited right-of-way.
- Safer (for the public) than above ground detention basins.
- Better odor control than above ground detention basins (Stahre and Urbonas 1990).

Disadvantages

- Methane gas production may create explosive conditions.
- Organic sludge deposits may be a nuisance.
- Ventilation provisions are required.
- Complex piping may increase costs.
- Pumps might be required, which leads to an increase in power demand, further increasing costs (Stahre and Urbonas 1990).

Applicability to hazardous material spills

Similar to detention and retention basins, underground concrete basins may be constructed to temporarily store the spill and accompanying runoff encountered. Underground concrete basins are especially desirable when the rights-of-way are limited or unavailable and in such situations concrete basins may be constructed below the roadway itself. Underground concrete basins should be incorporated in the construction phase of the project, when built under the roadway itself and are desirable due to reduced safety risk faced by the public and first responders. Gates may be used as outlet structures to control the release of the basin contents after a spill incident. In normal operation, the gate remains open allowing water to flow through the basin and is closed after a spill incident. Other secondary containment devices may be used in conjunction with this structure to separate the released materials from runoff. In addition, these basins provide certain amount of sediment removal. Skimmers are provided to stop the floatables from exiting the outlet.

Stormceptor

A Stormceptor is a proprietary pollution prevention device that removes fine sediments and hydrocarbons ranging in size from 20 to 2000 microns. Stormceptors treat pollution at its source, preventing oil spills from entering downstream water bodies or surrounding areas. The Stormceptor is intentionally designed to treat a majority of the annual rainfall and a portion of the peak flow volumes. Stormceptors treat small rainfall events that occur frequently and bypass a portion of high flows resulting from infrequent, large rainfall events. Bypass is intended to prevent or reduce scouring of previously settled sediments and hydrocarbons. The weir and the orifice plates ensure favorable conditions for the capture of fine suspended solids and hydrocarbons under conditions of peak flow. Along with TSS and hydrocarbons, the device is capable of removing oils, grease, petroleum products, heavy metals and sorbed contaminants like nutrients (NJCAT Technology 2004).

System Description

Various parts of a Stormceptor are displayed in Figure C.5. Stormceptor consists of a vertically oriented cylindrical device composed of concrete and a fiber reinforced plastic insert. The device comprises of a circular riser and slab constituting the tank and a fiberglass insert that is mounted inside the cylindrical chamber. The circular construction offsets turbulence and enhances settling (NJCAT Technology 2004). Stormceptor is installed according to state and local regulations.

Typical steps involved in the installation of the device include:

- Installation of an aggregate base
- Installation of base slab
- Installation of lower chamber section
- Installation of upper chamber section
- Assembly of fiberglass insert components (drop tee, riser pipe, oil cleanout port and orifice plate)
- Installation of remainder of upper chamber
- Installation of frame and access cover

Operation

Stormwater enters the device through the storm sewer located in the upper chamber while the lower chamber separates floatables, sediments and water. The two chambers are separated by a drop tee and weir arrangement, which is detailed in Figure C.6. To maximize the detention time, a drop tee is provided with two holes that direct the water to the inside circumference of the unit. Water flowing upwards from the lower chamber is dependent on the head at the inlet weir and is discharged at point downstream of the weir. Water is released from the outlet portion, which is connected to the upper chamber. Oil and other floatables are trapped at the surface of the water in the lower chamber, while sediments settle to the bottom of the lower chamber. There is no scouring of the settled particles in the lower chamber because the overflow decreases the head between inlet and outlet pipe which in turn reduces the velocity responsible for re-suspending settled material. Dissolved and emulsified pollutants are not affected by the turbulence and remain in water. If the incoming flow rate exceeds a design threshold, then excess flow bypasses directly to the sewer

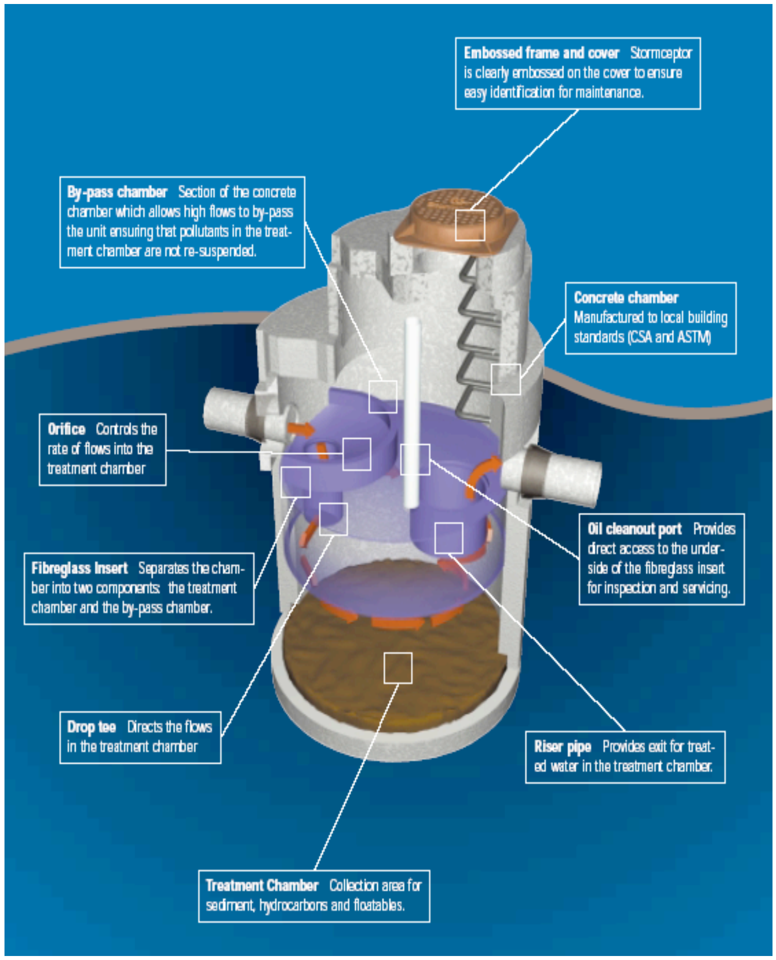

Figure C.5: Components of a Stormceptor (NJCAT Technology 2004)

system. In case of a spill during a large rainfall event, some portion of the flow to the Stormceptor might bypass the trap. The bypass facility ensuring long term efficiency is depicted in Figure C.7 (NJCAT Technology 2004).

Inspection and Maintenance

Stormceptor installations require minimal maintenance. However, the system requires regular inspection to ensure proper performance. The Stormceptor unit must be inspected every six months, with specific attention to the oil and sediment levels in the lower chamber.

Types

Stormceptors are propriety devices. Rinker Materials is one company that manufactures the following types of Stormceptors.

- Inlet Stormceptors. This unit is used instead of a traditional inlet structure for small drainage

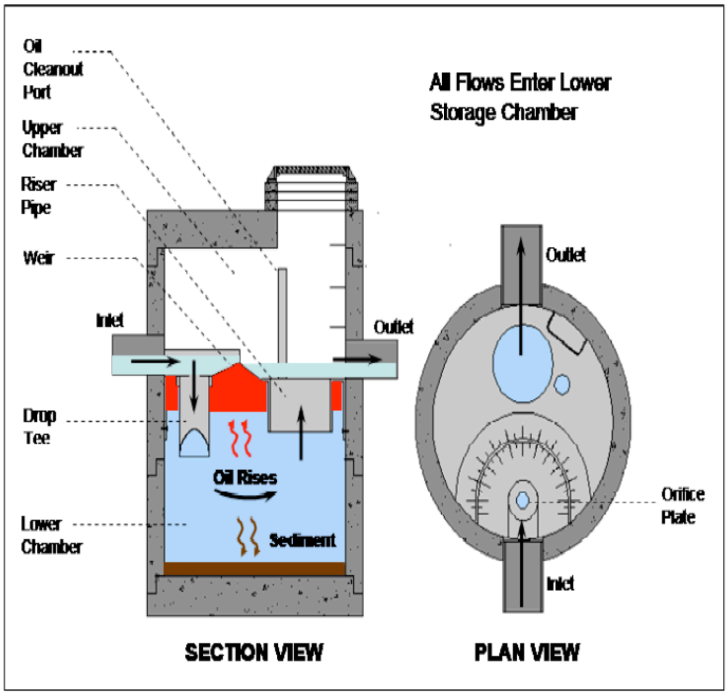

Figure C.6: Operation during average flow conditions (NJCAT Technology 2004).

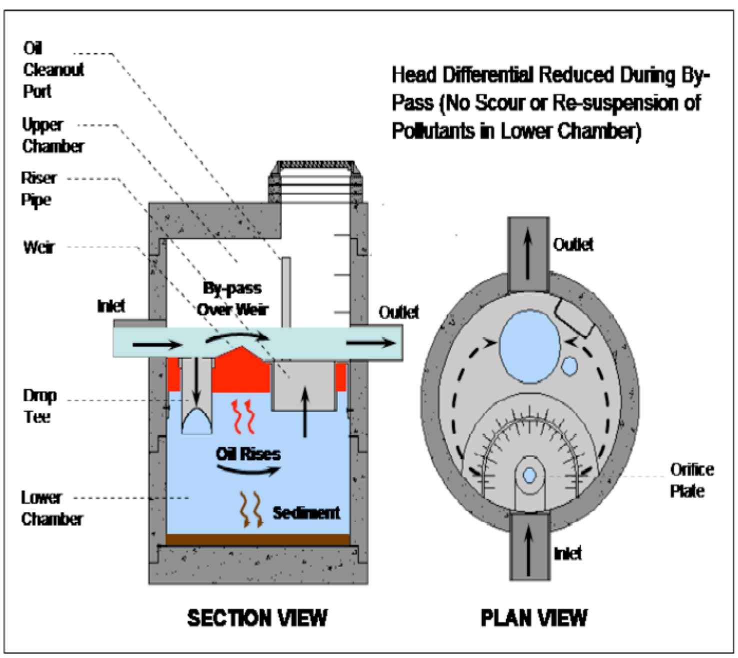

Figure C.7: Operation during high flow conditions (NJCAT Technology 2004).

areas.

- Inline Stormceptors. This unit is available in eight different capacities ranging from 900 to 7200 gallons and can remove more than 80 percent TSS and 95 percent free oil and hydrocarbons.
- Series Stormceptors. These units are used for treating runoffs from large drainage areas.
- Submerged Stormceptors. The units are suitable for removal of TSS and other pollutants from submerged pipes. Submerged Stormceptors have been used in coastal areas and other submerged pipe conditions and are available in a range of sizes of pipe diameters varying from 72 inches to 144 inches (Rinker Materials 2007).

Stormceptor Sizing Program

PCSWMM (Decision support system for Storm Water Management Model of USEPA) is a modeling software for Stormceptors. PCSWMM allows selection of rainfall data from 1,900 stations across North America and selection of particle sizes that may be encountered in the event (PCSWMM Stormceptor sizing program 2007).

Frame and Cover Installation

Stormceptor has a cast iron frame and a cover that may be installed in a manner to set the frame and cover at any desired elevation. (PCSWMM Stormceptor sizing program 2007).

General Facts

Stormceptors do not require any pre-treatment or mosquito control which may be required with other options. In fact, it could be used as standalone treatment when sized properly. The system is incapable of providing sufficient nutrient removal or fecal coliform removal. As a result Stormceptors are unsuitable for use near certified venal pools, public water supplies, and swimming beaches (NJCAT Technology 2004).

Applicability to Hazardous Spills

Inlet Stormceptors are not recommended for this project as they are incapable of handling large flows. Moreover, the bypass factor may lead to ineffective separation of hazardous materials during combined events (rain accompanying spill events). Inline or series Stormceptors are more suited for this project as they handle larger loads and remove hydrocarbons, oil, grease, petroleum, heavy metals and sorbed contaminants like nutrients. Stormceptors may be retrofitted into existing highways or may be installed as a part of new construction. Another advantage is minimal maintenance, which reduces costs. Spill containment is challenging on bridges due to limited space considerations and Stormceptors may be used to contain spills occurring on bridges (built over sensitive water bodies).

Oil/Water Separators

Oil/water separators might be used to segregate oils and greases from stormwater discharges by applying physical or chemical methods. In-line oil/water separators utilize a combination of separation methods, such as gravity separation, filters, coagulation/flocculation, and flotation. The method selected is dictated by the oil/water mixture.

Separation Technique and Chemistry

Gravity separation is best suited for a mixture of materials with low water solubility and different specific gravities. Increasing the size of oil droplets by gravity coalescence results in larger oil droplets, which are more buoyant and more likely to rise to the surface. Coalescence may also be brought about by the use of an oleophilic fabric that catches these droplets, holding them in place until they grow larger and become buoyant enough to rise to the surface. Figure C.8 is a conceptual drawing of an oil/water separator. The mixture to be separated enters the inlet chamber through the inlet pipe where the solids settle upstream of the baffle. In the second portion of the chamber, known as the separation camber, oil rises to the surface and collects behind the higher baffle. Clear water flows underneath the baffle to the outlet chamber from where it flows out of the separator (ProAct 1999).

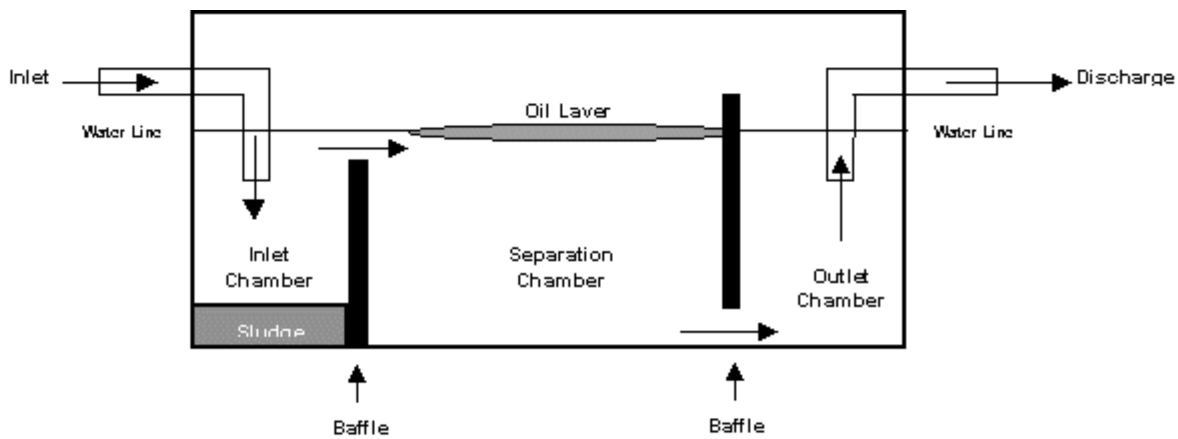

Figure C.8: Oil/water separators (ProAct 1999).

General Considerations

Oil/Water separators are simple devices, certain aspects of which require careful consideration with respect to safety, maintenance and management. Some of the factors are listed below.

- Flow rate. Effectiveness of the oil/water separator is increased by slower flow rates and increased residence times.
- Design Capacity. Each separator is capable of removing certain amount of contaminants. Excess contaminants leave in the outlet stream.

- Emulsifying agents. Oil and grease removing substances like soaps and detergents adversely affect the performance of these separators.
- Maintenance. Regular maintenance is required for smooth functioning (ProAct 1999).

Sizing

Oil/water separators are sized based on the Stokes Law. Oil droplets exist in water in a variety of sizes. Removing a particular size droplet ensures removal of droplets larger than that size. As per the desired effluent standard, a droplet size is selected and the separator is sized in such a way that it removes droplets of the selected size and those exceeding that size. Temperature of water and specific gravity influence the design and sizing (Oil/Water Separator 2002).

Maintenance

Oil/water separators require regular cleaning of residual oil to prevent leakage of a contained spill, especially during large storm events. Climatic conditions affect maintenance procedures and the procedures differ per oil/water separator manufacturer. Some of the common practices are listed below.

- The facility should be inspected weekly by the owner.
- Oil absorbent pads are to be replaced as needed and the effluent shutoff valve is to be closed during cleaning operations.
- Waste oil and residuals should be disposed in accordance with current local government health department requirements.
- Standing water removed during the maintenance operation should be directed to a sanitary sewer for treatment.
- Any standing water removed should be replaced with clean water to prevent oil carryover through the outlet (EPA 2002).

Advantages

- Excellent for oil spills.
- Simple in design and operation.

Disadvantages

- High maintenance is required which would increase cost.
- Limited ability to work with other light hazardous materials as the chemistry of the pollutant plays a vital role in the removal of the pollutant.

- Oil/water separators are suitable in the absence of a storm event due to wide variations in flow rates, turbulence and high suspended solids accompanying such events (Oil/Water Separator 2002).

Applicability to Hazardous Spills

Oil/water separators are best suited for impervious grounds and for places where oil spills are a concern. The separator should be installed downstream of catch basins or similar devices (that remove suspended matter) to avoid the presence of suspended solids. Oil/water separators are advantageous as they remain in-place unlike nonpermanent options such as booms or adsorbent pads that need to be deployed after the spill incident. As the separators may not handle larger loads, such devices should be installed in areas where the rainfall is low or where the output from the basin is controlled and small. Soil cover needs careful consideration to avoid runoff into these structures. Maintenance issues should be addressed by periodic inspection, especially after cleanup activities. Oil/water separators should be installed (for spill containment purposes) on bridges over water bodies to prevent contamination of water in the event of a spill.

Dikes

A dike is similar to a berm and may be constructed of soil, stone, rock or a combination of these materials. A dike contains spills to specific areas preventing the spread of pollution. Dikes serve a variety of purposes from erosion control to spill containment (U.S. Army Corps of Engineers 2007).

Site Selection

The site best suited for dikes is selected based on the following factors.

- Dikes should be limited in height and extent. For this purpose, the natural features of the land should be used properly.
- Trees and other obstructions weaken the structure, hence dikes should be constructed away from them (National Agricultural Safety Database 2002).

Design Criteria Based on Site Specific Details

- Foundation conditions.
- Dike stability with respect to shear and strength.
- Settlement, seepage, and erosion.
- Available dike materials.
- Available construction equipment (Golder Associates Ltd. and Associated Engineering (B.C.) Ltd. 2003).

Applicability to Hazardous Materials Spill

Dikes may be built around detention basins to contain potential overflows of the basin contents due to large storm or spill events. Construction and maintenance costs should be evaluated and justified before constructing dikes. Often, space considerations limit construction of detention basins. In such cases, roadside ditches are used to contain the spill. Dikes may be built around such ditches to prevent backflow of the spill (on the road) or spread to surrounding areas and subsequent contamination. Dikes may be built after the spill incident (around inplace structures) and used as a secondary measure to contain spills in the event of failure of inplace structures.

Pervious Concrete

Pervious concrete is a special type of concrete used for flatwork applications that allows water to percolate through the material. Pervious concrete has a high porosity that is attained via a highly interconnected void content. The ease with which water percolates through pervious concrete is shown in Figure C.9. This special concrete contains little or no fines and has just enough cementitious paste to connect the coarse aggregates while preserving the interconnectivity of the voids. Addition of small amounts of fines increases concrete strength but decreases the void content. Generally, the water to cementitious material ratio in the pervious concrete is 0.35 to 0.45 with a void porosity of 15 to 25 percent. Too much water segregates the mixture, while too little causes balling of the mixture in the mixer and hinders adequate curing (National Ready Mixed Concrete Association 2004).

Figure C.9: Pervious concrete (National Ready Mixed Concrete Association 2006)

Advantages

- The void structure allows quick draining of any accumulated water (Figure C.10), clearing the road and minimizing the chance of traffic accidents.
- Pervious concrete structures are highly durable and last for almost 20 years with little or no maintenance. These structures may achieve strengths of 3000 psi by using special designs and other methods.
- Pervious concrete has lower life cycle costs than asphalt. Despite higher initial installation costs, pervious concrete lasts longer and may be recycled.

Disadvantages

- Clogging might be a problem, if the surrounding area has grass or loose soil. Soil or vegetation may wash across on the concrete clogging the pores.
- Freeze-thaw conditions cause problems if the structure is not designed properly.

Figure C.10: Difference between asphalt and pervious concrete roads (National Ready Mixed Concrete Association 2006).

Applicability to Hazardous material spills

Pervious concrete roads are beneficial to the project as they help drain the spill quickly, reducing safety risk faced by first responders and other people at the incident site. An impervious layer capable of resisting hazardous materials should be installed below the roadway to carry the percolated spill to other intermediate structures. Pervious concrete may be incorporated into new roadways being built and should be used with an underlying impervious layer capable of resisting damage due to hazardous materials.

C.1.2. Secondary Containment Devices

The hazardous spill diverted to permanent containment structures (if present in the vicinity of the incident site) needs to be separated from runoff. Separation of a contained spill is done in conjunction with secondary containment apparatuses such as booms, Go Filters, pads and socks, which are available in variable sizes and degrees of absorbencies. Apparatus for containment used by HAZMAT contractors considerably aid in separation of spilled materials from runoff. In the absence of any permanent structure in the vicinity of the incident site, secondary containment devices are used alone for spill cleanup. TxDOT and other state DOTs currently use a majority of the devices discussed in the following paragraphs. Devices such as socks and pads and booms are used as initial measures to contain and prevent further releases. Other devices such as BioSolve and rubberizers that aid in efficient containment of hazardous spills are recommended for future use. A brief discussion on all such secondary containment devices is included here.

Booms

Booms are deployed to act as barriers, to localize and collect spills that are lighter than water. In the absence of in-place structures, booms are also used to contain spills on roadways to prevent their spread and consequent pollution. From the review of past spills, it is seen that oils are the most commonly released hazardous materials. Therefore, a detailed account of oil booms is included in the following sections of the text.

Oil Booms

Oil booms act as floating barriers (for spills on water) and might be used to contain, absorb, or deflect oil from specific areas. Oil booms should be used to localize spills to specific areas from where oil may be further separated and disposed. Hence, the scope of this project demands containment booming and adsorption booming. General layout of an oil boom is shown in Figure C.11 and the basic components of an oil boom are shown in Figure C.12. The fabric fence (Figure 2.12) is made of flexible material. The tension cable (Figure C.12) is a piece of cable that is stronger than the fabric fence, preventing the fabric from tearing under stress. The chain or weights act as a ballast to keep the boom vertical in water. The portion of fabric below the float is the skirt which plays a significant role in preventing oil from sweeping underneath the boom. Connectors seen in the Figure C.11 should be secure, strong and capable of preventing oil leaks. Individual connectors should be compatible with different types of connectors, allowing different brands of boom to be attached together (David Sales Inc. 2007).

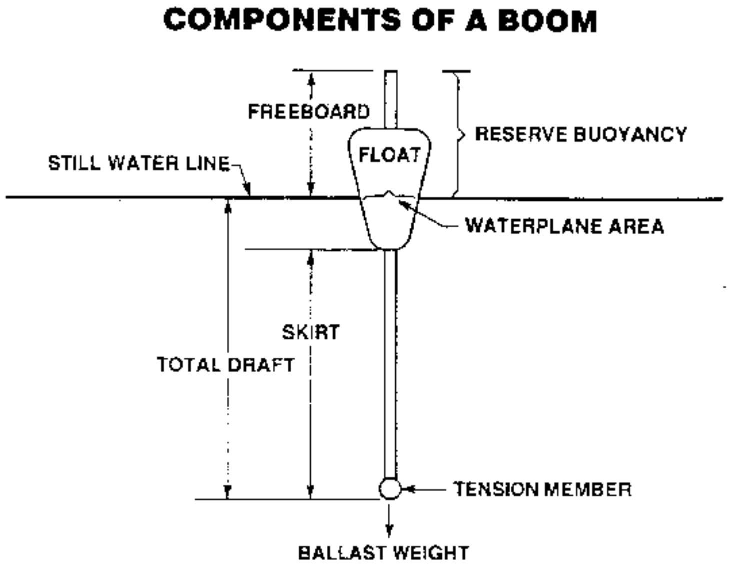

Figure C.11: General layout of a boom (David Sales Inc. 2007).

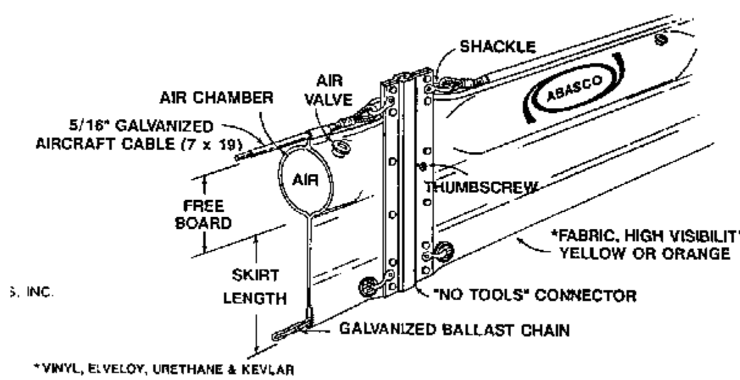

Figure C.12: Components of a boom (David Sales Inc. 2007)

Booms are classified based on area of use, purpose and construction. Based on area of use, booms are classified as open-water booms, protected water booms, and intertidal booms. Open-water booms have a sturdier construction and greater freeboard and draft. The protected water boom is best suited for calmer waters that require less freeboard and draft while the intertidal boom is best suited for areas that are periodically covered and uncovered by tidal motion.

Based on purpose, booms are classified as specialty booms, collection, containment, and diversion booms, and intertidal booms. Skimming booms are a type of specialty boom that incorporate a method of skimming oil. As illustrated in Figure C.13, skimming booms have weirs to localize oil that is then pumped to a recovery vessel. Skimming booms have the advantage of simultaneously collecting and skimming oil. Another type of specialty boom is the sorbent boom and barrier. This specialty boom absorbs oil in porous materials such as straw or some synthetic material and is more suitable for thin oil layers. Efficiency of sorbent boom and barrier booms decreases on absorption of oil and requires structural support to avoid breakage under the wind or current forces. Based on construction, either fence booms (sturdier and easier to install) or curtain booms may be used (David Sales Inc. 2007).

