General Spill Plan

Grand River Gathering LLC
K28E Compressor Station

OA Project No. 012-0732

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Grand River Gathering, LLC

Spill Plan

For Midstream Operations and Construction

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1.0 INTRODUCTION

The purpose of this document is to provide to construction, drilling, completion and production operations personnel for Grand River Gathering, LLC (GRG) the following information as it relates to spill incidents:

- Reporting requirements;
- Initial spill response procedures;
- How to access emergency response procedures; and
- Initial remediation techniques.

This document is intended to provide operations personnel with sufficient information so they can readily assess a spill, know which government agency to report to, what to report, and how to address the spill. This document only covers spills that are "manageable" with the tools and resources that operations personnel have readily available to them. The document does not cover unmanageable or catastrophic spills that require specialized expertise and equipment.

Regardless of the size or type of spill, if difficulties or uncertainties arise, contact GRG's Rifle, Colorado Office staff for advice and assistance. Please refer to the contact information provided in Section 2.1.

This Project Specific Spill Response Plan covers spills associated with construction, drilling, completion and production operations and services associated with them.

A copy of this Project Specific Spill Response Plan is on file at the following locations:

Grand River Gathering, LLC
2128 Railroad Avenue, Suite 106
Rifle, CO 81650

2.0 SPILL PREVENTION

Care should be taken to prevent spills, leaks and releases. Two variables must be considered if a release occurs:

Rate of flow: Is variable, depending on size and location of the related failure. Maximum expected potential rate of flow is not anticipated to exceed the amount of total liquid per day transferred using the pipeline. Personnel routinely perform visual inspections of piping to detect any failures.

Total quantity of fluid that could be discharged: Is variable, depending on the rate of flow though the pipeline and the location of the failure. The maximum potential release would not exceed the volume for the pipeline and tank of the fluid being transferred.

GRG has engineering controls and management practices in place to prevent spills. Secondary containment is provided for oil spills at permanent facilities. For temporary surface pipelines GRG has designed the pipeline with block valves which isolate sections of the pipeline to limit a release should one occur. Storage tanks are designed with isolation valves to ensure containment.

GRG's standard operating procedures require that any fluid transfer though temporary surface pipelines will be manned 24-hour a day until the transfer has been completed. If a spill is discovered then the following actions and reporting will be initiated immediately.

3.0 SPILL REPORTING PROCEDURES

Spill reporting is an important part of environmental management. There can be fines and penalties imposed upon a company for not reporting a spill if it is considered a "reportable" occurrence under the legislation. This plan outlines when a spill is reportable, and to whom the spill must be reported. In addition to reporting to regulators, GRG's personnel must be informed, and an incident/accident report completed and submitted to GRG's Rifle, Colorado Office.

3.1 INTERNAL NOTIFICATION

Field personnel are to notify the GRG's Rifle, Colorado office staff immediately upon locating a spill, release, or an unnatural event. The GRG's Rifle, Colorado office staff will notify the required local, federal and state agencies.

Grand River Gathering, LLC Corporate Office		720.876.5000
Grand River Gathering, LLC Parachute Office		970.285.2600
Brant Gimmeson, Group Lead, EHS Midstream Services	Office:	720.876.5030
	Mobile:	303.819.7323
	Home:	303.680.1568
Danny Knutson, EHS Field Coordinator	Office:	970.285.2709
	Mobile:	970.309.7510
Brad Ankrum, Piceance Midstream Operations Manager	Office:	970.285.2630
	Mobile:	435.260.1673
Rocky Erb, Field Operations Coordinator	Office:	970.285.2639
	Mobile:	970.210.8571
Floyd Alvey, Field Operations Coordinator	Office:	970.285.2679
	Mobile:	970.319.0357
Tom Ripper, Field Operations Coordinator	Mobile:	970.210.9424
RJ Taylor, Emergency Response Contractor (Backhoe, Dirt Work)	Mobile:	435.823.1947
Trinity, Emergency Response Contractor (Vacuum Truck)	Mobile:	970.985.0510

4.0 EXTERNAL SPILL REPORTING REQUIREMENTS

External spill reporting requirements are state and federal requirements as they relate to "reportable" spills.

4.1 WHAT IS A REPORTABLE SPILL?

4.1.1 OIL, CONDENSATE, AND PRODUCED WATER

In Colorado, spills are under the jurisdiction of the State of Colorado Oil and Gas Conservation Commission. Reportable spills are defined as:

- **ANY** spill or release that *may* impact waters of the State. These spills are reportable as soon as practicable.