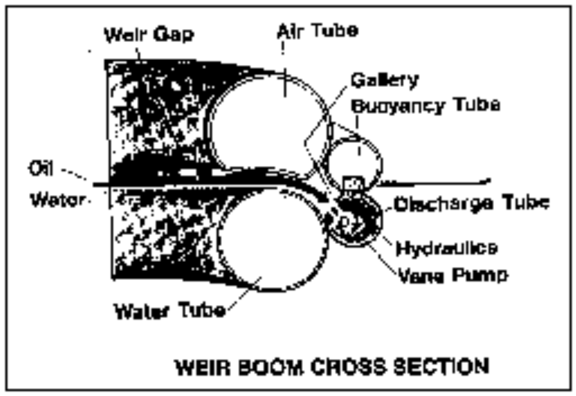

Figure C.13: Specialty skimming boom (David Sales Inc. 2007)

Applicability to Hazardous Material Spills

Booms are used for localizing spills and may be installed in detention basins to efficiently separate pollutants from collected runoff. Specialty booms collect and skim materials at the same time, speeding the recovery process. Booms may be built using special materials that absorb the hazardous materials which further speeds up the cleanup process. In the event of a fire, fire booms that are fabricated using inflammable material may be used in conjunction with extinguishers. Absorption booms may be used at the incident site to prevent spread of a spill. Booms are deployed after the spill has occurred and should not be left at the site after the cleanup. Booms are deployed in pieces and then connected together through connectors making them easier to transport. Booms are not very expensive and their cost to the cleanup project is justifiable as their use speeds up the cleanup process considerably and reduces the labor cost. Booms do not need anchors to stay in place and are attached to the edge of the basin or ditch. A suitable boom should be selected from a range of companies manufacturing booms.

Skimmers

Skimmers might be used to recover spills localized in permanent structures (such as detention basins or underground concrete basins). A skimmer is a mechanical device used to remove lighter substances from the water surface. Suction skimmers and adhesion skimmers are the two types of skimmers commonly in use. The selection of an appropriate skimmer is determined by the viscosity of the released material. Lower viscosity substances are lighter and typically spread out over a greater area. Higher viscosity oils do not spread out to the same extent and may form a thicker layer. Elements composing the selected skimmer differ depending on the type of oil (David Sales Inc. 2007).

There are basically five different types of skimmers.

- Weir skimmers
- Suction skimmers
- Centrifugal skimmers
- Submersion skimmers
- Sorbent surface skimmers

Skimmers have a sorbent or oleophilic surface to which contaminants adhere. The sorbent (or oleophilic) surface may be in the form of a drum, disc, belt, or rope that is continuously moved through the oil film. The collected contaminant is removed from the sorbent surface by a wiper or roller and is then stored in a storage tank and disposed in accordance with the laws and regulations (David Sales Inc. 2007).

Application to Hazardous Material Spills

Skimmers aid in separating materials localized by booms. The use of skimmers can be avoided when specialty booms are used because specialty booms are used to simultaneously skim and collect oil. Instead of skimming the collected lighter materials, absorbent materials may be used to soak up the spilled materials. However, retrieval of sorbed absorbents may be challenging.

BioSolve

BioSolve is a biodegradable, water soluble agent used for cleanup of a number of hydrocarbon products. It is a biosurfactant that converts petroleum-based products into non-flammable and biodegradable products by micro-emulsification. The surfactant in BioSolve strips the hydrocarbons in the emulsifying step (New Earth Concepts 2001). The formulation is responsible for breaking long chain polymers into micro-emulsions and encapsulating the contained hydrocarbon accelerating the natural biodegradation. In the absence of BioSolve, only the surface exposed to air is subject to degradation. BioSolve breaks hydrocarbons into smaller particles and encapsulates these particles creating a larger surface area for degradation. Naturally occurring bacteria in soil capable of degrading hydrocarbons break down these contaminants to carbon dioxide, cell mass, and waste products. Thus, BioSolve only acts as a catalyst. For BioSolve to be effective it is necessary for the hydrocarbon bacteria to be active in soil in spite of the presence of hazardous material. The ability of hydrocarbon degrading bacteria to thrive in the presence of hazardous materials should be evaluated before using BioSolve. BioSolve may be used for cleanup of flammable hydrocarbons because they become non-flammable when the Lower Explosion Limit approaches zero (RHI Company 2006).

Applications

Various application of BioSolve are illustrated in Figure C.14.

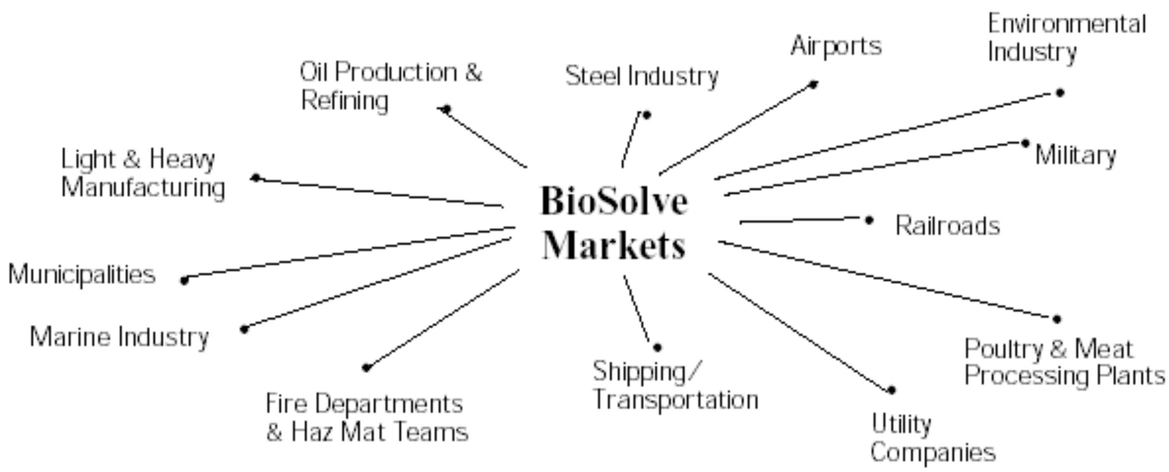

Figure C.14: BioSolve applications (Westford Chemical Corporation 2003)

Advantages

- Accelerates the natural biodegradation of hydrocarbon products.
- Hydrocarbon particles are separated and reduced in size and the surface area of the contaminants exposed to the bacteria is increased dramatically.
- When used as a vapor suppression agent, BioSolve is more effective than foam by providing long term vapor suppression.
- May be used to clean contaminated drums with little or no odor release.
- Does not require any special equipment for application (New Earth Concepts 2001).

Disposal

Vacuum equipment may be used to remove the treated hydrocarbon solution to reduce the danger of ignition. Untreated effluent is encapsulated in an oxygen-bearing solution that accelerates the degradation process (Westford Chemical Corporation 2007).

Applicability to Hazardous Materials Spills

BioSolve aids in the natural degradation of hydrocarbons by acting as a catalyst. BioSolve may be applied to soils contaminated with hydrocarbons spills to accelerate the natural degradation of hydrocarbons. Because the hazardous substance being treated may be oil or any other hydrocarbon, the bacteria remain alive and unaffected. In case of mixed spills, the ability of the microbes to thrive in presence of other hazardous materials should be evaluated before using BioSolve.

BioSolve may be used as a vapor suppressing agent and is highly effective as it encapsulates the hydrocarbons, thus preventing fire by reducing the LEL (Lower Explosive Limit) to zero. BioSolve is not recommended to be used in conjunction with permanent structures like detention basins as the time required for the bacteria to degrade the hydrocarbons is measured in terms of weeks, which would lengthen the separation process requiring long detention times.

Rubberizer

Rubberizer transforms hydrocarbon spills into a rubber-like substance on contact and retains it in solid state during the retrieval process. This conversion is a non-chemical process and as per EPA guidelines, rubberizer is classified as a sorbent. Rubberizer is available in the form of booms, pillows or granular substances (Haz-Mat Response Technologies Inc. 2007).

Applications

Rubberizer may be used to clean spills from bilges, deck spills, around storage tanks, under hydraulic machinery and for separating hydrocarbon spills from water. Rubberizer is effective in handling gasoline spills, jet fuel spills, diesel oil spills, transformer oil spills, hydraulic oil spills, lube oil spills, spills of aromatic solvents and chlorinated solvents (Haz-Mat Response Technologies Inc. 2007).

Advantages

The advantages of using rubberizer are listed below.

- Applicable to land or water spills.
- Remains buoyant.
- Rubberizer solidifies in contact with oil spills and is landfill approved.
- Does not leach.
- Holds oil under pressure.
- Incineration of product leads to less than 1 percent ash.
- Reduces cleanup time and cost (Haz-Mat Response Technologies Inc. 2007).

Disposal

EPA defines solidified liquids as solids; however, the materials retain their hazardous classification. One disposal method includes incineration, which is a cost-effective option. Ogden Projects, lnc. has facilities throughout the U.S. and accepts rubberizer products for energy recovery. USPCI, a subsidiary of Union Pacific Corporation, accepts waste organic liquids solidified with rubberizer products for landfilling (Haz-Mat Response Technologies Inc. 2007).

Applicability to Hazardous Spills

Rubberizer products are highly recommended as rubberizer converts liquid spills to solid forms, simplifying the clean up process. Rubberizer solidifies the following materials to solid on contact:

- Gasoline,
- Jet fuel,
- Diesel fuels,
- Transformer oils,
- Hydraulic oils,
- Lubrication oils,
- Aromatic solvents,
- Chlorinated solvents, and
- Light crude oil (Stormwater systems 2007).

The above list includes majority of materials that were repeatedly spilled over the last few years, proving rubberizer to be a highly useful product. Rubberizer products may be used by the HAZMAT contractors to absorb spills on roads or in detention basins. Rubberizer in the form of pillows and booms are extremely useful in separating oils or other materials from water, because they can float while retaining the solidified spill.

Socks and Pads

Hazardous material spills might be effectively cleaned by the use of absorbent socks and pads. There are many companies manufacturing a range of absorbent socks and pads of varying degrees of absorbencies. Certain socks and pads are capable of preferentially absorbing materials with specific gravity less than one, while certain others are capable of absorbing highly corrosive materials like acids. Global Environmental Products Ltd. is one such company that manufactures oil absorbent products that are designed preferentially to absorb oil. These oil adsorbent products are manufactured using 100 percent polypropylene that contain spills on the spot and is applicable to be used on both land and water. Use of polypropylene products is beneficial as the absorption capacity of polypropylene is up to 25 times its own weight (Global Environmental Products, Ltd. 2003). In case of an unknown spill, some companies manufacture universal sorbents that are capable of absorbing most materials.

Advantages

- Absorbents are effective for absorbing spills on both water and land.

- Oil-only products provide high adsorption ratios for oils, organic liquids and vegetable oils.
- The absorption capacity of socks and pads is greater than the weight of the absorbent material.
- Absorbent fillers made from cellulose fibers float on the surface after absorbing materials and simplify the retrieval process (Oil Cleaning Bio-Products Ltd. 2002).

Applications

- Separation of hydrocarbon spills, vegetable oil spills or spills of organic chemicals from fresh or salt water.
- Used as initial treatment by emergency services/spill response companies.
- Spill cleanup purposes on highways (Oil Cleaning Bio-Products Ltd. 2002).

Applicability to Hazardous Spills

A variety of mats, socks and pads are available for absorbing different material released on highways. Acid spills that are difficult to manage due to the safety risk faced by cleanup crew might be cleaned with acid adsorbents. Other hazardous materials like gasoline (highly flammable), benzene (carcinogen), ethylene glycol (toxic) and mercury may be absorbed using material specific absorbents (in the form of socks or pads).

Spill kits may be purchased, which contain a range of socks, pillows, pads and temporary disposable bags. Together the socks, pillows and pads absorb large quantities of hazardous materials with little or no leakage encountered during retrieval. Socks and pads may be used as the initial step for containing spills or for absorbing hazardous materials on highways to complete the cleanup process of the incident site. Pillows, socks and pads may also be used in the detention basin to adsorb hazardous materials that are localized by booms.

Go Filters

The Go Filter is a mobile, propriety stormwater filtration system designed for sites needing immediate and rapid treatment of water. The filter is constructed of light weight HDPE and is easily transported in the back of a truck. The filter is designed to handle variable flow rates with close to eighty percent TSS removal capacity. In addition the filter might remove pollutants like hydrocarbons, nutrients like phosphorus and various other heavy metals. Go Filter is illustrated in Figure C.15.

The filter system is designed to remove pollutants in a three stage treatment system. Gross pollutants are removed in a primary swirl concentrator. Chemicals may be added to aid flocculation and de-emulsification of sediments and oils, which are removed in the secondary swirl concentrator. The vortex produced accelerates gravity separation, which is followed by a filtration chamber for removing fine sediments and water borne pollutants. The filter mode might be down flow (under gravity) or up flow. The filter is capable of removing hydrocarbons, fine silts and clays. The commonly used filter media are zeolites and granular activated carbon, while synthetic media also may be used (AquaShield 2007).

Figure C.15: Go Filter system (AquaShield 2007)

Applicability to Hazardous Spills

Go Filters may be used in the event of failure of booms and rubberizers. Go Filters may be sized using online sizing tools, which account for rainfall curve and intensity, drainage area and runoff coefficients. Maintenance is easy and inexpensive and the device may be customized as per applications, based on the sizing tools. Literature indicates that the device may be hired on a temporary basis. TxDOT may consider hiring them if the HAZMAT contractors are not available in the immediate future.

D. GKY Pond Outlet Design Protocol

Young and Graziano (1989) developed an approach for sizing detention pond outlets[1]. Flow through the outlet control orifice is governed by

$$q = ca\sqrt{2gh}, \tag{D.1}$$

where q is the orifice discharge, c is the orifice coefficient, a is the orifice flow area (nominal), g is the gravitational constant, and h is the head above the center of the orifice[2]. Let V denote the storage volume in the pond. Then the outflow from the pond is

$$\frac{dV}{dt} = Q, \tag{D.2}$$

where t is time and Q is pond outflow. Because flow is from the pond and exits through the control structure orifice,

$$q = -\frac{dV}{dt}. \tag{D.3}$$

If the pond area is constant with respect to depth (prismatic pond), then

$$h = \frac{V}{A}, \tag{D.4}$$

where A is the pond area, and

$$\begin{aligned} q &= ca\sqrt{2g\,\frac{V}{A}}, \\ &= -\frac{dV}{dt}, \\ &= ca\sqrt{\frac{2gV}{A}}. \end{aligned} \tag{D.5}$$

[1]The Young and Graziano (1989) report is cited in the San Antonio Water Quality Standards. The Young and Graziano report is out of print, but a copy was obtained (by chance, it appears) from GKY and Associates.

[2]Equation D.1 results from direct application of the energy equation.

So,

$$
\begin{aligned}
-\frac{dV}{dt} &= ca\sqrt{\frac{2g}{A}}\,dt,\\
\int^{V_2} V_1 \frac{dV}{V^{0.5}} &= \int_{t_1}^{t_2} ca\sqrt{\frac{2g}{A}}\,dt,\\
-2\left(V_2^{0.5} - V_1^{0.5}\right) &= ca\sqrt{\frac{2g}{A}}\left(t_2 - t_1\right).
\end{aligned}
\tag{D.6}
$$

Notice that $t_1 = 0$ and $t_2 = T$ because of the initial and final conditions. For a constant surface area (prismatic pond), $V_2 = Ah_2$ and $V_1 = Ah_1$, so for a drawdown time of T, $V_2 = Ah$ and $V_1 = Ah_0$. Therefore,

$$
-2A\left(h^{0.5} - h_0^{0.5}\right) = \frac{\sqrt{2g}\,ca}{A^{0.5}}T. \tag{D.7}
$$

Solving Equation D.7[3] for T,

$$
T = \sqrt{\frac{2}{g}}\frac{A}{ca}\left(h_0^{0.5} - h^{0.5}\right). \tag{D.8}
$$

Equation D.8 can be solved for the required orifice area, a, given a required (or target) drawdown time, T,

$$
a = \sqrt{\frac{2}{g}}\frac{A}{cT}\left(h_0^{0.5} - h^{0.5}\right). \tag{D.9}
$$

If the pond is not prismatic (that is, the surface area is not constant), then Equation D.8 does not apply. Young and Graziano (1989) present an approximate method and a supporting program for the case where $A = b_0 + b_1 h + b_2 h^2$. However, another approach is possible[4]. Let $A = b_0 h^{b_1}$. Then

$$
h = \left(\frac{A}{b_0}\right)^{1/b_1}. \tag{D.10}
$$

The orifice equation remains as presented in Equation D.1. Substituting Equation D.10 into Equation D.1 yields

$$
q = ca\sqrt{2g\frac{A^{1/b_1}}{b_0^{1/b_1}}}. \tag{D.11}
$$

Because the volume is no longer a linear function of depth, then the pond volume is given by

$$
\begin{aligned}
dV &= A\,dh\\
&= b_0 h^{b_1}\,dh.
\end{aligned}
\tag{D.12}
$$

[3]Equation D.7 can also be solved for c. The result is

$$
c = \sqrt{\frac{2}{g}}\frac{A}{aT}\left(h_0^{0.5} - h^{0.5}\right).
$$

[4]This might have been presented in the literature, but no literature search was conducted to determine if the result is published.

The relation between orifice discharge and pond depth is

$$
\begin{aligned}
\frac{q}{h^{0.5}} &= ca\sqrt{2g}, \\
&= -\frac{1}{h^{0.5}}\frac{dV}{dt}, \\
&= -\frac{1}{h^{0.5}}b_0 h^{b_1}\frac{dh}{dt}.
\end{aligned}
\tag{D.13}
$$

Separating the variables in Equation D.13 and integrating yields

$$
\begin{aligned}
-h^{b_1-0.5}dh &= \frac{ca\sqrt{2g}}{b_0}dt, \\
-\int_{h_0}^{h} h^{b_1-0.5}dh &= \int_{t_0}^{t}\frac{ca\sqrt{2g}}{b_0}dt, \\
h_0^{b_1+0.5} - h^{b_1+0.5} &= \frac{b_1+0.5}{b_0}ca\sqrt{2g}\,T.
\end{aligned}
\tag{D.14}
$$

Solving Equation D.14 for T gives

$$
T = \sqrt{\frac{2}{g}}\frac{b_0(h_0^{b_1+0.5} - h^{b_1+0.5})}{(2b_1+1)ca}. \tag{D.15}
$$

Finally, given a target drawdown time, T, Equation D.15 can be solved for the required orifice area, a,

$$
a = \sqrt{\frac{2}{g}}\frac{b_0\left(h_0^{b_1+0.5} - h^{b_1+0.5}\right)}{(2b_1+1)\,cT}. \tag{D.16}
$$

Equation D.16 can be used to estimate the required orifice area given other parameters that describe the pond and the required drawdown time.

E. Potential Application of PP1725

The purpose of this appendix is to present materials from Thompson and others (2007) that might be pertinent for development of hydraulic designs of detention ponds and hazardous spill traps. This material is excerpted directly from Thompson and others (2007).

E.1. Example 1: Expected Number of Events

Jose Torres (APAC Corporation; personal communication) suggested that a threshold precipitation depth of about 0.1 inches is sufficient to impact certain construction activities. One approach to examining the statistics of rainfall is to compute the expected number of events over the life of a construction project. An mean interevent time (MIT) of 24-hours is used for the following example computations.[1] As an initial estimate, storm statistics for Station 7936 in Jasper County are shown on table E.1 (after appendix 4–1.5 of PP1725). The mean interevent time for Station 7936 in Jasper County is 306,666 hours/1,847 events or 6.91 days/event. Therefore, over the long term, a storm event is expected about once every 6.91 days. During a two-year period, approximately 106 events are expected (730.5 days/6.91 days). Although this statistic suggests the number of events expected over a two-year period, it does not exactly answer the original question because a depth of precipitation for the expected number of events is not specified.

Table E.1: Storm Statistics for a minimum interevent time of 24 hours at Sam Rayburn Dam in Jasper County (Station 7936).

Number of storm events	1,847
Hours of observations	306,666
Storm interevent time (hours)	6.40

The expected number of events is readily estimated if the occurrence of rainfall events is assumed to follow a Poisson process. The Poisson process is defined by

$$F_n(T) = e^{-T/\Lambda} \sum_{i=0}^{n} \frac{(T/\Lambda)^i}{i!}, \tag{E.1}$$

[1] An MIT of 24-hours seems reasonable because construction activities are generally undertaken on a daily basis. Choice of a different MIT will impact resulting computations. However, determination of appropriate MIT is an analyst decision and should take into consideration factors appropriate to the topic under consideration.

where $F_n(T)$ is the cumulative probability of n events in T days given a Poisson parameter of Λ days.

Example 1 of PP1725 presents use of the Poisson process for estimating the number of events for the 75$^{\text{th}}$ percentile for a site near Briggs, Texas. A similar approach can be taken for the U.S. Highway 96 project in Jasper County to estimate the median (50$^{\text{th}}$ percentile) number of events. The resulting computation should produce an estimate similar to that presented a few paragraphs above, but is illustrative of the power of application of Equation E.1.

Statistics for Station 7936 in Jasper County are presented in Table E.1 (after Appendix 4-1.5 of PP1725). For this application, T is 730.5 days (two years), the number of storms is 1,847, and observations occurred over 306,666 hours. Therefore, $\Lambda = 306666/(1847 \times 24) = 6.91$ days.[2] If $F_n(T)$ is taken to be 0.50 (the median), then application of Equation E.1 will return the expected value (median, or 50$^{\text{th}}$ percentile) of the Poisson distribution. Using these values, Equation E.1 becomes

$$0.50 = e^{-730.5/6.91} \sum_{i=0}^{n} \frac{(730.5/6.91)^i}{i!}. \tag{E.2}$$

Solution of Equation E.2 is not algebraic, but iterative. The solution is approachable with a handheld calculator or through application of a standard spreadsheet program, however a more substantive tool is available in use of `R` from the R-project (R Development Core Team, 2006). When Equation E.2 is solved for n, the result is between 105 and 106 events (Figure E.1). That is, an estimate for the 50$^{\text{th}}$ percentile number of events over a two-year period is about 105 events. This result is very similar to that resulting from using a less sophisticated arithmetic analysis. It is also important to observe that $730.5/6.91 = 105.7$ events.[3]

The choice of the cumulative percentile rests with the analyst. The 50$^{\text{th}}$ percentile represents the median number of events at a particular location. If a greater risk is acceptable, then a lower percentile value could be used. In contrast, if the situation demands a risk-averse approach, then a larger value of the percentile could be selected. In the case of Jasper County, if the 99$^{\text{th}}$ percentile is chosen, then the result of application of Equation E.1 produces about 130 events during the two-year time frame. This is about an additional month of impact.

The output from R for computation of the Poisson process is shown on Figure E.1. The Poisson parameter, Λ, is 6.91 days. Therefore, the expected value of the Poisson distribution is $T/\Lambda = 730.5/6.91 = 105.7$ events. From examination of Figure E.1, the computation returns the mean, or expected value of the distribution, when the median (50$^{\text{th}}$ percentile) is selected as the target event. This is what is supposed to result from the statistics, however the process serves to illuminate execution of the computations using a tool such as `R`. A different number of expected events would be computed if the percentile target was different from 0.5.

[2] The mean interevent time from this computation is 6.91 days. However, the storm interevent time from Table E.1 is 6.40 days. The difference is attributable to the mean duration of the storm event, which is implied to be $6.91 - 6.40 = 0.51$ days, or about 12 hours.

[3] This means application of Equation E.1 for the median (50$^{\text{th}}$ percentile) is work that is not required. That is, if the 50$^{\text{th}}$ percentile is desired, use the mean, $730.5/6.91 = 106$ events, is appropriate. However, the result of this example is implicit in Example 1 of PP1725, which uses the 75$^{\text{th}}$ percentile, and so is presented here.

```
> library(distributions)
> poissoncdf(mu=(730.5/6.91),x=100)
[1] 0.3102184
> poissoncdf(mu=(730.5/6.91),x=125)
[1] 0.9702258
> poissoncdf(mu=(730.5/6.91),x=102)
[1] 0.3828083
> poissoncdf(mu=(730.5/6.91),x=103)
[1] 0.4207270
> poissoncdf(mu=(730.5/6.91),x=104)
[1] 0.4592714
> poissoncdf(mu=(730.5/6.91),x=105)
[1] 0.4980787
> poissoncdf(mu=(730.5/6.91),x=106)
[1] 0.5367823
```

Figure E.1: Output from `R` used to compute results presented for the Poisson process.

E.2. Example 2: Number of Events Exceeding 0.10 in Depth

Unfortunately, the expected number of events from both preceding approaches does not address the number of events expected with a depth of 0.10 inches or more. Estimation of that value requires a different computation. The quantile function of the dimensionless kappa distribution (Equation 6 in PP1725) can be used to relate the expected number of events to the threshold depth of precipitation,

$$x(F) = \xi + \frac{\alpha}{\kappa}\left[1 - \left(\frac{1-F^h}{h}\right)^{\kappa}\right], \tag{E.3}$$

where $x(F)$ is the value of the quantile function for a nonexceedance probability F; and ξ, α, κ, and h are parameters of the function. Given the distribution parameters for the kappa distribution (ξ, α, κ, and h), the threshold precipitation depth, and the non-exceedance frequency (F), an estimate of the number of events exceeding the threshold depth can be computed. When Equation E.3, which is dimensionless, is multiplied by the mean storm depth, then the distribution of storm depth results.

For Texas statewide, basic distribution parameters for the dimensionless kappa distribution are listed in Table E.2. For Jasper County, the basic statistics are listed in Table E.3.

Table E.2: Dimensionless kappa distribution parameters for a minimum interevent time of 24 hours for Texas. (From table 7 of PP1725, p. 66.)

kappa ξ	-0.5790
kappa α	1.115
kappa κ	-0.1359
kappa h	1.747

Table E.3: Storm statistics for a minimum interevent time of 24 hours in Jasper County. (Tables in parenthesis indicate the data table from PP1725 used.)

Storm interevent time, days (table 18)	6.30
Mean storm depth, inches (table 19)	0.899
Mean storm duration, hours (table 20)	14.3

In Table E.3, the storm interevent time is 6.30 days. The mean storm duration is 14.3 hours. Therefore, the mean interevent time is $6.30 + 14.3/24 = 6.89$ days. This is slightly different than the mean interevent time computed using values from Table E.1, but the values are very close.

Application of Equation E.3 using the statistics for Texas and Jasper County can be approached using a statistical tool (such as `R`) or a standard spreadsheet. Input and output to `R` is shown on Figure E.2.[4] Tabular output (stored in output file `file.24`) is shown on Figure E.3. A few results from Figure E.3 are listed on Table E.4. From Table E.4, over a two-year period, about 90 events will occur with a threshold rainfall depth of 0.10 inches or more. Therefore, if the threshold precipitation of 0.10 inches indeed results in a substantive delay in construction either by re-tasking of activities or simply slower progress on scheduled activities, then over a two-year period about three months of weather-related impact are to be expected.[5]

```
> library(lmomco)
>
> # Establish the length of the 'simulation'
> Ty <- 2  # two-year project time
>
> ############### SET VALUES FOR EACH MIT OF INTEREST #######################
> Ibar.24 <- 6.30   # interevent in days,  TABLE 18 in PP1725
> Pbar.24 <- 0.899  # mean storm depth,    TABLE 19 in PP1725
> Dbar.24 <- 14.3   # mean storm duration, TABLE 20 in PP1725
> # Parameters of parent dimensionless 24-hour MIT kappa distribution of depth
> deppar.24 <- vec2par(c(-0.5790, 1.115,-0.1359, 1.747),type='kap') # TABLE 7 in PP1725
> EVENT.CURVE <- function(time.period.years,
+                         minimum.interevent.time,
+                         mean.interevent.days,
+                         mean.depth.inches,
+                         mean.duration.hours,
+                         depth.parameters) {
+   mean.interevent.hours <- mean.interevent.days*24  # now in hours
+   depths          <- seq(0,10,by=.1)                # sequence of thresholds
+   dimless.depths  <- depths/mean.depth.inches       # dimensionless depth
+   number.events   <- (time.period.years*24*365)/(mean.interevent.hours + mean.duration.hours)
+   counts          <- (1-cdfkap(dimless.depths,depth.parameters))*number.events
+   return(data.frame(mit=minimum.interevent.time,threshold=depths,counts=counts))
+ }
> EVENTS.24 <- EVENT.CURVE(2,24,Ibar.24,Pbar.24,Dbar.24,deppar.24) # 24-hour MIT calculations
> file.24 <- "mit24.txt"
> write.table(EVENTS.24,file=file.24,col.names=TRUE,row.names=FALSE,quote=FALSE)
```

Figure E.2: Output from R used to compute results for the kappa distribution applied to Jasper County.

[4]The library `lmomco` is not part of the standard `R` libraries and requires external installation. The `lmomco` library is available from the Comprehensive R Archive Network (`http://cran.r-project.org/`), where instruction for downloading and installation are presented.

[5]In addition, about one-half month (15 days) of working during precipitation events (105 events with precipitation less 90 days of 0.10 inches or more of precipitation) is also anticipated.

```
mit threshold counts
24 0 105.861027190332
24 0.1 90.1170121963352
24 0.2 74.396249742786
24 0.3 64.2010743453874
24 0.4 56.3932094764981
24 0.5 50.0558190705848
24 0.6 44.7515696200966
24 0.7 40.2257839852815
24 0.8 36.3124742448844
24 0.9 32.8953302580300
24 1 29.8886542194696
24 1.1 27.2269478138070
24 1.2 24.8587436504045
24 1.3 22.7427164451502
24 1.4 20.8451077898182
24 1.5 19.1379514790556
```

Figure E.3: Output from `R` (`file.24`) with the threshold precipitation depth and number of events expected over a two-year period for Jasper County.

Table E.4: Selected values from output file `file.24`.

Threshold (inches)	Number of Events
0.00	105.9
0.10	90.1
0.20	74.4
0.30	64.2
0.50	50.0
1.00	29.9
1.50	19.1

F. Raw Spill Incident Data from TCEQ

In this appendix, the raw spill incident data that were retrieved from the Texas Commission on Environmental Quality are presented. No processing or other interpretation of the data was done for this presentation; it is as was received from the department.

Table F.1: Spill data from TCEQ for spill incidents occuring in 2002.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Diesel fuel 2-D	150 GALLONS	03/01/2002	IH20 Westbound at Exit 367	MINGUS	ERATH	003 - Oil Minor ¡24B/1,000G
		04/02/2002	Intersection of Hwy 26 and Kimball S., Grapevine	GRAPEVINE	TARRANT	unknown
Sewage	10000 GALLONS	04/10/2002		ROUND ROCK	WILLIAMSON	006 - Other Substance
Unknown or other oil	20 GALLONS	04/15/2002	N IH 20, 2 Mi East of, Cisco, TX	CISCO	EASTLAND	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D		04/22/2002	Intersection of US Hwy 380 at FM 159, rural Denton County	DENTON	DENTON	003 - Oil Minor ¡24B/1,000G
Roofing coating/paint	200 GALLONS	04/30/2002	"State Hwy 148 South of Crandall Rural Kaufman County"	CRANDALL	KAUFMAN	006 - Other Substance
Latex paint	150 GALLONS	05/03/2002		ENNIS	ELLIS	006 - Other Substance
Diesel fuel	150 GALLONS	05/04/2002	"Hwy 75 North, 1/2 mile South of Exit 22 McKinney, TX"	MCKINNEY	COLLIN	003 - Oil Minor ¡24B/1,000G
aluminum hydroxide	5500 GALLONS	05/09/2002		ARLINGTON	TARRANT	005 - Hazardous Material Minor
Diesel fuel 2-D	100 GALLONS	05/11/2002	"Intersection of IH35E at FM66 Waxahachie"	WAXAHACHIE	ELLIS	003 - Oil Minor ¡24B/1,000G
Styrene	2530 GALLONS	05/14/2002	SH 146 AND FM 519 IN FRONT OF AMOCO	unavailable	GALVESTON	005 - Hazardous Material Minor
Unknown		05/20/2002		unavailable	NUECES	006 - Other Substance
Diesel fuel		05/23/2002	INTERSECTION OF I-20 & FM 254 (RANGER HILL)	RANGER	EASTLAND	005 - Hazardous Material Minor
Diesel fuel	100 GALLONS	05/25/2002	1-10 EAST MILE 1	HOUSTON	HARRIS	005 - Hazardous Material Minor
Diethylamine	0 GALLONS	05/27/2002	HWY 359 20 MILES EAST OF LAREDO	LAREDO	WEBB	005 - Hazardous Material Minor
Hydraulic fluid		06/04/2002		unavailable	HARRIS	003 - Oil Minor ¡24B/1,000G
Diesel fuel	1500 GALLONS	06/05/2002	FROM HWY 12 N ON OLD HWY 87 APPROX 4 MI	DEWEYVILLE	NEWTON	002 - Medium ¿24B/1,000G
Diesel fuel 2-D	20 GALLONS	06/05/2002	"Intersection of IH20 West at IH820 East Fort Worth, TX 76119"	FORT WORTH	TARRANT	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	80 GALLONS	06/05/2002	"Hwy 67 N, just East of Brazos River Bridge Somervell County"	GLEN ROSE	SOMERVELL	003 - Oil Minor ¡24B/1,000G
Battery	3 GALLONS	06/07/2002	"I45 North at MM 228 Corsicana, TX"	CORSICANA	NAVARRO	005 - Hazardous Material Minor
WASTEWATER FROM OILFIELD ACTIVITIES	200 GALLONS	06/07/2002		unavailable	No County Name	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid		06/08/2002		HOUSTON	HARRIS	003 - Oil Minor ¡24B/1,000G
Acrylonitrile	120 POUNDS	06/09/2002	HWY 185 6.5 M S OF BLOOMINGTON	PORT LAVACA	CALHOUN	005 - Hazardous Material Minor
Diesel fuel 2-D	100 GALLONS	06/12/2002	Near intersection of IH35E and Loop 288	DENTON	DENTON	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	125 GALLONS	06/16/2002	"IH30 Eastbound at Zion Road Garland, TX 75043"	GARLAND	DALLAS	003 - Oil Minor ¡24B/1,000G

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Table F.1: Spill data from TCEQ for spill incidents occuring in 2002 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Diesel fuel 2-D	50 GALLONS	06/24/2002	"IH20 Eastbound at Exit 512 FM 2965 Kaufman County, TX 75142"	WILLS POINT	KAUFMAN	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid	20 GALLONS	06/24/2002	IH-45 AT WILSON ROAD	unavailable	MONTGOMERY	003 - Oil Minor ¡24B/1,000G
		06/24/2002		unavailable	No County Name	unknown
Freon 113		06/28/2002		unavailable	No County Name	006 - Other Substance
Battery	60 POUNDS	07/01/2002		unavailable	CALHOUN	006 - Other Substance
Battery	60 POUNDS	07/01/2002		unavailable	CALHOUN	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	60 CUBICYARDS	07/10/2002		unavailable	NAVARRO	003 - Oil Minor ¡24B/1,000G
Diesel fuel	200 GALLONS	07/18/2002		unavailable	DIMMIT	003 - Oil Minor ¡24B/1,000G
		07/18/2002	Hwy.21 west, one mile west of Dougals, Tx. 5 miles east of Angelina River	unavailable	NACOGDOCHES	unknown
Diesel fuel 1-D	4000 GALLONS	07/20/2002		SIERRA BLANCA	HUDSPETH	002 - Medium ¿24B/1,000G
Diesel fuel	25 GALLONS	07/25/2002		unavailable	HARRIS	003 - Oil Minor ¡24B/1,000G
Grease, animal		07/25/2002		RED OAK	ELLIS	006 - Other Substance
Diesel fuel	90 GALLONS	07/26/2002		KATY	HARRIS	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	135 GALLONS	07/28/2002	"Southbound IH 635 near Seagoville Road Balch Springs, TX 75180"	BALCH SPRINGS	DALLAS	003 - Oil Minor ¡24B/1,000G
Nitrogen dioxide	10 POUNDS	07/28/2002	9500 Interstate 10 E, Baytown, TX	BAYTOWN	HARRIS	SARA Title III
Diesel fuel 2-D	50 GALLONS	07/29/2002		AMARILLO	POTTER	005 - Hazardous Material Minor
Diesel fuel 2-D	130 GALLONS	07/29/2002	"Southbound IH35E at Pleasant Run Road DeSoto, TX 75115"	DESOTO	DALLAS	003 - Oil Minor ¡24B/1,000G
GASOLINE, AUTOMOTIVE OR AVIATION	100 GALLONS	07/31/2002		DENISON	GRAYSON	005 - Hazardous Material Minor
Diesel fuel 2-D	40 GALLONS	08/01/2002		FORT WORTH	TARRANT	003 - Oil Minor ¡24B/1,000G
Cement (wet or dry)		08/02/2002		HOUSTON	HARRIS	006 - Other Substance
Diesel fuel 2-D	50 GALLONS	08/02/2002	"Southbound IH35E, near 9600 Block R.L. Thornton Fwy Dallas, TX 75202"	DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Waste oil	10 GALLONS	08/04/2002	"IH35E at intersection of Jefferson Blvd Dallas, TX 75207"	DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	180 GALLONS	08/05/2002		MESQUITE	DALLAS	003 - Oil Minor ¡24B/1,000G
Sulfuric acid	8000 GALLONS	08/05/2002		unavailable	HARRIS	005 - Hazardous Material Minor
GASOLINE, AUTOMOTIVE OR AVIATION	1 GALLONS	08/06/2002	8015 E Freeway, Houston, TX	HOUSTON	HARRIS	003 - Oil Minor ¡24B/1,000G
Unknown		08/06/2002		unavailable	FAYETTE	006 - Other Substance
Mineral oil	900 GALLONS	08/08/2002		PORT ARTHUR	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Waste oil	55 GALLONS	08/10/2002		unavailable	No County Name	003 - Oil Minor ¡24B/1,000G
Unknown or other oil	11 GALLONS	08/12/2002		unavailable	CALHOUN	003 - Oil Minor ¡24B/1,000G

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Table F.1: Spill data from TCEQ for spill incidents occuring in 2002 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Unknown	0	08/14/2002	"INTERSECTION OF FM 322 AND HWY 87 SABINE PASS TX"	unavailable	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Unknown or other oil	20 GALLONS	08/15/2002		unavailable	NUECES	003 - Oil Minor ¡24B/1,000G
wastewater and stormwater	87690 BARRELS	08/15/2002	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	006 - Other Substance
		08/15/2002	Highway 59 and Highway 84	unavailable	SHELBY	unknown
Diesel fuel 2-D	100 GALLONS	08/19/2002	3980 N IH 35 E, Service Rd and Lofland Rd, Waxahachie, TX	unavailable	ELLIS	003 - Oil Minor ¡24B/1,000G
GASOLINE, AUTOMOTIVE OR AVIATION		08/19/2002		POTTSBORO	GRAYSON	005 - Hazardous Material Minor
Diesel fuel	150 GALLONS	08/20/2002	MCLENNAN COUNTY - I-35 MM 322, SOUTHBOUND LANES AND CENTER MEDIAN	unavailable	MCLENNAN	006 - Other Substance
Diesel fuel	100 GALLONS	08/21/2002		unavailable	JASPER	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	150 GALLONS	08/21/2002		ROCKWALL	ROCKWALL	003 - Oil Minor ¡24B/1,000G
Sewage	2000 GALLONS	08/21/2002		unavailable	JEFFERSON	006 - Other Substance
Unknown or other oil		08/21/2002	ON HWY 87 10 MILES WEST OF SABINE PASS	SABINE PASS	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	30 GALLONS	08/23/2002		unavailable	JIM WELLS	005 - Hazardous Material Minor
Diesel fuel 2-D	70 GALLONS	08/24/2002	4532 HIGHWAY 67E	MESQUITE	DALLAS	003 - Oil Minor ¡24B/1,000G
GASOLINE, AUTOMOTIVE OR AVIATION	20 GALLONS	08/24/2002		MIDLOTHIAN	ELLIS	005 - Hazardous Material Minor
Other material	1 GALLONS	08/24/2002		HOUSTON	HARRIS	003 - Oil Minor ¡24B/1,000G
Sulfuric acid	8958 POUNDS	08/24/2002	Two miles west of hwy 1069 on hwy 361. 4133 Highway 361.	GREGORY	SAN PATRICIO	005 - Hazardous Material Minor
Diesel fuel	15 GALLONS	08/25/2002	US HIGHWAY 287 12 MILES N OF STRATFORD TX	KERRICK	DALLAM	006 - Other Substance
Unknown or other oil	21 GALLONS	08/28/2002		DRISCOLL	NUECES	003 - Oil Minor ¡24B/1,000G
Other material	30 GALLONS	08/29/2002		unavailable	HARDIN	006 - Other Substance
Diesel fuel 2-D	30 GALLONS	08/30/2002		DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Other material	40 GALLONS	08/31/2002		unavailable	HARDIN	006 - Other Substance
Amine	15192 POUNDS	09/06/2002	on Hwy. 59 at the Rusk / Nacogdoches County lines	unavailable	NACOGDOCHES	004 Hazardous Material Major
		09/06/2002	on Hwy. 59 at the Rusk / Nacogdoches County lines	unavailable	NACOGDOCHES	unknown
hazardous waste code F037	10 BARRELS	09/07/2002	21689 Hwy 35	OLD OCEAN	BRAZORIA	004 Hazardous Material Major
coker naphtha	5 BARRELS	09/08/2002	21689 Hwy 35	OLD OCEAN	BRAZORIA	002 - Medium ¿24B/1,000G
Diesel fuel 2-D	80 GALLONS	09/08/2002	Sothbound IH45 Service Road at Dallas Ave.	HUTCHINS	DALLAS	003 - Oil Minor ¡24B/1,000G

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Table F.1: Spill data from TCEQ for spill incidents occuring in 2002 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Diesel fuel	100 GALLONS	09/10/2002	MCLENNAN COUNTY - ON HIGHWAY 6 SOUTH OF CLIFTON	unavailable	MCLENNAN	003 - Oil Minor ¡24B/1,000G
Methyl mercaptan	0 GALLONS	09/13/2002		WEATHERFORD	PARKER	005 - Hazardous Material Minor
		09/13/2002	INTERSECTION OF HWY 332 AND HWY 288	FREEPORT	BRAZORIA	unknown
Asphalt	30 GALLONS	09/14/2002	northbound lane of interstate highway 37 at mile marker #44 George West Texas	GEORGE WEST	LIVE OAK	006 - Other Substance
Diesel fuel	110 GALLONS	09/18/2002		AMARILLO	POTTER	003 - Oil Minor ¡24B/1,000G
Xylene (mixed isomers)		09/18/2002	HWY 225 GATE 19	HOUSTON	HARRIS	002 - Medium ¿24B/1,000G
Diesel fuel	125 GALLONS	09/19/2002		unavailable	EL PASO	003 - Oil Minor ¡24B/1,000G
Diesel fuel	100 GALLONS	09/19/2002	I-35 W MM 12	unavailable	HILL	006 - Other Substance
Diesel fuel 2-D	60 GALLONS	09/19/2002	On IH35E at Kiest Blvd. Exit	DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	15 GALLONS	09/20/2002		DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Kerosene/Linseed Oil Mixture	200 GALLONS	09/20/2002		GAINESVILLE	COOKE	003 - Oil Minor ¡24B/1,000G
Unknown or other oil	2 GALLONS	09/20/2002		unavailable	SAN PATRICIO	003 - Oil Minor ¡24B/1,000G
		09/20/2002		unavailable	HARRIS	unknown
		09/22/2002	HWY 69N LEFT HAND SIDE 200 FT OF FM 2827 5 MI S OF WARREN TX 77664	unavailable	TYLER	unknown
		09/25/2002	i-10 east spur 330 exit past 2nd light	BAYTOWN	HARRIS	unknown
Hydraulic fluid	30 GALLONS	09/26/2002		unavailable	HARRIS	003 - Oil Minor ¡24B/1,000G
Epoxy Resin	100 GALLONS	09/30/2002	IH30 Eastbound near FM 549 Exit	ROCKWALL	ROCKWALL	005 - Hazardous Material Minor
Hydraulic fluid	50 GALLONS	09/30/2002	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	003 - Oil Minor ¡24B/1,000G
		10/02/2002	377 State Highway 87 S, Center, TX	CENTER	SHELBY	unknown
Battery	60 POUNDS	10/04/2002		unavailable	CALHOUN	006 - Other Substance
Diesel fuel 2-D	15 GALLONS	10/04/2002		DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Battery	0	10/09/2002		unavailable	CALHOUN	006 - Other Substance
Gasoline	20 GALLONS	10/09/2002	585 I-10 E 415 OLD HWY 90 ADJ TO ORANGE CO BLDG MATERIALS VIDOR TX 77662	VIDOR	ORANGE	003 - Oil Minor ¡24B/1,000G
Mineral Oil with PCBs	25 GALLONS	10/09/2002		DALLAS	DALLAS	006 - Other Substance
Battery	60 POUNDS	10/12/2002		unavailable	CALHOUN	006 - Other Substance
Unknown or other oil	0	10/18/2002		unavailable	ORANGE	003 - Oil Minor ¡24B/1,000G
Animal oil	1000 GALLONS	10/21/2002	FROM INTERSECTION OF HWY 60 & 385 GO WEST .5 MILES TO FM 2856, THEN GO .5 MILES TO COUNTY RD H, TURN LEFT ON S KINGWOOD	HEREFORD	DEAF SMITH	006 - Other Substance

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Table F.1: Spill data from TCEQ for spill incidents occuring in 2002 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Diesel fuel 2-D	50 GALLONS	10/21/2002	IH30 West on-ramp at Industrial Blvd	DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid	0 GALLONS	10/21/2002		unavailable	NUECES	003 - Oil Minor ¡24B/1,000G
Amine	33 BARRELS	10/22/2002	HIGHWAY 124 AND ROLLINS ROAD PETROLEUM REFINERY	WINNIE	JEFFERSON	005 - Hazardous Material Minor
GASOLINE, AUTOMOTIVE OR AVIATION	4000 GALLONS	10/22/2002	HWY 316 MAGNOLIA	PORT LAVACA	CALHOUN	001 - OIL-MAJOR ¡240B/10,000G
Sulfuric acid	20 GALLONS	10/22/2002		unavailable	TARRANT	005 - Hazardous Material Minor
		10/22/2002	8787 hwy 225 laporte tx	unavailable	HARRIS	unknown
Diesel fuel	75 GALLONS	10/24/2002	I 35 AT EXIT 67 BY COTULLA	COTULLA	LA SALLE	003 - Oil Minor ¡24B/1,000G
Diesel fuel	200 GALLONS	10/24/2002	Interstate highway 37 between mile markers 2 & 3	unavailable	NUECES	005 - Hazardous Material Minor
GASOLINE, AUTOMOTIVE OR AVIATION	50 GALLONS	10/25/2002		FORT WORTH	TARRANT	005 - Hazardous Material Minor
Oxygen (liquid)	1020 GALLONS	10/25/2002	IH20 Westbound at Ranch Road	WILLOW PARK	PARKER	005 - Hazardous Material Minor
Sodium hydroxide	1050 POUNDS	10/26/2002	HWY 185 6.5 M S OF BLOOMINGTON	PORT LAVACA	CALHOUN	005 - Hazardous Material Minor
Hydraulic fluid	0	10/27/2002	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	003 - Oil Minor ¡24B/1,000G
Asphalt or road oil	5000 GALLONS	10/28/2002	8600 N IH 35	GEORGETOWN	WILLIAMSON	002 - Medium ¿24B/1,000G
Malathion	10 GALLONS	10/29/2002	1 M N ON HWY 385	SEAGRAVES	GAINES	006 - Other Substance
Diesel fuel 2-D	60 GALLONS	10/30/2002		DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Mineral oil	10 GALLONS	10/30/2002		unavailable	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	0	10/31/2002		MESQUITE	DALLAS	002 - Medium ¿24B/1,000G
Diesel fuel 4-D	600 GALLONS	10/31/2002		unavailable	DALLAS	003 - Oil Minor ¡24B/1,000G
Isobutane	0	11/01/2002		unavailable	GALVESTON	005 - Hazardous Material Minor
Waste oil	0	11/01/2002	IH30 East, between MM 78 & 79	ROYSE CITY	ROCKWALL	003 - Oil Minor ¡24B/1,000G
Unknown	0	11/02/2002	6575 W Highway 97 in Jourdanton	JOURDANTON	ATASCOSA	006 - Other Substance
Diesel fuel	10 BARRELS	11/03/2002	i-10 east spur 330 exit past 2nd light	BAYTOWN	HARRIS	002 - Medium ¿24B/1,000G
Diesel fuel	263 GALLONS	11/03/2002		unavailable	HARRISON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	250 GALLONS	11/04/2002	Intersection of IH10 @ FM1516 in San Antonio, TX.	unavailable	BEXAR	003 - Oil Minor ¡24B/1,000G
Isoprene	470 POUNDS	11/04/2002	I.H. 10 Southwest at Smith Road, exit 9 miles Southwest of Beaumont Texas	BEAUMONT	JEFFERSON	006 - Other Substance
Diesel fuel 2-D	150 GALLONS	11/07/2002	I-20 eastbound mile marker 351, near Ranger	RANGER	EASTLAND	005 - Hazardous Material Minor
Unknown or other oil	60 GALLONS	11/07/2002		unavailable	CALHOUN	003 - Oil Minor ¡24B/1,000G
Diesel fuel	75 GALLONS	11/11/2002		GEORGE WEST	LIVE OAK	005 - Hazardous Material Minor

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Table F.1: Spill data from TCEQ for spill incidents occuring in 2002 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Diesel fuel	5 GALLONS	11/11/2002		HOUSTON	HARRIS	003 - Oil Minor ¡24B/1,000G
Heptane (or n-)	120 GALLONS	11/11/2002		unavailable	HARRIS	006 - Other Substance
		11/11/2002	@Highway 105, 4 miles west of Sour Lake	SOUR LAKE	HARDIN	unknown
		11/11/2002	Highway 35 & FM 524, Old Ocean, TX	SWEENY	BRAZORIA	unknown
Asphalt	10 BARRELS	11/16/2002	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Glycol ethers	68 POUNDS	11/17/2002	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Diesel fuel 2-D	60 GALLONS	11/18/2002		DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
		11/18/2002	24 MILES EAST ON HWY 359 WEST OF AGUILARES	LAREDO	WEBB	unknown
Diesel fuel 2-D	20 GALLONS	11/19/2002		DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Other material	8 GALLONS	11/19/2002	3.5 MI S OF HWY 44 ON NUECES COUNTY ROAD 69	ROBSTOWN	NUECES	005 - Hazardous Material Minor
Unknown or other oil	0	11/21/2002		ROCKPORT	ARANSAS	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	60 GALLONS	11/22/2002	IH35E at Sam Bass Road	DENTON	DENTON	003 - Oil Minor ¡24B/1,000G
Unknown or other oil	2 GALLONS	11/22/2002		unavailable	NUECES	003 - Oil Minor ¡24B/1,000G
Diesel fuel	50 GALLONS	11/26/2002	18385 OLD BEAUMONT HWY, HOUSTON, TX	unavailable	HARRIS	003 - Oil Minor ¡24B/1,000G
Diesel fuel	25 GALLONS	11/27/2002	IH-10 eastbound median, east of Highway 62	ORANGE	ORANGE	003 - Oil Minor ¡24B/1,000G
Unknown or other oil	2 GALLONS	11/28/2002	Highway 35 S at Cove Harbor, Rockport, TX	ROCKPORT	ARANSAS	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	0	12/01/2002	IH 35 South at Laredo St. Exit in San Antonio	SAN ANTONIO	BEXAR	005 - Hazardous Material Minor
Diesel fuel	100 GALLONS	12/02/2002		KNIPPA	UVALDE	003 - Oil Minor ¡24B/1,000G
Unknown or other oil	0 GALLONS	12/02/2002		unavailable	CALHOUN	003 - Oil Minor ¡24B/1,000G
Unknown or other oil	0	12/03/2002		unavailable	No County Name	003 - Oil Minor ¡24B/1,000G
Diesel fuel	75 GALLONS	12/04/2002	I-20 ACCESS ROAD EXIT 316 CALLAHAN COUNTY	ABILINE	CALLAHAN	005 - Hazardous Material Minor
Diesel fuel 2-D	100 GALLONS	12/04/2002	Highway 181, about one mile west of Loop 1604, near Elmendorf, TX.	ELMENDORF	BEXAR	003 - Oil Minor ¡24B/1,000G
Battery	60 POUNDS	12/06/2002		unavailable	CALHOUN	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid	35 GALLONS	12/06/2002	17910 IH10 W	SAN ANTONIO	BEXAR	005 - Hazardous Material Minor
Crude oil light	0	12/07/2002	CR136 just off Hwy 97 west of Floresville.	FLORESVILLE	WILSON	003 - Oil Minor ¡24B/1,000G
GASOLINE, AUTOMOTIVE OR AVIATION	5 BARRELS	12/09/2002	HWY 225 GATE 19	HOUSTON	HARRIS	003 - Oil Minor ¡24B/1,000G

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Table F.1: Spill data from TCEQ for spill incidents occuring in 2002 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Municipal waste	0	12/09/2002	Hwy 90 from San Antonio. South to D'Hanis. Turn right over RR track. On dead end county road. Call for directions.	D'HANIS	MEDINA	006 - Other Substance
Unknown	0	12/10/2002	Hwy 1560 and Altatierra St and Satillo Flat in Helotes, TX adjacent to Helotes Creek.	HELOTES	BEXAR	005 - Hazardous Material Minor
Diesel fuel	130 GALLONS	12/11/2002	From IH-10 go north on FM 3351 (Ralph Fair Road). Wreck was about 1/2 mile before reaching Gate 5 of Camp Stanley in San Antonio.	SAN ANTONIO	BEXAR	003 - Oil Minor ¡24B/1,000G
Ammonia	101 POUNDS	12/12/2002	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Diesel fuel 2-D	30 GALLONS	12/13/2002		MANSFIELD	TARRANT	003 - Oil Minor ¡24B/1,000G
Unknown or other oil	0 GALLONS	12/13/2002		unavailable	No County Name	003 - Oil Minor ¡24B/1,000G
		12/14/2002		BEAUMONT	JEFFERSON	unknown
Ammonia	101 POUNDS	12/16/2002	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
		12/16/2002	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	unknown
		12/17/2002	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	unknown
Diesel fuel 2-D	25 GALLONS	12/18/2002	"IH35W Southbound, between MM 554 and 555 Near FM 917 (Joshua) Exit"	JOHSUA	JOHNSON	003 - Oil Minor ¡24B/1,000G
Unknown	0	12/18/2002	FM 1516 and IH 10 East in San Antonio	SAN ANTONIO	BEXAR	006 - Other Substance
Diesel fuel 1-D	88 GALLONS	12/19/2002	SH 77 S BOUND N OF THE CITY OF DRISCOLL	DRISCOLL	NUECES	006 - Other Substance
Other material	600 POUNDS	12/20/2002		unavailable	VICTORIA	005 - Hazardous Material Minor
Other material	0	12/21/2002		unavailable	HARRIS	005 - Hazardous Material Minor
Other material	160 GALLONS	12/22/2002	INTERSECTION OF HWY 332 AND HWY 288	FREEPORT	BRAZORIA	005 - Hazardous Material Minor
Unknown or other oil	0	12/22/2002		unavailable	No County Name	003 - Oil Minor ¡24B/1,000G
		12/22/2002	6 miles north of Silsbee,Tx. on Hwy.92	SILSBEE	HARDIN	unknown
Diesel fuel	100 GALLONS	12/23/2002	HIGHWAY 190 6 MILES E OF MENARD, TX	MENARD	MENARD	005 - Hazardous Material Minor
Diesel fuel 2-D	100 GALLONS	12/23/2002	IH20 Westbound near MM 510	TERRELL	KAUFMAN	003 - Oil Minor ¡24B/1,000G
		12/23/2002	CORNER OF WINGATE BLVD & HWY 255 IN JASPER COUNTY	SAM RAYBURN	JASPER	unknown

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Table F.1: Spill data from TCEQ for spill incidents occuring in 2002 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Diesel fuel	100 GALLONS	12/25/2002	Highway 289 & IH 10 Eastbound in Comfort	COMFORT	KENDALL	005 - Hazardous Material Minor
Diesel fuel	20 BARRELS	12/25/2002	Highway 35 & FM 524, Old Ocean, TX	SWEENY	BRAZORIA	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	25 GALLONS	12/26/2002		DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Diesel fuel	200 GALLONS	12/27/2002	I-20 WEST BOUND .5 M WEST OF LAVENDER ROAD JUST EAST OF MM 561 IN SMITH COUNTY	unavailable	SMITH	005 - Hazardous Material Minor
		12/28/2002	HWY 225 GATE 19	HOUSTON	HARRIS	unknown
		12/29/2002	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	unknown
Diesel fuel	70 GALLONS	12/30/2002	NORTH IH 35 @ ONION CREEK	AUSTIN	TRAVIS	003 - Oil Minor ¡24B/1,000G
Diesel fuel	45 GALLONS	12/30/2002	11500 W HIGHWAY 71 SPICEWOOD TEXAS	AUSTIN	TRAVIS	003 - Oil Minor ¡24B/1,000G
		12/30/2002	Mile Marker 299 on the Intra-Coastal Waterway; Port Arthur, Tx.	PORT ARTHUR	JEFFERSON	unknown
Crude oil light	250 BARRELS	12/31/2002	HWY 185 S JUST OUTSIDE VICTORIA CITY LIMITS	VICTORIA	VICTORIA	001 - OIL-MAJOR ¡240B/10,000G
Sodium hydroxide	250 GALLONS	12/31/2002	BETWEEN MILE MARKER 246 & 252A ON IH 35 NORTHBOUND	ROUND ROCK	WILLIAMSON	005 - Hazardous Material Minor

Table F.2: Spill data from TCEQ for spill incidents occurring in 2003.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Mineral oil	120 GALLONS	01/01/2003	Intersection of State Hwy 11 and FM 1417	SHERMAN	GRAYSON	003 - Oil Minor ¡24B/1,000G
		01/03/2003	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	006 - Other Substance
Unknown heavy oil		01/05/2003	IH 35 SOUTH AT 204 MILE MARKER SAN MARCOS TEXAS 78666	unavailable	HAYS	003 - Oil Minor ¡24B/1,000G
Municipal waste		01/06/2003	I-40 and Helium Rd	unavailable	POTTER	006 - Other Substance
Other material		01/06/2003	Hwy 80 and Hwy 671 in Stairtown	STAIRTOWN	GUADALUPE	003 - Oil Minor ¡24B/1,000G
Unknown or other oil	4000 GALLONS	01/08/2003	2172 State Highway 25 N, Electra, TX	unavailable	WICHITA	unknown
Unknown or other oil		01/09/2003	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Diesel fuel 2-D	150 GALLONS	01/10/2003	EAST IH 10 MILE MARKER 645	unavailable	GONZALES	003 - Oil Minor ¡24B/1,000G
JP-8	80 GALLONS	01/10/2003	vic 9400 IH35W	FORT WORTH	TARRANT	003 - Oil Minor ¡24B/1,000G
		01/12/2003	IH20 at Spur 408 exit	DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Diesel fuel	60 GALLONS	01/13/2003	Intersection SH 16 & 211 in San Antonio.	unavailable	BEXAR	005 - Hazardous Material Minor
Hydrogen peroxide	300 GALLONS	01/14/2003	Highway 35 & FM 524, Old Ocean, TX	SWEENY	BRAZORIA	005 - Hazardous Material Minor
Acrylic acid	75000 POUNDS	01/15/2003	I-20 to Eastman Exit, South on Hwy 149, left on Garland Rd and left on Estes Blvd to Eastman Plant entrance.	LONGVIEW	HARRISON	005 - Hazardous Material Minor
Gasoline		01/17/2003	1500 IH 35 SAN MARCOS	SAN MARCOS	HAYS	003 - Oil Minor ¡24B/1,000G
Diesel fuel	60 GALLONS	01/18/2003	Hwy 249 at Cypresswood in north west Houston	unavailable	HARRIS	004 Hazardous Material Major
Industrial waste	500 GALLONS	01/18/2003	5900 Hwy 225	DEER PARK	HARRIS	unknown
Benzene	12 GALLONS	01/20/2003	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	006 - Other Substance
Sewage	5000 GALLONS	01/20/2003	5900 Hwy 225	DEER PARK	HARRIS	unknown
		01/20/2003	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	unknown
Diesel fuel	40 GALLONS	01/21/2003	Railroad crossing 1/2 mi. S of intersection of IH45 & US Hwy 287, W side of IH45, S of Ennis	ENNIS	ELLIS	003 - Oil Minor ¡24B/1,000G
Drilling mud (oil/gas related)	15 CUBICYARDS	01/23/2003	SPILL SITE LOCATED ON N SIDE OF IH-40 & FARM TO MARKET ROAD 2880	CONWAY	CARSON	005 - Hazardous Material Minor
Xylene (mixed isomers)	160 GALLONS	01/23/2003	US Hwy 80 Westbound, W. of FM 460	FORNEY	KAUFMAN	003 - Oil Minor ¡24B/1,000G
GASOLINE, AUTOMOTIVE OR AVIATION		01/24/2003	I45 and rayford sawdust rd, west side of 45, on the southbound service rd.	unavailable	MONTGOMERY	unknown

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Table F.2: Spill data from TCEQ for spill incidents occuring in 2003 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Sewage	40 GALLONS	01/24/2003	INTERSECTION OF HIGHWAY 71 W & FM 962 IN LLANO COUNTY	unavailable	LLANO	006 - Other Substance
Pentene	372 POUNDS	01/25/2003	Hwy 181 to Hwy 536 3 miles south of Floresville	FLORESVILLE	WILSON	006 - Other Substance
		01/28/2003	IH45 Northbound at MM 214	STREETMAN	NAVARRO	006 - Other Substance
Xylene	134 POUNDS	01/29/2003	On Hwy.69 from Hwy.96 intersection to Chance Cut-Off Rd. Lumberton, Tx.	LUMBERTON	HARDIN	003 - Oil Minor ¡24B/1,000G
Water contaminated with petroleum	1 BARRELS	01/30/2003	US Hwy 75 N at Center Street	SHERMAN	GRAYSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	30 GALLONS	02/01/2003	US Hwy 287 S. of SH 156 Intersection	FORT WORTH	TARRANT	003 - Oil Minor ¡24B/1,000G
Motor oil	2000 GALLONS	02/01/2003	IH35 W southbound at Felix Street (Exit 46)	FORT WORTH	TARRANT	003 - Oil Minor ¡24B/1,000G
Unknown		02/01/2003	3386 Highway 80 in Karnes City	KARNES CITY	KARNES	003 - Oil Minor ¡24B/1,000G
Unknown		02/03/2003	IH20 MEDIAN @ MM 570, WINONA, TX 75792	WINONA	SMITH	002 - Medium ¿24B/1,000G
Unknown or other oil		02/03/2003	3 MI S OF SUNRAY ON HWY 119, 1 MI E, 1/4 MI S on Beef Feeders Road.	SUNRAY	MOORE	005 - Hazardous Material Minor
NATURAL GAS		02/04/2003	IH30 Eastbound near FM 549 Exit	ROCKWALL	ROCKWALL	003 - Oil Minor ¡24B/1,000G
Spent Solvent Mixture	100 GALLONS	02/05/2003	US HIGHWAY 54-KENWORTHY DRIVE	unavailable	EL PASO	003 - Oil Minor ¡24B/1,000G
		02/12/2003	IH 35 South @ Junction of IH 10 & 410 in San Antonio	SAN ANTONIO	BEXAR	005 - Hazardous Material Minor
Asphalt	500 GALLONS	02/14/2003	Interchange of US Hwy 75 and IH635	DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	20 GALLONS	02/14/2003	MCLENNAN COUNTY - I-35 MM327 CENTER MEDIAN	unavailable	MCLENNAN	003 - Oil Minor ¡24B/1,000G
Vinyl Chloride	1 POUNDS	02/14/2003	IH20 Eastbound near MM509	TERRELL	KAUFMAN	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	30 GALLONS	02/17/2003	Intersection of FM 2146 and Hwy 173, NW of Jourdanton, Atascosa County	JOURDANTON	ATASCOSA	003 - Oil Minor ¡24B/1,000G
GASOLINE, AUTOMOTIVE OR AVIATION	70 GALLONS	02/17/2003	2 MILES SOUTH OF SEALY, TEXAS ON HWY 36, Sealy, 77474	SEALY	AUSTIN	002 - Medium ¿24B/1,000G
Sodium hydroxide	375 GALLONS	02/17/2003	On ramp to IH 10 West from FM 1604 in San Antonio	unavailable	BEXAR	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	70 GALLONS	02/18/2003	16301 State Highway 249, Houston, TX	HOUSTON	HARRIS	005 - Hazardous Material Minor
Unknown	2 GALLONS	02/18/2003	Highway 326 north; just south of Grayburg Road; Nome, Tx.	NOME	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Unknown		02/20/2003	1 mile south of FM 961 on US 59, south bound lane in Wharton, Tx	unavailable	WHARTON	003 - Oil Minor ¡24B/1,000G

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Table F.2: Spill data from TCEQ for spill incidents occuring in 2003 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Unknown or other oil		02/20/2003	SE CORNER OF IH 10 AND UTSA BLVD	SAN ANTONIO	BEXAR	003 - Oil Minor ¡24B/1,000G
Lube oil	50 GALLONS	02/22/2003	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	006 - Other Substance
Diesel fuel		02/24/2003	Highway 46 in Bulverde	BULVERDE	COMAL	003 - Oil Minor ¡24B/1,000G
Diesel fuel	10 GALLONS	02/24/2003	Southwest corner of Telge Rd and Hwy 290	HOUSTON	HARRIS	003 - Oil Minor ¡24B/1,000G
Crude oil heavy	5 BARRELS	02/25/2003	Intersection of Refinery Rd. and IH 20 East	BIG SPRING	HOWARD	005 - Hazardous Material Minor
Munitions		02/25/2003	”16212 STATE HIGHWAY 249 KEY MAP 370Q”	unavailable	HARRIS	006 - Other Substance
		02/25/2003	US 59 northbound, 5 miles south of Sheppard, TX.	unavailable	LIBERTY	003 - Oil Minor ¡24B/1,000G
Diesel fuel	1 GALLONS	02/26/2003	State Hwy 31 at Richland Chambers Bridge	POWELL	NAVARRO	003 - Oil Minor ¡24B/1,000G
Diesel fuel		02/27/2003	IH40 E BETWEEN MILE MARKERS 141 & 142 NEAR AMARILLO	AMARILLO	POTTER	005 - Hazardous Material Minor
Malathion	100 GALLONS	02/27/2003	HWY 225 GATE 19	HOUSTON	HARRIS	003 - Oil Minor ¡24B/1,000G
Crude oil light		02/28/2003	2213 Hwy 156	HASLET	TARRANT	003 - Oil Minor ¡24B/1,000G
		02/28/2003	7TH ST S FROM THE INTX WITH HWY 82 TURN L ONTO TEXACO ISLAND RD & THEN RIGHT ON COKE DOCK RD PROCEED APPROX 0.5 MI TO FACILITY	PORT ARTHUR	JEFFERSON	SARA Title III
Crude oil light	120 GALLONS	03/01/2003	INTERSECTION OF I-20 & FM 254 (RANGER HILL)	RANGER	EASTLAND	005 - Hazardous Material Minor
Unknown	2 GALLONS	03/02/2003	Intersection of Highway 158 and Highway 137, Glasscock County	GARDEN CITY	GLASSCOCK	004 Hazardous Material Major
Mixed petroleum products		03/03/2003	Located on Southbound lane of Expressway 77, south of intersection of FM 186 & Expressway 77 in Raymondville, Tx.	unavailable	WILLACY	003 - Oil Minor ¡24B/1,000G
Unknown or other oil	5 BARRELS	03/03/2003	Located approximately 0.4 mile south of the intersection of Brooks County Rd. 304 and U.S. HIghway 281, and 3.1 miles North of intersection of Farm-to-Market Rd. 755 and U.S. Highway 281, on South Bound Highway 281, Encino, Brooks Co., Tx	unavailable	BROOKS	003 - Oil Minor ¡24B/1,000G
JP-4	1 GALLONS	03/06/2003	HWY 69 AT WHEELER RD	unavailable	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		03/06/2003	5900 Hwy 225	DEER PARK	HARRIS	003 - Oil Minor ¡24B/1,000G
Diesel fuel 4-D	400 GALLONS	03/07/2003	HIGHWAY 21 AT BASTROP & CALDWELL COUNTY LINES	BASTROP	CALDWELL	003 - Oil Minor ¡24B/1,000G

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Table F.2: Spill data from TCEQ for spill incidents occuring in 2003 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Butadiene, 1-3	662 POUNDS	03/08/2003	MCLENNAN COUNTY - 1 MILE SOUTH OF I-35 AT INTERSECTION OF HWY 77 SOUTH AND WINGATE DRIVE	unavailable	MCLENNAN	003 - Oil Minor ¡24B/1,000G
Diethylamine	200 GALLONS	03/08/2003	on hw 90, 1/2 mile east of 1909, Ames, tx.	unavailable	HARRIS	unknown
Motor oil	40 GALLONS	03/08/2003	intersection of 1960 and east lake houston parkway.	unavailable	HARRIS	unknown
		03/08/2003	2.1 M S OF HWY 69 ON HWY 365	PORT ARTHUR	JEFFERSON	005 - Hazardous Material Minor
Other material	5 BARRELS	03/09/2003	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Unknown or other oil	160 GALLONS	03/09/2003	west of Angleton on hwy 35 right on westwood.	unavailable	BRAZORIA	unknown
filter cake	25 GALLONS	03/10/2003	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	006 - Other Substance
Freon	375 POUNDS	03/10/2003	Intersection Hwy 90 & Hwy 380 Beaumont TX; dir approx 4 miles southeast on Hwy 380. Exit onto Hwy 347, drive approx 2 miles Southeast, eixt into Dupont Beaumont Complex. BMC in in complex.	BEAUMONT	JEFFERSON	SARA Title III
Battery	60 POUNDS	03/12/2003	US HWY 83 2.2 MILES N OF MENARD	MENARD	MENARD	003 - Oil Minor ¡24B/1,000G
Sodium hydroxide	15800 GALLONS	03/12/2003	Highway 225 and Red Bluff	unavailable	HARRIS	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		03/13/2003	35 MILES SOUTHWEST OF ANDREWS TEXAS ON HIGHWAY 128	ANDREWS	ANDREWS	unknown
Unknown or other oil		03/13/2003	”HWY 281 AND BUSINESS 281 ALICE TX 78332”	unavailable	JIM WELLS	005 - Hazardous Material Minor
Zinc	30 GALLONS	03/14/2003	I 45 North at Holzwarth, mile marker 68	unavailable	HARRIS	006 - Other Substance
Diesel fuel	5 GALLONS	03/15/2003	Highway 82, @2 miles east of causeway bridge, on Pleasure Island; channel side of the highway at Mesquite Point, Port Arthur, Tx.	PORT ARTHUR	JEFFERSON	006 - Other Substance
Industrial waste	180 GALLONS	03/16/2003	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Brine	147 BARRELS	03/18/2003	on Highway 90 West in China	CHINA	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	10 GALLONS	03/18/2003	Off Highway 55, 15 miles northwest of Uvalde	UVALDE	UVALDE	005 - Hazardous Material Minor

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Table F.2: Spill data from TCEQ for spill incidents occuring in 2003 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Hydraulic fluid		03/18/2003	Approximately one mile west of the intersection of FM1686 and SH185, about 8 miles south of Victoria	VICTORIA	VICTORIA	005 - Hazardous Material Minor
Mixed petroleum products	80 GALLONS	03/18/2003	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Other material	166 POUNDS	03/18/2003	property at 203 Highway 149, in Montgomery Texas	unavailable	MONTGOMERY	003 - Oil Minor ¡24B/1,000G
Saltwater	35 BARRELS	03/19/2003	HWY 83 8 MILES EAST OF BIG WELLS	BIG WELLS	DIMMIT	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		03/19/2003	on median of Hwy 288 between Orem and Airport	unavailable	HARRIS	006 - Other Substance
Fuel oil 6	10 GALLONS	03/21/2003	Highway 3057 Bay City TX 77414	BAY CITY	MATAGORDA	005 - Hazardous Material Minor
Heavy crude oil	30 GALLONS	03/21/2003	Groendyke truck hit Teas Transeastern truck @ intersection of HWY 225 & Berle in Pasadena Texas	unavailable	HARRIS	004 Hazardous Material Major
Mineral oil	6500 GALLONS	03/21/2003	5900 Hwy 225 East	DEER PARK	HARRIS	006 - Other Substance
Industrial waste	300 GALLONS	03/22/2003	OFF OLD HIGHWAY 48 AND AT 750 ANCHOR ROAD	BROWNSVILLE	CAMERON	002 - Medium ¿24B/1,000G
Milk	48000 POUNDS	03/22/2003	CORNER OF WINGATE BLVD & HWY 255 IN JASPER COUNTY	SAM RAYBURN	JASPER	006 - Other Substance
Municipal waste		03/22/2003	HWY 146 & 225 STRANG R	LA PORTE	HARRIS	006 - Other Substance
Unknown or other oil		03/22/2003	INTERSECTION OF HWY 19 & FM 514 S OF SULPHUR SPRING IN RAINS COUNTY	unavailable	RAINS	006 - Other Substance
Crude oil heavy		03/25/2003	IH35W near Exit 60 (Hwy 287)	FORT WORTH	TARRANT	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid	1 GALLONS	03/25/2003	Intersection of Handley-Ederville at Randol Mill	FORT WORTH	TARRANT	006 - Other Substance
unknown chemical		03/31/2003	EAST BOUND IH20 @ MM 564 IN SMITH COUNTY	unavailable	SMITH	006 - Other Substance
GASOLINE, AUTOMOTIVE OR AVIATION	13 BARRELS	04/01/2003	US Highway 82 W, Texarkana, TX	TEXARKANA	BOWIE	005 - Hazardous Material Minor
Unknown light oil	1 GALLONS	04/01/2003	HWY 59 APPROXIMATELY 27 MILES EAST OF LAREDO	LAREDO	WEBB	006 - Other Substance
Diesel fuel	10 GALLONS	04/02/2003	HWY 146 & 225 STRANG R	LA PORTE	HARRIS	SARA Title III
Slop oil	10 BARRELS	04/03/2003	7075 US Highway 87 West in La Vernia	LA VERNIA	WILSON	005 - Hazardous Material Minor
Water contaminated with petroleum	15 BARRELS	04/03/2003	7350 INTERSTATE HWY 37	CORPUS CHRISTI	NUECES	005 - Hazardous Material Minor
		04/03/2003	SPILL INCIDENT 1 MILES W OF HEREFORD ON US HIGHWAY 60	HEREFORD	DEAF SMITH	005 - Hazardous Material Minor

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Table F.2: Spill data from TCEQ for spill incidents occuring in 2003 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Diesel fuel	100 GALLONS	04/06/2003	U.S. 59, 2 miles south of Loop 224; northbound near Nacogdoches, Tx.	NACOGDOCHES	NACOGDOCHES	003 - Oil Minor ¡24B/1,000G
Citric acid	1551 POUNDS	04/07/2003	Intersection of FM 802 and HWY 48	unavailable	CAMERON	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D		04/07/2003	IH30 under Hwy 360 bridge.	ARLINGTON	TARRANT	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	60 GALLONS	04/07/2003	HWY 146 & TEXAS CITY, Texas City, TX	unavailable	GALVESTON	006 - Other Substance
Hydrogen peroxide	1000 GALLONS	04/07/2003	Highway 80 @ IH 10	unavailable	CALDWELL	003 - Oil Minor ¡24B/1,000G
Diesel fuel		04/08/2003	MCLENNAN COUNTY - LOOP 340 WEST OF I-35 ON SOUTHEAST BOUND SHOULDER OF LOOP 340	unavailable	MCLENNAN	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid		04/08/2003	IH 35 South @ Solms Road near New Braunfels	NEW BRAUNFELS	COMAL	003 - Oil Minor ¡24B/1,000G
Chlorpyrifos		04/09/2003	5 2/10 miles N. of FM 253 on State Highway 87 northbound; near Buna, Tx.	BUNA	NEWTON	003 - Oil Minor ¡24B/1,000G
Other material		04/09/2003	FM 631 East, North of Hwy 188 in Taft	TAFT	SAN PATRICIO	005 - Hazardous Material Minor
Waste oil	30 GALLONS	04/09/2003	Highway 73 and Country Club Rd. near Port Arthur, Tx.	PORT ARTHUR	JEFFERSON	002 - Medium ¿24B/1,000G
Waste organic liquid	1700 POUNDS	04/09/2003	I-20 AT EXIT 224 NEAR COLORADO CITY	COLORODO CITY	MITCHELL	005 - Hazardous Material Minor
GASOLINE, AUTOMOTIVE OR AVIATION	40 GALLONS	04/10/2003	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	005 - Hazardous Material Minor
GASOLINE, AUTOMOTIVE OR AVIATION	450 BARRELS	04/11/2003	SW CORNER OF THE INTERSECTION OF INTERSTATE HIGHWAY 40 AND FM1912 AMARILLO POTTER COUNTY TEXAS	AMARILLO	POTTER	005 - Hazardous Material Minor
hydraulic oil	15 GALLONS	04/11/2003	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	003 - Oil Minor ¡24B/1,000G
Brine	70 BARRELS	04/17/2003	EMERGENCY RESPONSE SITE AT COUNTY ROAD 10 & US HIGHWAY 287 IN CHILDRESS COUNTY TX	CHILDRESS	CHILDRESS	005 - Hazardous Material Minor
Diesel fuel	75 GALLONS	04/17/2003	IH35W and FM 917, between MM 31 and 32	BRIAROAKS	JOHNSON	003 - Oil Minor ¡24B/1,000G
Phenol	0 GALLONS	04/18/2003	Highway 87 Mile Marker 225; near Newton, Tx.	NEWTON	NEWTON	005 - Hazardous Material Minor
		04/18/2003	US Hwy 380 just East of State Hwy 289	PROSPER	COLLIN	003 - Oil Minor ¡24B/1,000G
		04/19/2003	intersection of 8th and pine street in freeport, texas.	unavailable	BRAZORIA	006 - Other Substance

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Table F.2: Spill data from TCEQ for spill incidents occuring in 2003 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Sodium hydroxide	35000 GALLONS	04/20/2003	IH 10 and 1604 West in San Antonio	SAN ANTONIO	BEXAR	003 - Oil Minor ¡24B/1,000G
Methacrylic acid methyl ester	55 GALLONS	04/21/2003	INTXN OF FM 1593 & HWY 35 EXTENDING 1.8 MI N ON E SIDE OF FM 1593 & 1.7 MI E ON N SIDE HWY 35	POINT COMFORT	CALHOUN	006 - Other Substance
Oil and grease	55 GALLONS	04/24/2003	4613 Denton Hwy	HALTOM CITY	TARRANT	003 - Oil Minor ¡24B/1,000G
Waste oil	30 GALLONS	04/24/2003	I10 east at mile marker 752	unavailable	HARRIS	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid	100 GALLONS	04/25/2003	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	005 - Hazardous Material Minor
Diesel fuel	50 GALLONS	05/01/2003	Intersection of I-20 BR and FM 208, Colorado City	COLORADO CITY	MITCHELL	005 - Hazardous Material Minor
Diesel fuel	30 GALLONS	05/02/2003	IH30 Eastbound at MM87	GREENVILLE	HUNT	003 - Oil Minor ¡24B/1,000G
Unknown or other oil	10 GALLONS	05/02/2003	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	005 - Hazardous Material Minor
Drilling mud (oil/gas related)	2 BARRELS	05/03/2003	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Waste oil		05/04/2003	Intersection of State Hwy 183 at Loop 12	IRVING	DALLAS	004 Hazardous Material Major
Other material	1000 POUNDS	05/05/2003	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	005 - Hazardous Material Minor
Diesel fuel 2-D	100 GALLONS	05/06/2003	5530 IH 10 East in San Antonio	SAN ANTONIO	BEXAR	003 - Oil Minor ¡24B/1,000G
Waste oil	11 GALLONS	05/06/2003	IH 10 Eastbound Mile 604 in Seguin, TX	SEQUIN	GUADALUPE	003 - Oil Minor ¡24B/1,000G
Gas Oil	22 GALLONS	05/09/2003	1.5 miles west of Highway 77, 11 miles north of Refugio	REFUGIO	REFUGIO	005 - Hazardous Material Minor
Waste oil		05/10/2003	INTERSECTION OF BOB BULLOCK AND I 35	LAREDO	WEBB	003 - Oil Minor ¡24B/1,000G
PCBs	1 GALLONS	05/11/2003	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		05/11/2003	9500 Interstate 10 E, Baytown, TX	BAYTOWN	HARRIS	004 Hazardous Material Major
Hydraulic fluid		05/13/2003	17934 State Highway 16 S in San Antonio	SAN ANTONIO	BEXAR	003 - Oil Minor ¡24B/1,000G
Nitrogen dioxide		05/14/2003	Intersection of 29th Street and FM 495, McAllen, TX	unavailable	HIDALGO	003 - Oil Minor ¡24B/1,000G
Unknown	1 BARRELS	05/15/2003	5900 Hwy 225	DEER PARK	HARRIS	004 Hazardous Material Major
Gasoline	1200 GALLONS	05/17/2003	IH35W southbound near Western Center Blvd exit	FORT WORTH	TARRANT	003 - Oil Minor ¡24B/1,000G
Fuel oil 1	5 BARRELS	05/18/2003	IH35E Southbound	RED OAK	ELLIS	004 Hazardous Material Major
NATURAL GAS		05/19/2003	IH 35 Southbound @ Mile Marker 119, Frio/Medina County Line near Devine, TX.	DEVINE	FRIO	005 - Hazardous Material Minor

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Table F.2: Spill data from TCEQ for spill incidents occuring in 2003 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
p-dichlororbenzene	3 GALLONS	05/20/2003	IH35E south at NW Hwy Intersection	DALLAS	DALLAS	005 - Hazardous Material Minor
Unknown light oil	1 GALLONS	05/20/2003	IH35 Exit 468 (Oak Street)	DENTON	DENTON	003 - Oil Minor ¡24B/1,000G
Unknown		05/21/2003	Loop 410 and Highway 35 North in San Antonio	SAN ANTONIO	BEXAR	003 - Oil Minor ¡24B/1,000G
		05/21/2003	Highway 35 & FM 524, Old Ocean, TX	SWEENY	BRAZORIA	003 - Oil Minor ¡24B/1,000G
Anhydrous ammonia		05/22/2003	North Highway 83 at the edge of the city limits.	UVALDE	UVALDE	005 - Hazardous Material Minor
Diesel fuel 2-D	50 GALLONS	05/23/2003	Intersection of IH30 and IH635, any direction	MESQUITE	DALLAS	006 - Other Substance
NATURAL GAS	6500 BARRELS	05/23/2003	North Highway 83 at the edge of the city limits.	UVALDE	UVALDE	005 - Hazardous Material Minor
Unknown		05/27/2003	Highway 41, approximately 9 miles east of Rock Springs, North side - 30.04.34N & 099.58.55W	ROCK SPRINGS	EDWARDS	005 - Hazardous Material Minor
P-Xylene	100 POUNDS	05/28/2003	HWY 69 N COOKS LAKE RD EXIT IN LUMBERTON	BEAUMONT	HARDIN	005 - Hazardous Material Minor
GASOLINE, AUTOMOTIVE OR AVIATION	350 GALLONS	05/29/2003	4 MILES W OF AMARILLO ON IH 40 AT ARNOT ROAD	AMARILLO	POTTER	006 - Other Substance
Unknown or other oil		05/29/2003	Hwy 287, approx. 4 mi. N of Decatur	DECATUR	WISE	005 - Hazardous Material Minor
Grease	35 GALLONS	05/30/2003	Highway 90 at Knippa, TX	KNIPPA	UVALDE	003 - Oil Minor ¡24B/1,000G
Industrial waste	35 GALLONS	05/30/2003	Intersection of FM 1171 at Forums Road	FLOWER MOUND	DENTON	003 - Oil Minor ¡24B/1,000G
Sewage	2000 GALLONS	05/31/2003	OFF HWY 190 IN CEDAR POINT SUBDIVISION	ONALASKA	POLK	006 - Other Substance
Carbon Black Oil	10000 GALLONS	06/03/2003	LOCATED APPX 1/8 MILE NORTH OF I-635 ON PRESTON	DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		06/03/2003	Highway 96 South	JASPER	JASPER	003 - Oil Minor ¡24B/1,000G
Butadiene	184 POUNDS	06/04/2003	HWY 59 northbound, humble, tx.	unavailable	HARRIS	003 - Oil Minor ¡24B/1,000G
Diesel fuel	50 GALLONS	06/04/2003	HWY 225 GATE 19	HOUSTON	HARRIS	006 - Other Substance
Crude oil light	0 GALLONS	06/10/2003	Intersection of Refinery Rd. and IH 20 East	BIG SPRING	HOWARD	003 - Oil Minor ¡24B/1,000G
Crude oil light	200 GALLONS	06/10/2003	Interstate 10, Mile Marker 254	FORT STOCKTON	PECOS	003 - Oil Minor ¡24B/1,000G
Diesel fuel	30 GALLONS	06/10/2003	SMITH BLUFF ROAD AT HWY 347	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Benzene		06/11/2003	Westbound I-10 WW White (access road) in San Antonio	SAN ANTONIO	BEXAR	005 - Hazardous Material Minor
Diesel fuel 2-D		06/11/2003	IH45 N at Mile Marker 225	CORSICANA	NAVARRO	003 - Oil Minor ¡24B/1,000G
Diesel fuel	100 GALLONS	06/12/2003	IH20 WESTBOUND @ MM 545.7	LINDALE	SMITH	006 - Other Substance
Nitrogen oxide	16 POUNDS	06/12/2003	Near intersection of Hwy 121 and Denton Tap Road	LEWISVILLE	DENTON	003 - Oil Minor ¡24B/1,000G

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Table F.2: Spill data from TCEQ for spill incidents occuring in 2003 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
2, 5-Dihydrofuran	100 POUNDS	06/13/2003	Highway 59 south, near Lufkin, Tx. city limits	LUFKIN	ANGELINA	003 - Oil Minor ¡24B/1,000G
Industrial waste	3238000 GALLONS	06/13/2003	IH 45 Northbound at MM 219	CORSICANA	NAVARRO	003 - Oil Minor ¡24B/1,000G
Ammonia, anhydrous		06/16/2003	US Highway 57, 2 miles west of IH-35, near Moore, TX.	MOORE	FRIO	005 - Hazardous Material Minor
Crude oil light	5 BARRELS	06/16/2003	intersection of hwy 90 and 321 in Dayton, tx. Liberty county.	unavailable	LIBERTY	003 - Oil Minor ¡24B/1,000G
Gasoline	30 GALLONS	06/16/2003	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid	70 GALLONS	06/16/2003	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D		06/17/2003	3 MI WEST OF FRIONA ON HIGHWAY 60	FRIONA	PARMER	005 - Hazardous Material Minor
Gasoline		06/17/2003	US Hwy 377 2.7 mi. S	TOLAR	HOOD	002 - Medium ¿24B/1,000G
Wastewater discharge, industrial	47 BARRELS	06/17/2003	US 181 one mile south of Hobson	HOBSON	KARNES	005 - Hazardous Material Minor
Diesel fuel	100 GALLONS	06/18/2003	"Hwy 183 Southbound between Regal Row and Mockingbird Lane"	DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Diesel fuel	155 GALLONS	06/19/2003	"Intersection of IH35E and Hebron Parkway Exit 448"	LEWISVILLE	DENTON	003 - Oil Minor ¡24B/1,000G
Other material	2 GALLONS	06/19/2003	INTXN OF FM 1593 & HWY 35 EXTENDING 1.8 MI N ON E SIDE OF FM 1593 & 1.7 MI E ON N SIDE HWY 35	POINT COMFORT	CALHOUN	006 - Other Substance
Unknown	30 GALLONS	06/19/2003	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Butadiene	320 POUNDS	06/21/2003	HIGHWAY 90 WEST OF LULING	unavailable	CALDWELL	003 - Oil Minor ¡24B/1,000G
Dinitrotoluene (liquid, molten, or solid)	22 POUNDS	06/22/2003	HWY 92	SILSBEE	HARDIN	003 - Oil Minor ¡24B/1,000G
Diesel fuel	30 GALLONS	06/23/2003	Intersection of Refinery Rd. and IH 20 East	BIG SPRING	HOWARD	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	150 GALLONS	06/23/2003	IH635 (LBJ Fwy) near Welch Road	DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Nitrous Oxides	16 POUNDS	06/24/2003	Mile Marker 341 on Westbound lane of Interstate 10 near Sheffield	SHEFFIELD	PECOS	005 - Hazardous Material Minor
Other Organics	92 BARRELS	06/25/2003	HWY 59 CLOSE TO ELGIN EXIT TRUCK HEADING NORTH NEAR HOUSTON	unavailable	HARRIS	SARA Title III
Unknown or other oil	15 GALLONS	07/01/2003	Construction zone on Hwy 66, Rural Ellis Co	unavailable	ELLIS	003 - Oil Minor ¡24B/1,000G
Caustic soda	50 GALLONS	07/03/2003	Old HWY 105 @ HWY 105 Cut-N-Shoot tx 77304	unavailable	MONTGOMERY	006 - Other Substance
Unknown or other oil		07/03/2003	13437 IH 35 S, Von Ormy, TX	unavailable	BEXAR	003 - Oil Minor ¡24B/1,000G

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Table F.2: Spill data from TCEQ for spill incidents occuring in 2003 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Used oil with 1,1,1-Trichloroethylene	40 GALLONS	07/05/2003	ER AT INTERSECTION OF HWY 60 AND HWY 521 IN WADSWORTH.	unavailable	MATAGORDA	006 - Other Substance
Crude oil light		07/06/2003	HWY 225 AT BATTLEGROUND ROAD	DEER PARK	HARRIS	006 - Other Substance
Diesel fuel	110 GALLONS	07/07/2003	Mile Marker 876 eastbound IH-10; Orange, Tx.	ORANGE	ORANGE	003 - Oil Minor ¡24B/1,000G
Naptha	203 GALLONS	07/07/2003	2100 Block of West IH-10 in San Antonio	SAN ANTONIO	BEXAR	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	60 GALLONS	07/10/2003	4200 S. IH45	DALLAS	DALLAS	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	100 GALLONS	07/10/2003	Carrier Parkway at IH20	GRAND PRAIRIE	DALLAS	003 - Oil Minor ¡24B/1,000G
Freon		07/12/2003	HWY 225 AT BATTLEGROUND ROAD	DEER PARK	HARRIS	003 - Oil Minor ¡24B/1,000G
Waste oil	40 GALLONS	07/14/2003	State Hwy 361 - 1.5 miles SE of intersection of SH 361 and SH 35 near the city of Gregory in San Patricio County.	GREGORY	SAN PATRICIO	003 - Oil Minor ¡24B/1,000G
Diesel fuel	10 GALLONS	07/15/2003	HWY 225 GATE 19	HOUSTON	HARRIS	006 - Other Substance
Diesel fuel	2000 GALLONS	07/16/2003	State Highway 77 in Kingsville	KINGSVILLE	KLEBERG	005 - Hazardous Material Minor
Lead	60 POUNDS	07/17/2003	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	005 - Hazardous Material Minor
JP-8	150 GALLONS	07/18/2003	HILL COUNTY - I-35 AND MM 349	unavailable	HILL	006 - Other Substance
Other Organics	35000 POUNDS	07/18/2003	1 MI N OF ROPESVILLE ON HWY 62-82	ROPESVILLE	HOCKLEY	006 - Other Substance
Unknown or other oil		07/18/2003	LOCATED ON THE 700 BLOCK OF SOUTH BOUND LANES OF US HIGHWAY 83 IN WESLACO, TX 78596	unavailable	HIDALGO	003 - Oil Minor ¡24B/1,000G
Industrial waste	2 GALLONS	07/20/2003	7501 State Hwy 185 N	SEADRIFT	CALHOUN	005 - Hazardous Material Minor
Diesel fuel	70 GALLONS	07/23/2003	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Water contaminated with petroleum	500 GALLONS	07/25/2003	HWY 326	SOUR LAKE	HARDIN	003 - Oil Minor ¡24B/1,000G
Crude oil heavy		07/28/2003	INTERSECTION OF HWY 347 AND HILL ST NEDERLAND TX	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel		07/29/2003	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D		07/30/2003	IH30 Westbound at Exit 95	GREENVILLE	HUNT	003 - Oil Minor ¡24B/1,000G
Parrafin oil	1000 GALLONS	07/30/2003	Intersection of Hwy 50 and Business Hwy 224	COMMERCE	HUNT	003 - Oil Minor ¡24B/1,000G
GASOLINE, AUTOMOTIVE OR AVIATION		07/31/2003	i-10 east spur 330 exit past 2nd light	BAYTOWN	HARRIS	003 - Oil Minor ¡24B/1,000G

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Table F.2: Spill data from TCEQ for spill incidents occuring in 2003 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Mineral oil	100 GALLONS	08/01/2003	US 288 & MILE POLE 320.0, ANGLETON, TX	unavailable	BRAZORIA	005 - Hazardous Material Minor
Diesel fuel	1 GALLONS	08/06/2003	INTERSTATE 10 BETWEEN MI MARKER 873 & 879 E OF ORANGE TX NEAR BEAUMONT	BEAUMONT	ORANGE	005 - Hazardous Material Minor
Saltwater		08/10/2003	I-45N & Parker Road	unavailable	HARRIS	005 - Hazardous Material Minor
Diesel fuel marine	1 GALLONS	08/11/2003	SOUTH BEFORE LANDER ROAD 1.5 MILES SOUTH ON HIGHWAY 87	PLACEDO	VICTORIA	006 - Other Substance
Wastewater discharge, municipal	100 GALLONS	08/14/2003	1 1/2 miles west of Beaumont on Highway 90	BEAUMONT	JEFFERSON	SARA Title III
Butyric acid	35 POUNDS	08/21/2003	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Mineral oil	75 GALLONS	08/21/2003	US Hwy 380 approx. 5 mi. W of Denton	DENTON CO	DENTON	003 - Oil Minor ¡24B/1,000G
Crude oil light	4 BARRELS	08/25/2003	I-20 Eastbound at Mile Marker 177	BIG SPRING	HOWARD	005 - Hazardous Material Minor
Diesel fuel	20 GALLONS	08/27/2003	HWY 225 GATE 19	HOUSTON	HARRIS	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	30 GALLONS	08/27/2003	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Ferric chloride	800 POUNDS	08/27/2003	Highway overpass, IH-10 E at Horizon Blvd. exit, El Paso, Tx	unavailable	EL PASO	002 - Medium ¿24B/1,000G
Sludge	300 GALLONS	08/30/2003	Intersection of State Hwy 183 at Loop 12	IRVING	DALLAS	002 - Medium ¿24B/1,000G
Diesel fuel	400 GALLONS	08/31/2003	APPROXIMATELY 4.5 MILES WEST OF THE CITY OF INGRAM ON HWY 39	INGRAM	KERR	006 - Other Substance
Diesel fuel marine	2 GALLONS	09/04/2003	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	003 - Oil Minor ¡24B/1,000G
Other material		09/04/2003	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	003 - Oil Minor ¡24B/1,000G
Unknown		09/05/2003	Hwy 287 Northbound, approx. 13 mi. N of Decatur	unavailable	WISE	003 - Oil Minor ¡24B/1,000G
		09/05/2003	STATE HIGHWAY 21 23 MI E OF CROCKETT TX	CROCKETT	HOUSTON	003 - Oil Minor ¡24B/1,000G
Sodium hydroxide	30 GALLONS	09/09/2003	ON HWY 87 10 MILES WEST OF SABINE PASS	SABINE PASS	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	80 GALLONS	09/11/2003	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	003 - Oil Minor ¡24B/1,000G
Crude oil light	500 BARRELS	09/12/2003	IH 35 North @ Riverside Dr	unavailable	TRAVIS	003 - Oil Minor ¡24B/1,000G
GASOLINE, AUTOMOTIVE OR AVIATION	154 BARRELS	09/14/2003	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Butadiene		09/15/2003	IH35E southbound, near Mile Marker 384	ITALY	ELLIS	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	100 GALLONS	09/15/2003	4.3 miles south of US Highway 377 and US Highway 63	BROWNWOOD	BROWN	004 Hazardous Material Major

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Table F.2: Spill data from TCEQ for spill incidents occuring in 2003 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Methyl ethyl ketone (MEK)		09/15/2003	U.S. Highway 80 approximately 1 mile west of Forney	unavailable	KAUFMAN	005 - Hazardous Material Minor
Lube oil	11 BARRELS	09/18/2003	IH35 N at Exit 478	SANGER	DENTON	003 - Oil Minor ¡24B/1,000G
Gasoline	20 GALLONS	09/19/2003	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel marine	120 GALLONS	09/20/2003	HWY 225 GATE 19	HOUSTON	HARRIS	003 - Oil Minor ¡24B/1,000G
Diesel fuel	1 GALLONS	09/22/2003	Intersection of Hwy 77 S and Northgate	WAXAHACHIE	ELLIS	003 - Oil Minor ¡24B/1,000G
Sodium hydroxide	900 GALLONS	09/25/2003	Interstate Highway 10 eastbound at mile marker 619 near Kingsbury	KINGSBURY	GUADALUPE	003 - Oil Minor ¡24B/1,000G
Unknown		09/25/2003	Intersection of US Hwy 69 and State Hwy 11	SHERMAN	GRAYSON	003 - Oil Minor ¡24B/1,000G
Other material	15 GALLONS	10/01/2003	"INTERSTATE 45 SOUTH AND ENTERPRISE RD CONROE, TEXAS"	unavailable	MONTGOMERY	006 - Other Substance
		10/05/2003	IH 35 southbound at exit 186 in New Braunfels	NEW BRAUNFELS	COMAL	003 - Oil Minor ¡24B/1,000G
Diesel fuel	2 GALLONS	10/06/2003	US Highway 82	TEXARKANA	BOWIE	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		10/07/2003	State Highway 7 east of Nacogdoches, Tx.	NACOGDOCHES	NACOGDOCHES	005 - Hazardous Material Minor
Unknown or other oil		10/10/2003	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	003 - Oil Minor ¡24B/1,000G
Diesel fuel	100 GALLONS	10/17/2003	MILE MARKER 281-3 I-HWY 59 IN MONTGOMERY COUNTY	unavailable	MONTGOMERY	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid	200 GALLONS	10/19/2003	vic. intersection of State Hwy 114 and William D Tate	GRAPEVINE	TARRANT	002 - Medium ¿24B/1,000G
Benzene	23 POUNDS	10/27/2003	IH45 Northbound at MM 264	ENNIS	ELLIS	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	35 GALLONS	10/29/2003	"US Hwy 69, approx. 1 mi E of intersection with State Hwy 11"	WHITEWRIGHT	GRAYSON	003 - Oil Minor ¡24B/1,000G
Ethylene oxide		11/01/2003	7801 E IH20, Midland	unavailable	MIDLAND	unknown
Asbestos		11/02/2003	Northeast intersection of Hwy 146 and Port Rd	SEABROOK	HARRIS	006 - Other Substance
Benzoyl peroxide		11/03/2003	on state hwy 288 1/2 mile north of 1462 in rosharon, tx.	unavailable	BRAZORIA	003 - Oil Minor ¡24B/1,000G
Diesel fuel	50 GALLONS	11/03/2003	Intersection of Sidney Baker (Hwy 16) at North St, Kerrville	KERRVILLE	KERR	005 - Hazardous Material Minor
Sulfuric acid	235000 GALLONS	11/03/2003	Downtown Trinity, Tx. on Highway 94 at the RR crossing.	TRINITY	TRINITY	006 - Other Substance
Diesel fuel 2-D	50 GALLONS	11/05/2003	IH45 N at Mile Marker 225	CORSICANA	NAVARRO	003 - Oil Minor ¡24B/1,000G
Aldicarb	10 POUNDS	11/11/2003	Along the Guadalupe River on Hwy 27 at Goat Creek	KERRVILLE	KERR	006 - Other Substance
Diesel fuel		11/23/2003	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Coal	300 CUBICYARDS	11/24/2003	INTERSECTION OF MAIN & HWY 277 N 2.5 MI ON N SIDE OF HWY 277 EAGLE PASS TX MAVERICK COUNTY	EAGLE PASS	MAVERICK	003 - Oil Minor ¡24B/1,000G

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Table F.2: Spill data from TCEQ for spill incidents occuring in 2003 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Crude oil heavy		11/24/2003	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	002 - Medium ¿24B/1,000G
Unknown		12/06/2003	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Diesel fuel 2-D	0 GALLONS	12/09/2003	CORNER HWY 181 & 72	KENEDY	KARNES	002 - Medium ¿24B/1,000G
Hydraulic fluid	1 GALLONS	12/09/2003	5500 State Highway 366, Port Neches, TX	GROVES	JEFFERSON	005 - Hazardous Material Minor
Gasoline	126 GALLONS	12/14/2003	Northeast intersection of Hwy 146 and Port Rd	SEABROOK	HARRIS	006 - Other Substance
Diesel fuel 2-D	50 GALLONS	12/22/2003	INTERSECTION OF HWY 332 AND HWY 288	FREEPORT	BRAZORIA	006 - Other Substance
Diesel fuel	34 GALLONS	12/27/2003	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	SARA Title III
Sulfuric acid	9000 GALLONS	12/29/2003	3310 Highway 36 N	ROSENBERG	FORT BEND	003 - Oil Minor ¡24B/1,000G

Table F.3: Spill data from TCEQ for spill incidents occurring in 2004.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Diesel fuel	75 GALLONS	01/02/2004	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	200 GALLONS	01/05/2004	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	85 GALLONS	01/08/2004	MILE MARKER 263, I-20 TRENT	TRENT	TAYLOR	006 - Other Substance
Industrial waste	1499 POUNDS	01/10/2004	Spill at Mile Marker 267, I-20, Merkle, Taylor county	unavailable	TAYLOR	006 - Other Substance
Acetic acid	15 POUNDS	01/11/2004	1604 & IH 10 INTERSECTION	CONVERSE	BEXAR	005 - Hazardous Material Minor
Carbon Soot	0	01/12/2004	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	005 - Hazardous Material Minor
Other material	0	01/13/2004	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Diesel fuel	30 GALLONS	01/21/2004	I45 southbound and mile marker 120	unavailable	WALKER	003 - Oil Minor ¡24B/1,000G
Unknown	1 GALLONS	01/21/2004	6275 Highway 347, Beaumont, TX	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
phenolic compound	50 GALLONS	01/22/2004	807 W HWY 82, SAINT JO	SAINT JO	MONTAGUE	006 - Other Substance
Diesel fuel	150 GALLONS	01/24/2004	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	005 - Hazardous Material Minor
Wastewater discharge, municipal	0	01/24/2004	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	003 - Oil Minor ¡24B/1,000G
Light crude oil	1 BARRELS	01/27/2004	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Lube oil	5 GALLONS	01/29/2004	Gate 99, Intersection of Hwy 73 and Hwy 366	PORT ARTHUR	JEFFERSON	SARA Title III
Wastewater discharge, industrial	0	01/29/2004	HWY 59 & 1960	unavailable	HARRIS	004 Hazardous Material Major
Wastewater discharge, industrial	30 GALLONS	01/30/2004	US Highway 180 7 miles east of Anson	ANSON	JONES	unknown
Wastewater discharge, municipal	0	01/31/2004	HWY 225 GATE 19	HOUSTON	HARRIS	005 - Hazardous Material Minor
Diesel fuel	80 GALLONS	02/02/2004	4 MI S OF DEVINE ON HWY 3176	DEVINE	FRIO	006 - Other Substance
Nitrogen oxide	14 POUNDS	02/02/2004	8 miles east of Devers, Tx. Hwy 90 E	unavailable	LIBERTY	002 - Medium ¿24B/1,000G
Crude oil light	6 BARRELS	02/06/2004	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	005 - Hazardous Material Minor
Other material	70 BARRELS	02/06/2004	Highway 69 between Lumberton and Kountze, Tx. by Beaumont Colony	KOUNTZE	HARDIN	003 - Oil Minor ¡24B/1,000G
Gasoline	350 GALLONS	02/09/2004	1700 NORTH HIGHWAY 360	GRAND PRAIRIE	TARRANT	006 - Other Substance
Benzene	2 BARRELS	02/11/2004	5900 Hwy 225	DEER PARK	HARRIS	005 - Hazardous Material Minor
Benzene	5 BARRELS	02/11/2004	Highway 255, Deer Park, TX	unavailable	HARRIS	006 - Other Substance

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Table F.3: Spill data from TCEQ for spill incidents occurring in 2004 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Wastewater discharge, municipal	2500 GALLONS	02/11/2004	ON HWY 3186, .25 MI FROM EAST END OF ROAD	ONALASKA	POLK	006 - Other Substance
JP-8	25 GALLONS	02/12/2004	northeast of the intersection of hwy 75 and Interstate 635 in Dallas	DALLAS	DALLAS	006 - Other Substance
Sodium hypochlorite	40 GALLONS	02/14/2004	US Hwy 277 and TX Hwy 95	STAMFORD	JONES	006 - Other Substance
Diesel fuel	50 GALLONS	02/15/2004	1604 & IH 10 INTERSECTION	CONVERSE	BEXAR	003 - Oil Minor ¡24B/1,000G
Diesel fuel	60 GALLONS	02/17/2004	Intersection of Highway 349 and Highway 137, Lamesa TX	LAMESA	DAWSON	004 Hazardous Material Major
Diesel fuel	50 GALLONS	02/19/2004	Mile Marker 172 on IH 20 west of Big Spring, TX	BIG SPRING	HOWARD	003 - Oil Minor ¡24B/1,000G
Benzene	0	02/21/2004	Mile Marker 184 on Interstate 20 (Moss Creek Road), Big Spring	BIG SPRING	HOWARD	003 - Oil Minor ¡24B/1,000G
Diesel fuel	10 GALLONS	02/22/2004	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	50 GALLONS	02/24/2004	19720 Highway 281 South in San Antonio	SAN ANTONIO	BEXAR	003 - Oil Minor ¡24B/1,000G
Industrial waste	1000 GALLONS	02/24/2004	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Hydraulic Oil	60 GALLONS	02/26/2004	HWY 87N APPROX 4 MI N OF INTXN HWY 87 AND HWY 12	DEWEYVILLE	NEWTON	002 - Medium ¿24B/1,000G
Diesel fuel	75 GALLONS	02/28/2004	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	005 - Hazardous Material Minor
Hydraulic Oil	40 GALLONS	03/08/2004	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	SARA Title III
		03/09/2004	ON NE COUNTY RD 119 & US HWY 79	HUTTO	WILLIAMSON	003 - Oil Minor ¡24B/1,000G
		03/09/2004	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	SARA Title III
Motor oil	25 GALLONS	03/10/2004	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	SARA Title III
Mineral oil	15 GALLONS	03/15/2004	Interstate Highway 10 Exit 849 near Walden Rd.; Beaumont, Tx.	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Mineral oil	13 GALLONS	03/15/2004	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	SARA Title III
Propylene (Propene)	0	03/15/2004	OFF HWY 242, CONROE TX.	unavailable	MONTGOMERY	SARA Title III
Sulfur dioxide	0	03/18/2004	HIGHWAY 347	BEAUMONT	JEFFERSON	SARA Title III
Diesel fuel	1200 GALLONS	03/22/2004	ON 9402 EXPRESSWAY 83	HARLINGEN	CAMERON	003 - Oil Minor ¡24B/1,000G
Hydraulic Oil	45 GALLONS	03/23/2004	10 Miles South of Seminole on State Highway 285 on FM 2885	SEMINOLE	GAINES	003 - Oil Minor ¡24B/1,000G
Chlorine	0	03/24/2004	702 HWY 11 W	WHITEWRIGHT	GRAYSON	003 - Oil Minor ¡24B/1,000G
Sewage	500 GALLONS	04/04/2004	ON HWY 87 S TOWARDS SABINE PASS IN PORT ARTHUR	PORT ARTHUR	JEFFERSON	SARA Title III

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Table F.3: Spill data from TCEQ for spill incidents occurring in 2004 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Diesel fuel	130 GALLONS	04/07/2004	1700 NORTH HIGHWAY 360	GRAND PRAIRIE	TARRANT	005 - Hazardous Material Minor
Diesel fuel 2-D	20 GALLONS	04/07/2004	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	SARA Title III
Diesel fuel	0	04/11/2004	Intersection of Refinery Rd. and IH 20 East	BIG SPRING	HOWARD	003 - Oil Minor ¡24B/1,000G
Mercury	1 GALLONS	04/13/2004	2002 NW HWY	GARLAND	DALLAS	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid	30 GALLONS	04/15/2004	9548 Interstate 10 E, Baytown, TX	BAYTOWN	HARRIS	006 - Other Substance
Diesel fuel	90 GALLONS	04/17/2004	"Intersection of Matamoros and San Bernardo St. Laredo"	LAREDO	WEBB	unknown
Crude oil heavy	0	04/22/2004	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	005 - Hazardous Material Minor
Crude oil heavy	30 GALLONS	04/23/2004	Westbound exit ramp from Highway 69 to IH-10; Beaumont, Tx.	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Hydrogen	0	04/27/2004	1 Mile Southwest of the intersection of IH35 and State Highway 85 in Frio Co, TX.	DILLEY	FRIO	006 - Other Substance
Nitric acid	20 GALLONS	04/27/2004	Northeast intersection of Hwy 146 and Port Rd	SEABROOK	HARRIS	003 - Oil Minor ¡24B/1,000G
Hydrocarbons	0	05/06/2004	1604 & IH 10 INTERSECTION	CONVERSE	BEXAR	003 - Oil Minor ¡24B/1,000G
Benzene	56 GALLONS	05/11/2004	HWY 59; 12 MI N OF LIVINGSTON, TX	MOSCOW	POLK	003 - Oil Minor ¡24B/1,000G
Isopropyl alcohol	1 GALLONS	05/11/2004	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	005 - Hazardous Material Minor
GASOLINE, AUTOMOTIVE OR AVIATION	40 GALLONS	05/17/2004	"HWY 366 PORT NECHES, TX"	unavailable	JEFFERSON	005 - Hazardous Material Minor
Mineral Oil with PCBs	2 GALLONS	05/17/2004	5900 Hwy 225	DEER PARK	HARRIS	005 - Hazardous Material Minor
Paint waste	0	05/19/2004	— 10404 I-10 HWY 146, BAYTOWN, TX, 77520 —	unavailable	CHAMBERS	003 - Oil Minor ¡24B/1,000G
Sulfur dioxide	0	05/24/2004	Highway 287 east out of Corrigan, Texas	CORRIGAN	POLK	002 - Medium ¿24B/1,000G
Diesel fuel	2000 GALLONS	05/26/2004	5500 State Highway 366, Port Neches, TX	GROVES	JEFFERSON	SARA Title III
Diesel fuel	50 GALLONS	05/28/2004	Intersection of Refinery Rd. and IH 20 East	BIG SPRING	HOWARD	002 - Medium ¿24B/1,000G
		05/29/2004	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Petroleum	406 GALLONS	06/01/2004	HWY 225 GATE 19	HOUSTON	HARRIS	003 - Oil Minor ¡24B/1,000G
Diesel fuel 4-D	350 GALLONS	06/07/2004	HWY 225 GATE 19	HOUSTON	HARRIS	003 - Oil Minor ¡24B/1,000G
Other Organics	0	06/09/2004	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	005 - Hazardous Material Minor

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Table F.3: Spill data from TCEQ for spill incidents occurring in 2004 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Residual Oil	5 BARRELS	06/09/2004	HWY 59 SOUTHBOUND, APPLEBY, TX	APPLEBY	NACOGDOCHES	003 - Oil Minor ¡24B/1,000G
Caustic soda	300 GALLONS	06/11/2004	SOUTH OF HWY 377 WEST OF TOLAR.	TOLAR	HOOD	006 - Other Substance
Brine	6 BARRELS	06/14/2004	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	005 - Hazardous Material Minor
Used Oil	53 GALLONS	06/14/2004	Northeast intersection of Hwy 146 and Port Rd	SEABROOK	HARRIS	005 - Hazardous Material Minor
Drilling mud (oil/gas related)	0	06/24/2004	Highway 96 by Lazy H Smokehouse; near Kirbyville, Tx.	KIRBYVILLE	JASPER	003 - Oil Minor ¡24B/1,000G
Chlorine	0	06/25/2004	Mile Marker 276.5 Intracoastal Waterway	PORT ARTHUR	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	0 GALLONS	07/02/2004	16301 State Highway 249, Houston, TX	HOUSTON	HARRIS	003 - Oil Minor ¡24B/1,000G
Gas Oil	40 GALLONS	07/02/2004	6275 Highway 347, Beaumont, TX	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	25 GALLONS	07/04/2004	1700 NORTH HIGHWAY 360	GRAND PRAIRIE	TARRANT	006 - Other Substance
Diesel fuel marine	0 GALLONS	07/09/2004	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	005 - Hazardous Material Minor
Waste oil	70 GALLONS	07/09/2004	northeast of the intersection of hwy 75 and Interstate 635 in Dallas	DALLAS	DALLAS	005 - Hazardous Material Minor
Diesel fuel	300 GALLONS	07/12/2004	FM 3322 & HWY 87 IN SABINE PASS, TX	SABINE PASS	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	200 GALLONS	07/15/2004	5900 Hwy 225	DEER PARK	HARRIS	006 - Other Substance
Hydraulic fluid	10 GALLONS	07/18/2004	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	002 - Medium ¿24B/1,000G
Asphalt or road oil	40 GALLONS	07/21/2004	— 5619 IH 10 EXIT 582, SAN ANTONIO, TX, 78219 —	SAN ANTONIO	BEXAR	005 - Hazardous Material Minor
		07/25/2004	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	003 - Oil Minor ¡24B/1,000G
Ammonia, anhydrous	1 POUNDS	07/26/2004	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	003 - Oil Minor ¡24B/1,000G
NITROGEN	50 GALLONS	07/28/2004	10 M W OF TX HWY 277 MILE POST 634	CARRIZO SPRINGS	DIMMIT	006 - Other Substance
Alcohol Fire Fighting Foam (AFFF)	25 GALLONS	07/29/2004	1 1/2 miles west of Beaumont on Highway 90	BEAUMONT	JEFFERSON	SARA Title III
Diesel fuel	15 GALLONS	07/29/2004	1 MILE NORTHWEST OF THE INTERSECTION OF INTERSTATE 37 ON STATE HIGHWAY 72	THREE RIVERS	LIVE OAK	003 - Oil Minor ¡24B/1,000G
Sulfuric acid	1368 POUNDS	07/29/2004	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	002 - Medium ¿24B/1,000G
OILY WATER	0	08/07/2004	1 ML N OF GARNER STATE PARK ON HWY 183	LEAKEY	REAL	006 - Other Substance
Coke (petroleum coke)	0	08/08/2004	Approximately 1 mile north of Highway 225 on Miller Cut Off Rd.	DEER PARK	HARRIS	005 - Hazardous Material Minor
Hydraulic fluid	50 GALLONS	08/08/2004	HWY 225 GATE 19	HOUSTON	HARRIS	003 - Oil Minor ¡24B/1,000G

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Table F.3: Spill data from TCEQ for spill incidents occurring in 2004 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Wastewater discharge, industrial	0	08/08/2004	IH 35 & SH 195	GEORGETOWN	WILLIAMSON	003 - Oil Minor ¡24B/1,000G
Naphtha (petroleum), catalytic reformed	8 GALLONS	08/12/2004	4001 E Highway 67, Cleburne, TX	KEENE	JOHNSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	0	08/15/2004	— 5619 IH 10 EXIT 582, SAN ANTONIO, TX, 78219 —	SAN ANTONIO	BEXAR	003 - Oil Minor ¡24B/1,000G
Saltwater	0	08/17/2004	MM 836 on I-H-10 Eastbound between Winnie and Beaumont, Texas.	FANNETT	JEFFERSON	005 - Hazardous Material Minor
Diesel fuel	600 GALLONS	08/19/2004	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	005 - Hazardous Material Minor
Oil and grease	0 GALLONS	08/19/2004	Highway 96 N to Kirbyville, Tx. thru to the last traffic light at the intersection of Hwy. 96 and Hwy. 363.	KIRBYVILLE	JASPER	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid	50 GALLONS	08/21/2004	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	003 - Oil Minor ¡24B/1,000G
Butyl acrylate	85 GALLONS	08/28/2004	Mile Marker 270 & IH 20, Merkel, Taylor County	MERKEL	TAYLOR	unknown
Crude oil light	0	08/30/2004	5900 Hwy 225	DEER PARK	HARRIS	001 - OIL-MAJOR ¡240B/10,000G
Unknown or other oil	0	09/01/2004	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	005 - Hazardous Material Minor
Pyrolysis Gasoline	2757 POUNDS	09/04/2004	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	005 - Hazardous Material Minor
Smoke	0	09/07/2004	HIGHWAY 347	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Other material	20 GALLONS	09/13/2004	2 MI N HWY 83 3 4 MI W	PERRYTON	OCHILTREE	005 - Hazardous Material Minor
Diesel fuel	1400 GALLONS	09/15/2004	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid	35 GALLONS	09/17/2004	Highway 69 south and Old Amoco Road at the LNVA Canal; Beaumont, Tx.	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
NAPHTHALENE	73000 POUNDS	09/17/2004	Highway 66, 8 Blks S of IH 40, Amarillo,	AMARILLO	POTTER	005 - Hazardous Material Minor
Drilling mud (oil/gas related)	1 CUBICYARDS	09/19/2004	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	SARA Title III
		09/21/2004	I.H. 10 Southwest at Smith Road, exit 9 miles Southwest of Beaumont Texas	BEAUMONT	JEFFERSON	004 Hazardous Material Major
GASOLINE, AUTOMOTIVE OR AVIATION	2400 GALLONS	09/22/2004	5500 State Highway 366, Port Neches, TX	GROVES	JEFFERSON	005 - Hazardous Material Minor
UNLEADED GASOLINE	169 GALLONS	09/26/2004	IH 35 N MILE MARKER 12	LAREDO	WEBB	003 - Oil Minor ¡24B/1,000G

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Table F.3: Spill data from TCEQ for spill incidents occurring in 2004 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Sludge	3 POUNDS	09/28/2004	Mile marker 181 IH-10, Jeff Davis County, TX	unavailable	JEFF DAVIS	005 - Hazardous Material Minor
GASOLINE, AUTOMOTIVE OR AVIATION	7500 GALLONS	10/02/2004	3RD ST & HWY 335	AMARILLO	POTTER	005 - Hazardous Material Minor
Sludge	1 POUNDS	10/02/2004	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	SARA Title III
Diesel fuel	150 GALLONS	10/07/2004	At the entrance ramp of I10 westbound at exit 789, between baytown and highlands.	unavailable	HARRIS	003 - Oil Minor ¡24B/1,000G
Diesel fuel	250 GALLONS	10/08/2004	US Highway 59 in Jackson County	GANADO	JACKSON	005 - Hazardous Material Minor
Diesel fuel 2-D	10 GALLONS	10/08/2004	HWY 67 & HARRINGTON	PRESIDIO	PRESIDIO	003 - Oil Minor ¡24B/1,000G
2,5 dihydroperoxy-2,5-dimethylhexane decomposition products	0	10/15/2004	HWY 225 GATE 19	HOUSTON	HARRIS	005 - Hazardous Material Minor
Unknown	0	10/17/2004	Highway 59 3 miles south of Garrison, Texas southbound side	GARRISON	NACOGDOCHES	003 - Oil Minor ¡24B/1,000G
Diesel fuel	71 GALLONS	10/20/2004	1604 & IH 10 INTERSECTION	CONVERSE	BEXAR	003 - Oil Minor ¡24B/1,000G
Wastewater discharge, industrial	0	10/21/2004	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	SARA Title III
Unknown	0	10/26/2004	7350 INTERSTATE HWY 37	CORPUS CHRISTI	NUECES	003 - Oil Minor ¡24B/1,000G
Gasoline	0	10/27/2004	4501 East Hwy 31	CORSICANA	NAVARRO	006 - Other Substance
Gasoline	20 GALLONS	10/27/2004	50 miles NE Hwy.692 from Burkeville, Tx.	unavailable	NEWTON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	300 GALLONS	10/29/2004	HWY 225 GATE 19	HOUSTON	HARRIS	006 - Other Substance
Diesel fuel	0	11/02/2004	Mile Marker 234, Interstate 20, Sweetwater, Nolan County	SWEETWATER	NOLAN	unknown
Mixed Solvents	1000 GALLONS	11/04/2004	3900 IH 35 N, New Braunfels, TX	NEW BRAUNFELS	COMAL	003 - Oil Minor ¡24B/1,000G
Unknown	0	11/05/2004	OFF HWY 190 IN CEDAR POINT SUBDIVISION	ONALASKA	POLK	006 - Other Substance
		11/06/2004	State highway 185 between Seadrift and Port O'Connor	PORT LAVACA	CALHOUN	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	130 GALLONS	11/07/2004	MILE MARKER 350 INTERSTATE 20 BAIRD CALLAHAN COUNTY	BAIRD	CALLAHAN	unknown
Diesel fuel 2-D	100 GALLONS	11/11/2004	— 1269 STATE HWY 78 N, FARMERSVILLE, TX, 75442 —	FARMERSVILLE	COLLIN	003 - Oil Minor ¡24B/1,000G
Sewage	100 GALLONS	11/17/2004	THE INTERSECTION OF US 87 & LOOP 577 AT THE CROSSOVER NEAR VICK	VICK	CONCHO	006 - Other Substance

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Table F.3: Spill data from TCEQ for spill incidents occurring in 2004 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Sewage	100 GALLONS	11/18/2004	I-40 access road between mile marker 110 and 111 at the bridge, at Groom, Texas	GROOM	CARSON	005 - Hazardous Material Minor
Unknown	0	11/20/2004	1/4 mile south of Transmountain Rd. on 1-10 East, El Paso, Tx	unavailable	EL PASO	003 - Oil Minor ¡24B/1,000G
NATURAL GAS	0	11/23/2004	Highway 59 at the Trinity River Bridge; near Sheppard, Texas	SHEPPARD	SAN JACINTO	005 - Hazardous Material Minor
Waste oil	0	11/24/2004	HWY 225 AT BATTLEGROUND ROAD	DEER PARK	HARRIS	SARA Title III
Wood, scrap	0	11/24/2004	I-10 at the trinity river. south side of highway, east side trinity river.	unavailable	CHAMBERS	005 - Hazardous Material Minor
Diesel fuel	100 GALLONS	11/26/2004	Located immedicatedly north of intersectio of Medical Drive and Hwy 77/83 frontage on west side of Harlingen Medical Center.	HARLINGEN	CAMERON	003 - Oil Minor ¡24B/1,000G
Smoke	0	11/27/2004	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
		11/28/2004	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid	10 GALLONS	12/04/2004	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Other material	20 GALLONS	12/08/2004	20000 Hwy 48	BROWNSVILLE	CAMERON	unknown
Unknown	0	12/08/2004	HWY 59 N CORRIGAN TX 75939	CORRIGAN	POLK	003 - Oil Minor ¡24B/1,000G
Paint waste	0	12/09/2004	HIGHWAY 347	BEAUMONT	JEFFERSON	005 - Hazardous Material Minor
Sewage	100 GALLONS	12/14/2004	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	SARA Title III
Diesel fuel	130 GALLONS	12/20/2004	7901 NORTH HIGHWAY 136	AMARILLO	POTTER	004 Hazardous Material Major
Explosive Ordnance (D003)	1 POUNDS	12/21/2004	HWY 73 & 124 INTX; NEAR HAMSHIRE, TX	HAMSHIRE	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Crude oil light	75 BARRELS	12/22/2004	8957 E IH 10, Converse, TX	CONVERSE	BEXAR	005 - Hazardous Material Minor
GASOLINE, AUTOMOTIVE OR AVIATION	20 GALLONS	12/22/2004	HWY 3 and Loop 197 near Texas City.	unavailable	GALVESTON	003 - Oil Minor ¡24B/1,000G
Crude oil light	5880 GALLONS	12/23/2004	IH 35 S OF GEORGETOWN	GEORGETOWN	WILLIAMSON	003 - Oil Minor ¡24B/1,000G

Table F.4: Spill data from TCEQ for spill incidents occurring in 2005.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Creosote		01/03/2005	8618 State Highway 185 N, Port Lavaca, TX	PORT LAVACA	CALHOUN	005 - Hazardous Material Minor
Diesel fuel marine		01/03/2005	Mile Marker 237, IH 20, North of Roscoe	ROSCOE	NOLAN	unknown
Used Oil	8 GALLONS	01/03/2005	Hwy 36 N @ Ave E, Somerville, TX	SOMERVILLE	BURLESON	006 - Other Substance
Unknown or other oil		01/05/2005	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	1500 GALLONS	01/08/2005	State Hwy 361—1.5 miles SE of intersection of SH 361 and SH 35 near the city of Gregory in San Patricio County.	GREGORY	SAN PATRICIO	005 - Hazardous Material Minor
Diesel fuel	65 GALLONS	01/09/2005	occurred at I10 eastbound, exit 776.	unavailable	HARRIS	003 - Oil Minor ¡24B/1,000G
Pyrolysis Gasoline	8000 POUNDS	01/10/2005	4508 E US Hwy 90, approx. 7 miles east of downtown Uvalde.	UVALDE	UVALDE	005 - Hazardous Material Minor
Diesel fuel		01/11/2005	16.2 MILES N OF STERLING CITY ON US HIGHWAY 87, SOUTHBOUND LANE	STERLING CITY	STERLING	005 - Hazardous Material Minor
Other Organics	3 GALLONS	01/11/2005	IH-10 W service road drainage ditch near Burr's BBQ; Vidor, Tx.	VIDOR	ORANGE	003 - Oil Minor ¡24B/1,000G
Other material		01/12/2005	Highway 59; 2-3 miles south of Diboll, Tx.	DIBOLL	ANGELINA	003 - Oil Minor ¡24B/1,000G
Motor oil	650 GALLONS	01/17/2005	FROM THE INTX OF IH 10 AND FM 1406 NEAR WINNIE DRIVE APPROX 3.6 MI W ON IH 10 THEN TURN S ON LEASE RD AND DRIVE APPROX 0.6 MI SITE IS OFF E SIDE OF THE LEASE RD	WINNIE	CHAMBERS	003 - Oil Minor ¡24B/1,000G
Smoke		01/18/2005	I-20 to Eastman Exit, South on Hwy 149, left on Garland Rd and left on Estes Blvd to Eastman Plant entrance.	LONGVIEW	HARRISON	005 - Hazardous Material Minor
Lube oil	37 BARRELS	01/20/2005	JCT HWY 62 & 105; W ON 105 1 MI	ORANGEFIELD	ORANGE	003 - Oil Minor ¡24B/1,000G
Mercaptans		01/21/2005	5900 Hwy 225	DEER PARK	HARRIS	SARA Title III
Crude oil light	9 BARRELS	01/22/2005	Hwy 77, North of Spur 56, between Lyford & Raymondville, Raymondville, TX	unavailable	WILLACY	006 - Other Substance

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Table F.4: Spill data from TCEQ for spill incidents occurring in 2005 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
lauric acid	4 GALLONS	01/25/2005	S ON HWY 285 APPROX 28 MI, GO LEFT ON GREY RANCH RD APPROX 10 MI, PLANT IS ON RIGHT	FT. STOCKTON	PECOS	005 - Hazardous Material Minor
Hydraulic Oil	0 GALLONS	01/26/2005	Location is Mile Marker 191 On Interstate 20, Big Spring Westbound Lane	BIG SPRING	HOWARD	006 - Other Substance
Ferric sulfate	103 GALLONS	01/28/2005	Facility is located west of I-45 and North of the 610 Soutloop	HOUSTON	HARRIS	003 - Oil Minor ¡24B/1,000G
Bleach	300 GALLONS	01/31/2005	Southbound Hihgway 70 at FM 57, Nolan County, Roby	unavailable	NOLAN	003 - Oil Minor ¡24B/1,000G
Diesel fuel	1 GALLONS	02/01/2005	IH-10 W-BOUND @ MM 838; BEAUMONT, TX	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Used Oil		02/03/2005	I-20 to Eastman Exit, South on Hwy 149, left on Garland Rd and left on Estes Blvd to Eastman Plant entrance.	LONGVIEW	HARRISON	005 - Hazardous Material Minor
Crude oil heavy	8 BARRELS	02/05/2005	OFF HWY 190 IN CEDAR POINT SUBDIVISION	ONALASKA	POLK	006 - Other Substance
Diesel fuel	50 GALLONS	02/06/2005	I-20 at mile marker 316 westbound between Baird & Putnam	BAIRD	CALLAHAN	006 - Other Substance
Isohexane	50 GALLONS	02/06/2005	Highway 59 N of Nacogdoches, Tx. near Garrison; approximately 1/4 mi. from Hwy. 59 and CR 631.	GARRISON	NACOGDOCHES	003 - Oil Minor ¡24B/1,000G
Gasoline	20 GALLONS	02/07/2005	From Galveston take I-45 north. Exist State Hwy 3 going Northeast. Exist off Looop 197 going Northeast. Plant is off Loop 197. 1320 LOOP 197 South	TEXAS CITY	GALVESTON	003 - Oil Minor ¡24B/1,000G
Gear Oil	40 GALLONS	02/07/2005		ANGLETON	BRAZORIA	005 - Hazardous Material Minor
OSC (original source of crude oil) oil	1 BARRELS	02/07/2005	Highway 59 N of Lufkin, Tx. at the Angelina River Bridge	LUFKIN	ANGELINA	003 - Oil Minor ¡24B/1,000G
2-(2-Aminoethoxy) Ethanol	100 GALLONS	02/08/2005	From Texarkana take I-30 W (toward Dallas). Take Nash Exit (FM989). Go left (South) over I-30 to Alumax Dr. Take a right onto Alumax Dr. Entrance 0.25 miles on right.	TEXARKANA	BOWIE	006 - Other Substance
Diesel fuel		02/09/2005	5314 IH 37, Corpus Christi, TX	CORPUS CHRISTI	NUECES	005 - Hazardous Material Minor

Continued on next page

Table F.4: Spill data from TCEQ for spill incidents occurring in 2005 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Diesel fuel	1200 GALLONS	02/11/2005	ON THE SW INT OF US HWY 385 AND 16TH STREET	HEREFORD	DEAF SMITH	005 - Hazardous Material Minor
chlorodifluromethane	27000 POUNDS	02/13/2005	I-20 to Eastman Exit, South on Hwy 149, left on Garland Rd and left on Estes Blvd to Eastman Plant entrance.	LONGVIEW	HARRISON	005 - Hazardous Material Minor
JP-8	165 GALLONS	02/13/2005	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Mineral Oil with PCBs	20 GALLONS	02/13/2005	county road 128 west of hwy 35, hastings, texas	unavailable	BRAZORIA	unknown
Waste oil	0 GALLONS	02/15/2005	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	005 - Hazardous Material Minor
Diesel fuel		02/21/2005	HWY 31 S 4 MILES EAST OF MT CALM, HILL COUNTY	MT CALM	HILL	003 - Oil Minor ¡24B/1,000G
TIRES (SCRAP)		02/21/2005	Highway 96 north; 1 mile south of Jasper city limits.	JASPER	JASPER	003 - Oil Minor ¡24B/1,000G
Diesel fuel	50 GALLONS	02/23/2005	— 26205 HWY 59 @ FM 2218, ROSENBERG, TX, 77471 —	unavailable	FORT BEND	003 - Oil Minor ¡24B/1,000G
Diesel fuel	5 GALLONS	02/24/2005	REST AREA NORTH OF HAMILTON ON HWY 36 APPROXIMATELY 3.8 MILES FROM THE HWY 22 AND HWY 36 SPLIT	unavailable	HAMILTON	005 - Hazardous Material Minor
Diesel fuel	25 GALLONS	02/24/2005	From Galveston take I-45 north. Exist State Hwy 3 going Northeast. Exist off Looop 197 going Northeast. Plant is off Loop 197. 1320 LOOP 197 South	TEXAS CITY	GALVESTON	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		02/24/2005	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Mineral oil	400 GALLONS	02/28/2005	Highway 59; 32 miles N. of Nacogdoches, TX., between Timpson and Tenaha	TIMPSON	SHELBY	003 - Oil Minor ¡24B/1,000G
Diesel fuel	30 GALLONS	03/01/2005	mile marker 269 on I-20 near Merkel	MERKEL	TAYLOR	unknown
organophosphorus pesticide		03/01/2005	Interstate Highway 10 westbound feeder road at Walden Rd. Beaumont, Tx.	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Unknown or other oil	230 BARRELS	03/02/2005	N US HIGHWAY 87 DALHART DALLAM COUNTY TEXAS	DALHART	DALLAM	005 - Hazardous Material Minor

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Table F.4: Spill data from TCEQ for spill incidents occurring in 2005 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Unknown or other oil		03/02/2005	INTXN OF FM 1593 & HWY 35 EXTENDING 1.8 MI N ON E SIDE OF FM 1593			
	1.7 MI E ON N SIDE HWY 35	POINT COMFORT	CALHOUN	005 - Hazardous Material Minor		
Dust		03/05/2005	ON US HIGHWAY 82 WEST	TEXARKANA	BOWIE	006 - Other Substance
Hydrocarbons	20 BARRELS	03/07/2005	AT HWY 62/82 & FM 378 IN LORENZO	LORENZO	CROSBY	005 - Hazardous Material Minor
Diesel fuel	130 GALLONS	03/09/2005	I.H. 10 Southwest at Smith Road, exit 9 miles Southwest of Beaumont Texas	BEAUMONT	JEFFERSON	005 - Hazardous Material Minor
Fertilizer Blend (Liquid)	550 GALLONS	03/09/2005	INTERSTATE 35 & SR 22	HILLSBORO	HILL	003 - Oil Minor ¡24B/1,000G
Diesel fuel	150 GALLONS	03/19/2005	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Diesel fuel	200 GALLONS	03/19/2005	9700 Old Highway 48, Brownsville, TX	BROWNSVILLE	CAMERON	006 - Other Substance
Nitrogen Oxides	10 POUNDS	03/19/2005	HWY 21 & FM 2000 TURN ONTO FM 2000N, GO 3.5 MI. TURN LEFT ONTO CR 332 UNTIL IT DEAD ENDS INTO CR 333. TURN RIGHT ONTO CR 333. FACILITY ON RIGHT ABOUT 1/2 MI.	CALDWELL	BURLESON	unknown
Muriatic acid	55 GALLONS	03/21/2005	I-20 @ exit 349, westbound, near Ranger	RANGER	EASTLAND	unknown
Hydrocarbons		03/22/2005	located on FM 2817 approximately 8 miles south of the intersection of Texas Hwy 35 and FM 2917	ALVIN	BRAZORIA	005 - Hazardous Material Minor
2-Ethylhexanol	4156 POUNDS	03/25/2005	US HWY 87	LA VERNIA	WILSON	005 - Hazardous Material Minor
Diesel fuel	100 GALLONS	03/28/2005	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Fuel oil 2	40 GALLONS	03/28/2005	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	SARA Title III
GASOLINE, AUTOMOTIVE OR AVIATION		03/30/2005	approximately 12 miles south of Quanah on Highway 6.	QUANAH	HARDEMAN	006 - Other Substance
Motor oil	40 GALLONS	03/30/2005	MILE MARKER 878 EASTBOUND IH-10 CONSTRUCTION ZONE NEAR VIDOR TX	VIDOR	ORANGE	003 - Oil Minor ¡24B/1,000G

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Table F.4: Spill data from TCEQ for spill incidents occurring in 2005 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Diesel fuel	200 GALLONS	04/01/2005	1400 E HWY 67	ALVARADO	JOHNSON	003 - Oil Minor ¡24B/1,000G
Hydrocarbons		04/01/2005	1 ML N OF GARNER STATE PARK ON HWY 183	LEAKEY	REAL	006 - Other Substance
Dust		04/03/2005	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Waste oil	0 GALLONS	04/04/2005	Approximately 1/2 mile East of downtown Port Neches. 615 Main Street	PORT NECHES	JEFFERSON	SARA Title III
Mineral Oil Dielectric Fluid	250 GALLONS	04/05/2005	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	005 - Hazardous Material Minor
Oil and grease		04/06/2005	Interstate Highway 20, approximately 3.8 km southeast of Odessa, Texas	ODESSA	ECTOR	006 - Other Substance
PETROLEUM FUMES		04/07/2005	SW CORNER OF INTERSECTION OF LOOP 1604 AND HWY 151	SAN ANTONIO	BEXAR	003 - Oil Minor ¡24B/1,000G
GASOLINE, AUTOMOTIVE OR AVIATION	50 GALLONS	04/16/2005	Approximately 1 mile north of Highway 225 on Miller Cut Off Rd.	DEER PARK	HARRIS	SARA Title III
R-22 (Monochlorodifluoromethane)	6 POUNDS	04/19/2005	US 77 N BOUND, NEAR BORDER PATROL IN SARITA, TX	unavailable	KENEDY	003 - Oil Minor ¡24B/1,000G
Gasoline	768 GALLONS	04/20/2005	Take IH 10 west from Beaumont, In Vodor take Hwy 12 to the NW Hwy 12 approx 17 miles to Hwy 87. Take Hwy 87 south, turn left immediately following first overpass and follow the signs	DEWEYVILLE	ORANGE	005 - Hazardous Material Minor
Used Oil	5 GALLONS	04/20/2005	FM 1132 and IH-10 intersection; 200-300 yards W. of 1132 near Vidor, Tx.	VIDOR	ORANGE	003 - Oil Minor ¡24B/1,000G
Diesel fuel	50 GALLONS	04/23/2005	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
UNKNOWN SUBSTANCE		04/23/2005	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	5 GALLONS	04/25/2005	State Highway 7 W. and Loop 500; Center, Tx.	CENTER	SHELBY	003 - Oil Minor ¡24B/1,000G
Other material	250 GALLONS	04/25/2005	alley south of the intersection of Judge Ely Blvd. and Highway 180 E, Abilene	ABILENE	TAYLOR	003 - Oil Minor ¡24B/1,000G
UNLEADED GASOLINE	100 GALLONS	04/27/2005	100 OLD HIGHWAY 90 WEST	BEAUMONT	ORANGE	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		05/02/2005	US Highway 82 W, Texarkana, TX	TEXARKANA	BOWIE	004 Hazardous Material Major

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Table F.4: Spill data from TCEQ for spill incidents occurring in 2005 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Unknown or other oil		05/03/2005	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
		05/06/2005	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	SARA Title III
Sewage		05/08/2005	Rt 259 at the exit for US 59 South; Nacogdoches, Tx.	NACOGDOCHES	NACOGDOCHES	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		05/10/2005	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Sewage		05/11/2005	Facility is located west of I-45 and North of the 610 Sout-loop	HOUSTON	HARRIS	SARA Title III
Unknown		05/12/2005	Off Highway 55, 15 miles northwest of Uvalde	UVALDE	UVALDE	unknown
Diesel fuel	1 GALLONS	05/13/2005	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	SARA Title III
Diesel fuel	40 GALLONS	05/14/2005	US Hwy 87 and CR 2134, 11 miles north of Snyder	SNYDER	SCURRY	006 - Other Substance
Sulfuric acid		05/16/2005	128 IH 20 E, Abilene	ABILENE	TAYLOR	003 - Oil Minor ¡24B/1,000G
Lube oil	4 GALLONS	05/22/2005	— 5595 HWY 1187, FT WORTH, TX, 76140 —	unavailable	JOHNSON	003 - Oil Minor ¡24B/1,000G
Aldehydes		05/23/2005	5424 US Highway 181 N, Floresville	FLORESVILLE	WILSON	003 - Oil Minor ¡24B/1,000G
Sewage		05/25/2005	HWY 259 @ HWY 59 IN NACOGDOCHES	NACOGDOCHES	NACOGDOCHES	003 - Oil Minor ¡24B/1,000G
Sulfuric acid	1 GALLONS	05/28/2005	5500 State Highway 366, Port Neches, TX	GROVES	JEFFERSON	005 - Hazardous Material Minor
Chloroform	2 GALLONS	05/30/2005	From Galveston take I-45 north. Exist State Hwy 3 going Northeast. Exist off Looop 197 going Northeast. Plant is off Loop 197. 1320 LOOP 197 South	TEXAS CITY	GALVESTON	003 - Oil Minor ¡24B/1,000G
Crude oil heavy	40 BARRELS	05/30/2005	5900 Hwy 225	DEER PARK	HARRIS	006 - Other Substance
Propane	150 POUNDS	05/30/2005	Cibolo Creek from just west of IH 35 to IH 10	unavailable	BEXAR	005 - Hazardous Material Minor
Wastewater discharge, municipal		05/30/2005	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	SARA Title III
OILY WATER	5 GALLONS	05/31/2005	I-20 to Eastman Exit, South on Hwy 149, left on Garland Rd and left on Estes Blvd to Eastman Plant entrance.	LONGVIEW	HARRISON	004 Hazardous Material Major
Dredged spoil		06/01/2005	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G

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Table F.4: Spill data from TCEQ for spill incidents occurring in 2005 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Gas Oil	100 BARRELS	06/01/2005	Approximately 5 miles South of Expressway 83 on Mile 1, Mercedes, TX 78570.	MERCEDES	HIDALGO	005 - Hazardous Material Minor
Naptha	5 BARRELS	06/02/2005	I-20 to Eastman Exit, South on Hwy 149, left on Garland Rd and left on Estes Blvd to Eastman Plant entrance.	LONGVIEW	HARRISON	004 Hazardous Material Major
Sand		06/02/2005	From Galveston take I-45 north. Exist State Hwy 3 going Northeast. Exist off Looop 197 going Northeast. Plant is off Loop 197. 1320 LOOP 197 South	TEXAS CITY	GALVESTON	003 - Oil Minor ¡24B/1,000G
		06/04/2005	551 South IH 35 Georgetown Texas	GEORGETOWN	WILLIAMSON	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid		06/06/2005	HWY 59 N-BOUND @ LOOP 287 IN LUFKIN	LUFKIN	ANGELINA	003 - Oil Minor ¡24B/1,000G
Motor oil	20 GALLONS	06/06/2005	Highway 87 between South 1st St and South 2nd St	LAMESA	DAWSON	005 - Hazardous Material Minor
Unknown or other oil		06/10/2005	1 1/2 miles west of Beaumont on Highway 90	BEAUMONT	JEFFERSON	SARA Title III
Slop oil	4 BARRELS	06/13/2005	Highway 70, Bishop, TX	unavailable	NUECES	003 - Oil Minor ¡24B/1,000G
Nitrogen Oxides	101 BARRELS	06/17/2005	HWY 59; 2 MI N OF TENAHA	TENAHA	SHELBY	003 - Oil Minor ¡24B/1,000G
Nitrogen oxide	110 POUNDS	06/19/2005	Northeast intersection of Hwy 146 and Port Rd	SEABROOK	HARRIS	005 - Hazardous Material Minor
Other Organics	50 GALLONS	06/21/2005	"6241 OLD HWY AND 135N KILGORE LIBERTY CITY 75662"	KILGORE	GREGG	006 - Other Substance
Lube oil	0 GALLONS	06/23/2005	SMITH BLUFF ROAD AT HWY 347	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	25 GALLONS	06/24/2005	9500 Interstate 10 E, Baytown, TX	BAYTOWN	HARRIS	006 - Other Substance
Hydraulic Oil		06/28/2005	1700 NORTH HIGHWAY 360	GRAND PRAIRIE	TARRANT	unknown
Motor oil	3 GALLONS	07/05/2005	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Sun 6, i.e. pipeline cable oil	300 GALLONS	07/06/2005	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	006 - Other Substance
Unknown or other oil		07/10/2005	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		07/25/2005	On Americas, southbound, just south of I-10	unavailable	EL PASO	006 - Other Substance

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Table F.4: Spill data from TCEQ for spill incidents occurring in 2005 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Saccharin and salts	340 GALLONS	07/27/2005	— 1145 IH 30, MESQUITE, TX, 75150 —	unavailable	DALLAS	003 - Oil Minor ¡24B/1,000G
Diesel fuel	200 GALLONS	07/28/2005	located at MM 286 on I-20 in Abilene	ABILENE	TAYLOR	003 - Oil Minor ¡24B/1,000G
Nitrogen oxide	10 POUNDS	07/28/2005	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	SARA Title III
Diesel fuel marine		07/29/2005	1 ML N OF GARNER STATE PARK ON HWY 183	LEAKEY	REAL	006 - Other Substance
Wastewater discharge, industrial	600 POUNDS	07/31/2005	Facility lies north of Nederland and south of Beaumont on the east side of Hwy 347	BEAUMONT	JEFFERSON	005 - Hazardous Material Minor
Hydraulic Oil	0 BARRELS	08/01/2005	Hwy.59 near MM452, 3/10mile N. of FM223, southbound side in construction area; Shepherd, Tx.	SHEPHERD	SAN JACINTO	003 - Oil Minor ¡24B/1,000G
Hydraulic fluid	40 GALLONS	08/02/2005	MM 354 IH-35 SOUTHBOUND LN NEAR WEST, TX	WEST	MCLENNAN	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		08/02/2005	Highway 190 westbound at the Louisiana Pacific plant entrance near Jasper, Tx.	JASPER	JASPER	005 - Hazardous Material Minor
Unknown or other oil		08/03/2005	SMITH BLUFF ROAD AT HWY 347	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	100 GALLONS	08/08/2005	HWY 80	MIDLAND	MIDLAND	005 - Hazardous Material Minor
Gas Oil		08/09/2005	near mile marker 270 on I-20, near Merkel	MERKEL	TAYLOR	003 - Oil Minor ¡24B/1,000G
Mineral Oil with PCBs	8 GALLONS	08/10/2005	22 MILES EAST ON HWY 59 FROM LOOP 20	LAREDO	WEBB	003 - Oil Minor ¡24B/1,000G
Municipal Solid Waste		08/10/2005	Facility is locatd aprox 3 miles north of city of Plainview. I-27 North			
	FM 3183.	PLAINVIEW	HALE	006 - Other Substance		
Diesel fuel	20 GALLONS	08/15/2005	Hwy.124 to Hwy 73 turn left on Hwy.73 go mile			
	half south	WINNIE	JEFFERSON	003 - Oil Minor ¡24B/1,000G		
Unknown		08/16/2005	mile marker 264 on I-20, west bound lane, near Abilene	ABILENE	TAYLOR	006 - Other Substance
Unknown or other oil		08/17/2005	AT THE INTERSECTION OF WAUGH DRIVE AND ALLEN PARKWAY. IN BUFFALO BAYOU.	unavailable	HARRIS	005 - Hazardous Material Minor

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Table F.4: Spill data from TCEQ for spill incidents occurring in 2005 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Wastewater discharge, municipal	200 GALLONS	08/21/2005	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	SARA Title III
Wastewater discharge, municipal	200 GALLONS	08/21/2005	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	SARA Title III
DIESEL/GASOLINE/WATER MIXTURE	80 GALLONS	09/08/2005	Highway 365 5 miles south of US 90 in Nome, Tx.	NOME	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Vacuum Gas Oil	15 GALLONS	09/11/2005	10619 S US Highway 281, San Antonio, TX	SAN ANTONIO	BEXAR	005 - Hazardous Material Minor
Anhydrous ammonia	100 POUNDS	09/12/2005	IH 10 EASTBOUND AT COW BAYOU; ORANGE, TEXAS	unavailable	ORANGE	003 - Oil Minor ¡24B/1,000G
Aviation regulated liquid,n.o.s.	3000 POUNDS	09/19/2005	240 HWY 173 N, HONDO, TX 78861	HONDO	MEDINA	006 - Other Substance
Hydraulic fluid	26 GALLONS	09/20/2005	Six (6) miles south of Girvin on State Hwy 67 (Windward Windmills)	unavailable	PECOS	003 - Oil Minor ¡24B/1,000G
Slop oil	40 GALLONS	09/26/2005	3 Miles N of Intersection of FM 509/US Hwy 281 (Military Hwy), Los Indios, TX	unavailable	CAMERON	005 - Hazardous Material Minor
Diesel fuel 2-D	20 GALLONS	10/06/2005	INTXN OF FM 1593 & HWY 35 EXTENDING 1.8 MI N ON E SIDE OF FM 1593 & 1.7 MI E ON N SIDE HWY 35	POINT COMFORT	CALHOUN	005 - Hazardous Material Minor
Diesel fuel	40 GALLONS	10/09/2005	located on FM 2817 approximately 8 miles south of the intersection of Texas Hwy 35 and FM 2917	ALVIN	BRAZORIA	004 Hazardous Material Major
Diesel fuel	150 GALLONS	10/09/2005	6275 Highway 347, Beaumont, TX	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	50 GALLONS	10/10/2005		NATALIA	MEDINA	003 - Oil Minor ¡24B/1,000G
UNKNOWN SUBSTANCE		10/21/2005	10.3 MILES E OF LOOP 20 AND HWY 359 ON HWY 359	unavailable	WEBB	006 - Other Substance
Chloroform	13 POUNDS	11/06/2005	Northeast intersection of Hwy 146 and Port Rd	SEABROOK	HARRIS	005 - Hazardous Material Minor
Other material	2310 POUNDS	11/07/2005	2 MILES SOUTH OF FAIRFIELD ON IH45, FREESTONE COUNTY	FAIRFIELD	FREESTONE	unknown
Transformer Mineral Oil (Non-PCB)	240 GALLONS	11/07/2005		KERRVILLE	KERR	003 - Oil Minor ¡24B/1,000G
Used Oil		11/07/2005	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Jet Fuel	250 GALLONS	11/09/2005	Northeast intersection of Hwy 146 and Port Rd	SEABROOK	HARRIS	005 - Hazardous Material Minor

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Table F.4: Spill data from TCEQ for spill incidents occurring in 2005 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Aqueous film forming foam (AFFF)		11/14/2005	— 17599 N INTERSTATE 35, SAN ANTONIO, TX, 78154 —	unavailable	GUADALUPE	005 - Hazardous Material Minor
Crude oil light	50 BARRELS	11/14/2005	18th Street and Lubbock/Highway 87	LAMESA	DAWSON	003 - Oil Minor ¡24B/1,000G
Styrene	1 GALLONS	11/15/2005	Highway 35 & FM 524, Old Ocean, TX	SWEENY	BRAZORIA	004 Hazardous Material Major
JET FUEL JP-4	75 GALLONS	11/16/2005	Area off shoulder of I-10 East and Lee Trevino on ramp	unavailable	EL PASO	003 - Oil Minor ¡24B/1,000G
Nitrogen oxide	8 PPERHOUR	11/16/2005	Spill–I-20 at mile marker 262 near Trent	TRENT	TAYLOR	003 - Oil Minor ¡24B/1,000G
Diesel fuel	30 GALLONS	11/18/2005	1 MILE NORTH OF CITY LIMITS ON NORTH HIGHWAY 214	DENVER CITY	YOAKUM	006 - Other Substance
Diesel fuel	75 GALLONS	11/20/2005	Spill–10 miles north of Quanah on Hwy 287	unavailable	HARDEMAN	unknown
Herbicide: Pre-M3.3 EC Turf Herbicide	60 GALLONS	11/21/2005	ABOUT 0.4 MILES N OF INTERSECTION HWY 67 AND HWY 137	BIG LAKE	REAGAN	005 - Hazardous Material Minor
Tank Bottoms	778 BARRELS	11/25/2005	LOCATED APPROXIMATELY 5000 FEET NORTHEAST OF THE INTERSECTION OF US HIGHWAY 96 AND FARM TO MARKET ROAD 147 IN SAN AUGUSTINE COUNTY, TEXAS	SAN AUGUSTINE	SAN AUGUSTINE	006 - Other Substance
Lead		11/30/2005	HWY 90 W	SABINAL	UVALDE	003 - Oil Minor ¡24B/1,000G
Butadiene	875 POUNDS	12/02/2005	20000 Hwy 48	BROWNSVILLE	CAMERON	002 - Medium ¿24B/1,000G
Gear Oil	188 GALLONS	12/02/2005	Highway 69 south and exit 3514; Beaumont, Tx.	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Crude Oil	20 BARRELS	12/03/2005	5900 Hwy 225	DEER PARK	HARRIS	004 Hazardous Material Major
DIESEL, GASOLINE, WATER MIXTURE	300 GALLONS	12/05/2005	5900 Hwy 225	DEER PARK	HARRIS	005 - Hazardous Material Minor
Lead		12/06/2005	I-20 to Eastman Exit, South on Hwy 149, left on Garland Rd and left on Estes Blvd to Eastman Plant entrance.	LONGVIEW	HARRISON	006 - Other Substance
Methyl Propyl Ketone	175 POUNDS	12/06/2005	Farm to Market Road 307 and East Interstate 20, North Service road	MIDLAND	MIDLAND	003 - Oil Minor ¡24B/1,000G
Diesel fuel	40 GALLONS	12/08/2005	Intersection of Refinery Rd. and IH 20 East	BIG SPRING	HOWARD	002 - Medium ¿24B/1,000G

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Table F.4: Spill data from TCEQ for spill incidents occurring in 2005 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Gasoline	9000 GALLONS	12/09/2005	I-20 to Eastman Exit, South on Hwy 149, left on Garland Rd and left on Estes Blvd to Eastman Plant entrance.	LONGVIEW	HARRISON	006 - Other Substance
Mineral spirits	400 GALLONS	12/09/2005	I-20 to Eastman Exit, South on Hwy 149, left on Garland Rd and left on Estes Blvd to Eastman Plant entrance.	LONGVIEW	HARRISON	006 - Other Substance
Container, Unknown Contents		12/10/2005	Highway 35 & FM 524, Old Ocean, TX	SWEENY	BRAZORIA	004 Hazardous Material Major
Diesel fuel	100 GALLONS	12/12/2005	10 MI W OF KINGSVILLE 4 MI S OF HWY 141	KINGSVILLE	KLEBERG	005 - Hazardous Material Minor
		12/16/2005	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Light Cycle Oil		12/18/2005	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	30 GALLONS	12/19/2005	rest area park located south of Falfurrias, Texas off Highway 281	unavailable	BROOKS	003 - Oil Minor ¡24B/1,000G
Diesel fuel	35 GALLONS	12/21/2005	IH 45 ON 500 HWY 75	HUNTSVILLE	WALKER	003 - Oil Minor ¡24B/1,000G
Diesel fuel	400 GALLONS	12/22/2005	5900 Hwy 225	DEER PARK	HARRIS	002 - Medium ¿24B/1,000G
Formaldehyde	20 GALLONS	12/22/2005	1604 & IH 10 INTERSECTION	CONVERSE	BEXAR	003 - Oil Minor ¡24B/1,000G
Mineral oil		12/23/2005	10 miles north of Snyder on US Highway 84 close to FM 612	SNYDER	SCURRY	unknown
Sewage		12/27/2005	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Benzene	10 POUNDS	12/28/2005	24541 SOUTH EAST HWY 359	BRUNI	WEBB	005 - Hazardous Material Minor
Diesel fuel	50 GALLONS	12/28/2005	Northeast intersection of Hwy 146 and Port Rd	SEABROOK	HARRIS	005 - Hazardous Material Minor
Sewage	300 GALLONS	12/28/2005	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	005 - Hazardous Material Minor
Xylene (mixed isomers)	30 GALLONS	12/28/2005	1305 S Highway 287, Decatur	DECATUR	WISE	006 - Other Substance

Table F.5: Spill data from TCEQ for spill incidents occurring in 2006.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Diesel fuel	150 GALLONS	01/02/2006	Approximately a 10 acre tract between Campbellton Rd. & IH37, San Antonio.	SAN ANTONIO	BEXAR	003 - Oil Minor ¡24B/1,000G
Other material		01/09/2006	ON INTERSECTION OF HIGHWAY 35 & FM 524	OLD OCEAN	BRAZORIA	001 - OIL-MAJOR ¡240B/10,000G
Methanol	10 GALLONS	01/10/2006	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	005 - Hazardous Material Minor
Sewage	500 GALLONS	01/10/2006	8618 State Highway 185 N, Port Lavaca, TX	PORT LAVACA	CALHOUN	002 - Medium ¿24B/1,000G
Hydraulic fluid	41 GALLONS	01/12/2006	1604 & IH 10 INTERSECTION	CONVERSE	BEXAR	unknown
Hydraulic fluid	50 GALLONS	01/17/2006	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Industrial waste	10000 POUNDS	01/17/2006	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	005 - Hazardous Material Minor
Hydraulic Oil	7 BARRELS	01/18/2006	550 W HWY 6 ALVIN TX 77511	ALVIN	BRAZORIA	001 - OIL-MAJOR ¡240B/10,000G
Ethylene (gaseous)	1600 PPERHOUR	01/22/2006	6275 Highway 347, Beaumont, TX	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	40 GALLONS	01/23/2006	10404 IH 10 E, Baytown, TX	BAYTOWN	CHAMBERS	001 - OIL-MAJOR ¡240B/10,000G
Diesel fuel	100 GALLONS	01/26/2006	6.3 M S OF HWY 16 AND HWY 1283 INTERSECTION ON HWY 1283	unavailable	BANDERA	006 - Other Substance
Diesel fuel	120 GALLONS	01/29/2006	IH-10 westbound between FM 1132 and FM 1135 near Vidor, Tx.	VIDOR	ORANGE	003 - Oil Minor ¡24B/1,000G
VOC - Oxygenated		01/29/2006	Highway 63 west of Jasper, Tx.	JASPER	JASPER	003 - Oil Minor ¡24B/1,000G
Diesel fuel	35 GALLONS	02/02/2006	1 1/2 miles west of Beaumont on Highway 90	BEAUMONT	JEFFERSON	SARA Title III
Unknown corrosive Liquid (DOO1)		02/02/2006	N. of Highway 12 on Highway 87, just north of Nichols Creek; near Salem, Tx.	SALEM	NEWTON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	35 GALLONS	02/03/2006	US 287 Service Rd at TX 101, Sunset	SUNSET	MONTAGUE	006 - Other Substance
Diesel fuel	100 GALLONS	02/04/2006	8535 HWY 242 C	SPRING	MONTGOMERY	004 Hazardous Material Major
Crude Oil		02/06/2006	Facility lies north of Nederland and south of Beaumont on the east side of Hwy 347	BEAUMONT	JEFFERSON	005 - Hazardous Material Minor
Lube oil		02/06/2006	MILE MARKER 139 3/4 AT STOUTS CREEK, I-30 EAST IN HOPKINS CO	SALTILLO	HOPKINS	006 - Other Substance
Aluminum chloride		02/07/2006	IH-10 EAST AT EXIT 19	unavailable	EL PASO	003 - Oil Minor ¡24B/1,000G
Diesel fuel	75 GALLONS	02/07/2006	Gate 99, Intersection of Hwy 73 and Hwy 366	PORT ARTHUR	JEFFERSON	006 - Other Substance
Diesel fuel	75 GALLONS	02/08/2006	US 283 near Rockwood	ROCKWOOD	COLEMAN	003 - Oil Minor ¡24B/1,000G

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Table F.5: Spill data from TCEQ for spill incidents occurring in 2006 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Distillates (petroleum), alkylate	0 GALLONS	02/08/2006	INTERSECTION IH 27 & 4TH ST	LUBBOCK	LUBBOCK	006 - Other Substance
GASOLINE, AUTOMOTIVE OR AVIATION	25 GALLONS	02/08/2006	IH-10 WESTBOUND VIDOR TX	VIDOR	ORANGE	003 - Oil Minor ¡24B/1,000G
Diesel fuel		02/09/2006	Highway 62 exit near the Flying J Truck Stop; in Orange, Tx.	ORANGE	ORANGE	003 - Oil Minor ¡24B/1,000G
UNKNOWN SUBSTANCE		02/10/2006	10658 Highway 90 W, Beaumont, TX	BEAUMONT	JEFFERSON	006 - Other Substance
Nitrogen Oxides	11 POUNDS	02/11/2006	I.H. 10 Southwest at Smith Road, exit 9 miles Southwest of Beaumont Texas	BEAUMONT	JEFFERSON	SARA Title III
Sodium hydroxide		02/16/2006	IH 35 HWY 85 EXIT 84	DILLEY	FRIO	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		02/16/2006	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	SARA Title III
GASOLINE, AUTOMOTIVE OR AVIATION	35 GALLONS	02/18/2006	LOCATED BETWEEN STATE HWY 185 AND THE VICTORIA BARGE CANAL, SOUTH OF THE INTERSECTION OF STATE HWYS 185 AND 35, APPROX 6.0 MILES NORTHWEST OF THE CITY OF SEADRIFT, CALHOUN COUNTY, TEXAS	PORT LAVACA	CALHOUN	003 - Oil Minor ¡24B/1,000G
Diesel fuel	200 GALLONS	02/20/2006	"23412 HWY 242 - W1 & W2 KEY MAP 223W"	unavailable	MONTGOMERY	003 - Oil Minor ¡24B/1,000G
Resin		02/20/2006	The facility is located South of the City of Point Comfort Texas and Southwest of the intersection of State Hwy 35 and FM 1593, West of FM 1593 and East of Lavaca Bay.	POINT COMFORT	CALHOUN	004 Hazardous Material Major
Diesel fuel	100 GALLONS	02/21/2006	IH 35 SOUTHBOUND AT MILE MARKER 27	LAREDO	WEBB	003 - Oil Minor ¡24B/1,000G
Oil and grease		02/27/2006	IH-35 N MILE MARKER 370 NORTH OF HILLSBORO	HILLSBORO	HILL	006 - Other Substance
Lube oil	5 BARRELS	03/01/2006	Highway 87 under the Rainbow Bridge, at the turnaround on the Port Arthur, Texas side.	PORT ARTHUR	JEFFERSON	006 - Other Substance

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Table F.5: Spill data from TCEQ for spill incidents occurring in 2006 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Used Oil	50 GALLONS	03/01/2006	2.7 MILES SOUTH OF LANELY ON HIGHWAY 489, OFF WEST SIDE OF HIGHWAY OR FROM DEW, GO EAST ON HIGHWAY 489 APPROXIMATELY 6 MILES TO HIGHWAY 1848 SOUTH, DRIVE APPROXIMATELY 3 MILES, THE PLANT WILL BE ON THE RIGHT	LANELY	FREESTONE	006 - Other Substance
Nitrogen oxide	11 POUNDS	03/02/2006	Intersection Highway 105 and Keith Road; Beaumont, Tx.	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Used Oil	30 GALLONS	03/06/2006	HIGHWAY 171 NEAR MALONE	MALONE	HILL	005 - Hazardous Material Minor
Other material		03/10/2006	INTX SH79 & SH251	OLNEY	YOUNG	003 - Oil Minor ¡24B/1,000G
Benzene		03/20/2006	Hwy 103 E, Lufkin, TX	LUFKIN	ANGELINA	006 - Other Substance
DIESEL OIL #2/GUAR GUM	65 GALLONS	03/23/2006	"2759 Battleground Rd, Ste C, Deer Park, TX IHW- 2759 BATTLEGROUND RD, DEER PARK, TX, 77536"	DEER PARK	HARRIS	003 - Oil Minor ¡24B/1,000G
Oil and grease	20 GALLONS	03/23/2006	Eastbound I-10 at Mile Marker 317, Fort Stockton	FORT STOCKTON	PECOS	003 - Oil Minor ¡24B/1,000G
Trichloroethylene	600 GALLONS	03/27/2006	2.1 miles east of intersection Hwy.105 & SH 720 northside of 105 near Batson, Tx.	BATSON	HARDIN	003 - Oil Minor ¡24B/1,000G
Phosphoric acid		03/28/2006	10658 Highway 90 W, Beaumont, TX	BEAUMONT	JEFFERSON	005 - Hazardous Material Minor
Mercaptans		04/03/2006	1100 SAN DIEGO HIGHWAY IN ALICE TEXAS	ALICE	JIM WELLS	005 - Hazardous Material Minor
Nonane		04/05/2006	Facility lies north of Nederland and south of Beaumont on the east side of Hwy 347	BEAUMONT	JEFFERSON	005 - Hazardous Material Minor
ODORS		04/07/2006	10658 Highway 90 W, Beaumont, TX	BEAUMONT	JEFFERSON	005 - Hazardous Material Minor
Unknown or other oil		04/18/2006	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	SARA Title III
CARBON BLACK	190 GALLONS	04/20/2006	State Highway 105; Evadale, Tx.	EVADALE	JASPER	003 - Oil Minor ¡24B/1,000G
Other		04/20/2006	3 MILES W OF PAMPA ON US HIGHWAY 60 GRAY COUNTY TEXAS	PAMPA	GRAY	005 - Hazardous Material Minor
Gasoline	35 GALLONS	04/21/2006	HWY 225 AT BATTLEGROUND ROAD	DEER PARK	HARRIS	003 - Oil Minor ¡24B/1,000G
Crude Oil	7 BARRELS	04/30/2006	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Naphtha	1 GALLONS	04/30/2006	10319 HIGHWAY 146	MONT BELVIEU	CHAMBERS	003 - Oil Minor ¡24B/1,000G

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Table F.5: Spill data from TCEQ for spill incidents occurring in 2006 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Oil and grease		05/01/2006	5900 Hwy 225	DEER PARK	HARRIS	003 - Oil Minor ¡24B/1,000G
Oil and grease	75 GALLONS	05/03/2006	0.25 MILE NORHT OF HWY 380 ON HWY 101	BRIDGEPORT	WISE	005 - Hazardous Material Minor
Diesel fuel	25 GALLONS	05/04/2006	State Hwy 361 - 1.5 miles SE of intersection of SH 361 and SH 35 near the city of Gregory in San Patricio County.	GREGORY	SAN PATRICIO	004 Hazardous Material Major
Sodium hydroxide	22600 POUNDS	05/04/2006	6240 S HIGHWAY 77 RIVIERA TX 78379 3596	unavailable	KLEBERG	003 - Oil Minor ¡24B/1,000G
Diesel fuel marine	10 GALLONS	05/05/2006	northeast of the intersection of hwy 75 and Interstate 635 in Dallas	DALLAS	DALLAS	006 - Other Substance
Mineral oil		05/05/2006	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	SARA Title III
Wastewater discharge, municipal	250000 GALLONS	05/06/2006	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	SARA Title III
Diesel fuel	75 GALLONS	05/07/2006	Highway 73 to Labelle Rd. go approx. 5 miles N. to dirt road and right through black metal gate to pump station.	LABELLE	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel 2-D	15 GALLONS	05/07/2006	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Diesel fuel	60 GALLONS	05/10/2006	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Used Oil	220 GALLONS	05/11/2006	Interstate 10 westbound, Exit 876 access road; Orange, Tx.	ORANGE	ORANGE	006 - Other Substance
Waste oil		05/11/2006	1604 & IH 10 INTERSECTION	CONVERSE	BEXAR	003 - Oil Minor ¡24B/1,000G
OIL	300 GALLONS	05/16/2006	SMITH BLUFF ROAD AT HWY 347	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Oil and grease	20 GALLONS	05/17/2006	IH-10, just east of the Neches River bridge; near Vidor, Tx.	VIDOR	ORANGE	003 - Oil Minor ¡24B/1,000G
Diesel fuel	30 GALLONS	05/20/2006	6240 S HIGHWAY 77 RIVIERA TX 78379 3596	unavailable	KLEBERG	003 - Oil Minor ¡24B/1,000G
Phenol	50 GALLONS	05/25/2006	3301 S Highway 157, Euless, TX	EULESS	TARRANT	003 - Oil Minor ¡24B/1,000G
DIESEL OIL #2/GUAR GUM	100 GALLONS	05/30/2006	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	25 GALLONS	06/03/2006	Hwy 87 and 1200 16th St, Orange, TX	ORANGE	ORANGE	003 - Oil Minor ¡24B/1,000G
Diesel fuel		06/04/2006	HWY 347	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Hydraulic Oil		06/04/2006	ON HWY 359 E AT SOUTH TEXAS OIL & GAS INDUSTRIAL PARK	LAREDO	WEBB	003 - Oil Minor ¡24B/1,000G
UNKNOWN SUBSTANCE	100 GALLONS	06/05/2006	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor

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Table F.5: Spill data from TCEQ for spill incidents occurring in 2006 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Diesel fuel	20 GALLONS	06/07/2006	5900 Hwy 225	DEER PARK	HARRIS	005 - Hazardous Material Minor
DIESEL OIL #2/GUAR GUM	20 GALLONS	06/07/2006	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Waste oil		06/09/2006	1 Gulf States Hwy, Beaumont, TX	unavailable	JEFFERSON	006 - Other Substance
DIESEL/GASOLINE/WATER MIXTURE	75 GALLONS	06/12/2006	US Hwy 287, 1 mile east of Childress	CHILDRESS	HARDEMAN	003 - Oil Minor ¡24B/1,000G
Diesel fuel	150 GALLONS	06/14/2006	Hwy 87 and 1200 16th St, Orange, TX	ORANGE	ORANGE	003 - Oil Minor ¡24B/1,000G
Latex paint	40 GALLONS	06/15/2006	20600 HIGHWAY 290	CYPRESS	HARRIS	003 - Oil Minor ¡24B/1,000G
Other Organics		06/15/2006	6275 Highway 347, Beaumont, TX	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Phenol	350 GALLONS	06/15/2006	Jade Road at Highway 73; Port Arthur, Tx.	unavailable	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Mineral oil	316 GALLONS	06/18/2006	Hwy 87 and 1200 16th St, Orange, TX	ORANGE	ORANGE	SARA Title III
Sulfuric acid	100 GALLONS	06/20/2006	Facility lies north of Nederland and south of Beaumont on the east side of Hwy 347	BEAUMONT	JEFFERSON	005 - Hazardous Material Minor
Nitrogen oxide	10 POUNDS	06/21/2006	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Slop oil	6 BARRELS	06/22/2006	Interstate Highway 10 curve westbound at MLK exit; Beaumont, Tx.	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diethyl amine (DEA)	209 POUNDS	06/29/2006	4.5 MILES EAST OF BASTROP ON STATE HIGHWAY 21. 256 Power Plant Rd	BASTROP	BASTROP	006 - Other Substance
Other		06/30/2006	State Hwy 361 - 1.5 miles SE of intersection of SH 361 and SH 35 near the city of Gregory in San Patricio County.	GREGORY	SAN PATRICIO	005 - Hazardous Material Minor
DIESEL OIL #2/GUAR GUM	40 GALLONS	07/02/2006	I-40 access road between mile marker 110 and 111 at the bridge, at Groom, Texas	GROOM	CARSON	003 - Oil Minor ¡24B/1,000G
Crude Oil	2 BARRELS	07/03/2006	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Hydrogen cyanide	10 POUNDS	07/03/2006	Highway 96 north of Lumberton, Tx. southbound lane.	LUMBERTON	HARDIN	003 - Oil Minor ¡24B/1,000G
Mineral Oil with PCBs	300 GALLONS	07/03/2006	BRAZOS RIVER AT STATE HWY 79, MILAM COUNTY	unavailable	MILAM	003 - Oil Minor ¡24B/1,000G
Diesel fuel	90 GALLONS	07/05/2006	HWY 69	KOUNTZE	HARDIN	003 - Oil Minor ¡24B/1,000G
		07/06/2006	7350 INTERSTATE HWY 37	CORPUS CHRISTI	NUECES	003 - Oil Minor ¡24B/1,000G
Diesel fuel	70 GALLONS	07/13/2006	HWY 87 2.5 MI E OF SABINE PASS	SABINE PASS	JEFFERSON	003 - Oil Minor ¡24B/1,000G
		07/15/2006	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	SARA Title III

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Table F.5: Spill data from TCEQ for spill incidents occurring in 2006 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Diesel fuel	50 GALLONS	07/16/2006	6275 Highway 347, Beaumont, TX	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Paint waste		07/19/2006	ON INTERSECTION OF HIGHWAY 35 & FM 524	OLD OCEAN	BRAZORIA	003 - Oil Minor ¡24B/1,000G
Water (H2O)	6300 GALLONS	07/24/2006	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	SARA Title III
Saltwater	20 GALLONS	07/25/2006	0.5 miles from intersection of Hwy 347 and Hwy 366 on Hwy 366	NEDERLAND	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		07/25/2006	HWY 225 AT BATTLEGROUND ROAD	DEER PARK	HARRIS	005 - Hazardous Material Minor
Diesel fuel	70 GALLONS	08/13/2006	APPROX. 0.25 MILE NORTH OF INTERSECTION OF HWY 21 & OLD LOCKHART RD IN CALDWELL COUNTY	BUDA	CALDWELL	005 - Hazardous Material Minor
Milk	6250 GALLONS	08/14/2006	IH-10, just east of the Neches River bridge; near Vidor, Tx.	VIDOR	ORANGE	006 - Other Substance
Hydraulic fluid	8 GALLONS	08/15/2006	Interstate Highway 10 Exit 849 near Walden Rd.; Beaumont, Tx.	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Water (H2O)		08/16/2006	5900 Hwy 225	DEER PARK	HARRIS	004 Hazardous Material Major
Other material	50 GALLONS	08/18/2006	240 HWY 173 N, HONDO, TX 78861	HONDO	MEDINA	006 - Other Substance
Diesel fuel	50 GALLONS	08/20/2006	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	SARA Title III
Benzene	30 POUNDS	08/21/2006	Intersection of Refinery Rd. and IH 20 East	BIG SPRING	HOWARD	003 - Oil Minor ¡24B/1,000G
Unknown or other oil	54 BARRELS	08/21/2006	LOCATED APPROX. 5500 FT. NORTH OF THE CENTER OF THE CITY OF TROY AND LYING BETWEEN IH 35 AND MKT RAILROAD	TROY	BELL	006 - Other Substance
Diesel fuel	484 GALLONS	08/30/2006	Highway 59; 2-3 miles south of Diboll, Tx.	DIBOLL	ANGELINA	003 - Oil Minor ¡24B/1,000G
Crude Oil	500 GALLONS	09/02/2006	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
OILY SUBSTANCE		09/03/2006	I 20 & CHERRY LANE CLYDE, TX 79510 (705 S Access Rd)	CLYDE	CALLAHAN	003 - Oil Minor ¡24B/1,000G
Other		09/03/2006	5 miles Southeast of Colorado City off Hwy 163	COLORADO CITY	MITCHELL	003 - Oil Minor ¡24B/1,000G
Diesel fuel	80 GALLONS	09/06/2006	5500 State Highway 366, Port Neches, TX	GROVES	JEFFERSON	005 - Hazardous Material Minor
Other material	210 GALLONS	09/09/2006	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Sulfuric acid	0 GALLONS	09/10/2006	I 20 & EXIT 370, NORTHWEST CORNER OF IH 20 W AND HWY 919	GORDON	PALO PINTO	003 - Oil Minor ¡24B/1,000G

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Table F.5: Spill data from TCEQ for spill incidents occurring in 2006 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Morpholine		09/13/2006	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
Sulfuric acid	117 GALLONS	09/14/2006	7901 NORTH HIGHWAY 136	AMARILLO	POTTER	005 - Hazardous Material Minor
Nitrogen oxide	181 POUNDS	09/15/2006	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	50 GALLONS	09/18/2006	24 miles South of Lubbock on Highway 87	TAHOKA	LYNN	006 - Other Substance
Diesel fuel	65 GALLONS	09/20/2006	HWY 190 ABOUT 1 MILE WEST OF POINT BLANK	POINT BLANK	SAN JACINTO	004 Hazardous Material Major
Motor oil	5 GALLONS	09/20/2006	1604 & IH 10 INTERSECTION	CONVERSE	BEXAR	003 - Oil Minor ¡24B/1,000G
Diesel fuel	65 GALLONS	09/21/2006	FROM LIVINGSTON, TX. ON HWY. 190 TO HWY 980 TURN RT. GO N. 2-3 MILES TO SUBDIVISION:OUTLAW RIDGE MAIN ENTRANCE TURN LEFT ON MAIN DRIVE TOWARDS BACK END OF SUBDIVISION TO MOTALLO THEN TO BISHOP, TURN LEFT ON JONES RD. LOT 16 ON LEFT SIDE EDGE OF CREEK.	POINT BLANK	SAN JACINTO	003 - Oil Minor ¡24B/1,000G
UNKNOWN SUBSTANCE	6 GALLONS	09/21/2006	770 W IH 35 MCARTHUR, IRVING, TX, 75240	unavailable	DALLAS	003 - Oil Minor ¡24B/1,000G
Used Oil	30 GALLONS	09/22/2006	US 69 on northbound side, passed Fannett Rd.; .5 miles north, Beaumont, Tx.	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Oil and grease		09/25/2006	50 miles NE Hwy.692 from Burkeville, Tx.	unavailable	NEWTON	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		09/25/2006	IH 45 SOUTH AT 60 MILE MARKER	unavailable	HARRIS	003 - Oil Minor ¡24B/1,000G
Diesel fuel	25 GALLONS	09/26/2006	ABOUT 8 MI S OF SONORA ON HWY 277	SONORA	SUTTON	003 - Oil Minor ¡24B/1,000G
Lube oil	250 GALLONS	09/29/2006	Hwy 87 and 1200 16th St, Orange, TX	ORANGE	ORANGE	003 - Oil Minor ¡24B/1,000G
Used Oil	42 GALLONS	10/03/2006	12300 West Interstate 20 East, Mile Marker 125, Midland	MIDLAND	MIDLAND	unknown
2,4,-D Esters	130 GALLONS	10/07/2006	I-20 AND MCCART	FORT WORTH	TARRANT	005 - Hazardous Material Minor
Diesel fuel	120 GALLONS	10/10/2006	6001 Highway 366, Port Neches, TX	PORT NECHES	JEFFERSON	005 - Hazardous Material Minor
DIESEL/GASOLINE/WATER MIXTURE	75 GALLONS	10/16/2006	9010 IH 10 E	CONVERSE	BEXAR	003 - Oil Minor ¡24B/1,000G

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Table F.5: Spill data from TCEQ for spill incidents occurring in 2006 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Naptha	20 GALLONS	10/16/2006	Interstate Highway 10 westbound near MM 870 and Cole Creek; Orange, Tx.	ORANGE	ORANGE	003 - Oil Minor ¡24B/1,000G
Waste oil		10/17/2006	WEST OF PORT ARTHUR TEXAS ON STATE HWY 87 TOWARD SABINE PASS	PORT ARTHUR	JEFFERSON	SARA Title III
Hydraulic fluid	40 GALLONS	10/20/2006	LOCATED 1 MILE NW OF THE JUNCTION OF HWY 619 AND HWY 696	unavailable	BASTROP	003 - Oil Minor ¡24B/1,000G
		10/20/2006	IH-10 W OF EXIT 843 AT DRAINAGE CULVERT NEAR BEAUMONT	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Diesel fuel	30 GALLONS	10/21/2006	1604 & IH 10 INTERSECTION	CONVERSE	BEXAR	unknown
Diesel fuel	90 GALLONS	10/23/2006	ON STATE HWY. SPUR 119 N.; 1 MI. N. OF THE PRAIRIE ST. INTRSCTN.	BORGER	HUTCHINSON	005 - Hazardous Material Minor
DIESEL/GASOLINE/WATER MIXTURE	15 GALLONS	10/24/2006	6275 Highway 347, Beaumont, TX	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Unknown or other oil		10/26/2006	26995 Highway 281 N, San Antonio	SAN ANTONIO	BEXAR	006 - Other Substance
Transformer Mineral Oil (Non-PCB)	15 GALLONS	10/27/2006	From Galveston take I-45 north. Exist State Hwy 3 going Northeast. Exist off Looop 197 going Northeast. Plant is off Loop 197. 1320 LOOP 197 South	TEXAS CITY	GALVESTON	005 - Hazardous Material Minor
Other Organics	250 POUNDS	11/06/2006	5625 Old Hwy 90, Orange, TX	unavailable	ORANGE	003 - Oil Minor ¡24B/1,000G
Hydraulic Oil	20 GALLONS	11/07/2006	12091 HWY 105 EAST	CONROE	MONTGOMERY	003 - Oil Minor ¡24B/1,000G
Jet Fuel	80 GALLONS	11/10/2006	ON INTERSECTION OF HIGHWAY 35 & FM 524	OLD OCEAN	BRAZORIA	006 - Other Substance
Mineral oil	1 GALLONS	11/27/2006	Intersection of Refinery Rd. and IH 20 East	BIG SPRING	HOWARD	003 - Oil Minor ¡24B/1,000G
Crude Oil	200 BARRELS	11/29/2006	US 59 SOUTHBOUND INTERSECTION OF I-69 LUFKIN TX	LUFKIN	ANGELINA	003 - Oil Minor ¡24B/1,000G
Diesel fuel	90 GALLONS	12/08/2006	Interstate Highway 10 westbound at MM 845; Beaumont, Tx.	BEAUMONT	JEFFERSON	003 - Oil Minor ¡24B/1,000G
Crude Oil	30 BARRELS	12/11/2006	Intersection of Hwy 366 and 32 street	GROVES	JEFFERSON	004 Hazardous Material Major
Other	900 GALLONS	12/11/2006	FM 1685 0.75 MILE E OF INTERSECTION OF FM 1686 AND STATE HIGHWAY 404	VICTORIA	VICTORIA	006 - Other Substance
OIL	1 GALLONS	12/13/2006	STATE HIGHWAY 77 SOUTHBOUND BETWEEN LINE M ROAD AND FM 732 IN SAN BENITO	unavailable	CAMERON	003 - Oil Minor ¡24B/1,000G

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Table F.5: Spill data from TCEQ for spill incidents occurring in 2006 — Continued.

Material	Volume	Date	Physical Location	City	County	Hazardous Class
Gasoline	4 GALLONS	12/15/2006	US HIGHWAY 281 AND E. FREDDIE GONZALEZ DR.	unavailable	HIDALGO	unknown

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