- Any spills in excess of 20 barrels (840 US gallons) are reportable within 24 hours.

- Any spills in excess of five barrels (210 US gallons) are reportable within ten days.

In addition, the following types of spills are reportable.

Spills that may cause an adverse effect to the environment. An adverse effect is defined as *"impairment of or damage to the environment, human health, or safety or property."* Specifically, it is considered the following:

- Spill is confirmed to have moved off-location (including vertical migration to water table);
- Contaminants are present off-location at levels generally accepted to be problematic to soil, groundwater, livestock, and vegetation. This includes third party impact such as vegetation damage, and livestock impact;
- Release is into surface water or a watercourse and moves off location;
- Release or spill has potential for offsite odor complaints; and
- Potential for toxic or flammable release to air going offsite.

For assistance in determining if a release can be classified as an "adverse effect" or "potentially hazardous to the environment", contact GRG's Rifle, Colorado Office Staff (See contact information provided in Section 2.1).

4.1.2. CHEMICAL AND REFINED HYDROCARBON SPILL

Spills of production chemicals, fuels, lubricating oils as well as other refined hydrocarbons require reporting. Reporting of **ANY AMOUNT** of chemicals identified as toxic substances is required. Most of these compounds are associated with the downstream refining end of the petroleum industry, and are therefore not dealt with in detail in this report.

4.1.2.1 Release into Water

A release of **ANY AMOUNT** of a chemical into surface water, a watercourse or groundwater that can cause an adverse effect on the environment must be immediately reported. Typically this means water found external to a containment berm. The regulations require reporting of any amount that can cause an adverse effect. This effectively means any chemical, fuel or lubricant used in construction; drilling, completion and production operations that are spilled into surface water must be reported. The regulatory authority then decides if any further action is required.

4.1.2.2 Releases onto the Ground

A release of chemical or fuels onto the ground below the State of Colorado thresholds may still be reportable. Contact the GRG's Rifle, Colorado Office staff for specific chemical releases.

4.1.3 CUMULATIVE RELEASES

Cumulative releases involve the slow release of material over a sufficiently long time that the volumes eventually become significant and represent a potential risk to the environment. Cumulative releases that typically occur at our operations are associated with load outs, tank farms, pits, etc. and are relatively confined, therefore not causing a "significant environmental effect". Although the reporting of cumulative releases is required if they are causing a significant environmental effect, it should only be done in consultation with GRG's Rifle, Colorado Office staff.

4.2 WHO IS TO REPORT?

When an operator, maintenance person or other employee discovers a reportable spill, the area supervisor of GRG's Rifle, Colorado Office staff must be notified immediately. The area supervisor must immediately contact GRG's Rifle, Colorado Office staff, who will contact the appropriate government agency to report the spill (see Table 1 below). GRG's employees and contractors are not to contact regulators unless directed to do so by their manager.

4.3 WHEN TO REPORT AND WHAT TO REPORT?

A release should be reported to the appropriate government agency as soon as it is discovered or at the first available opportunity. The requirement for reporting is both verbal and written depending on the severity of the spill. Government authorities will advise if a written report is required at the time the verbal report is provided. Reporting personnel should make a point of inquiring about the need for a written report. The Table on page 10 outlines the specific information to be provided verbally and in written reports for spills of oil, condensate and produced water, as well as spills of chemicals and refined hydrocarbons. Verbal reports are provided as soon as possible, written reports are provided according to the schedule required by the government agency.

The proposed well sites are located in Garfield County, Colorado. In the Garfield County region, the Local Emergency Planning Commission (LEPC) is the County Sheriff's Office (Table 1).

When notified of a spill, they may contact state and federal agencies, but be sure to confirm this, because procedures change regularly. Written reports will be compiled and submitted by GRG.

TABLE 1: GOVERNMENT AGENCY EMERGENCY CONTACT LIST

FEDERAL AGENCIES	
National Response Center: http://www.nrc.uscg.mil/index.html	800-424-8802 **(24 Hour)**
EPA Region VIII: http://www.epa.gov/region8/	303-312-6312 303-293-1788 **(Spill Line)** 800-227-8914 **(24 Hour)**
BLM Glenwood Springs Energy Office http://www.blm.gov/co/st/en/fo/gsfo.html	970-947-2800
BLM Grand Junction Field Office http://www.blm.gov/co/st/en/fo/gjfo.html	970-244-3000
BLM: White River Field Office http://www.co.blm.gov/wrra/index.htm	970-878-3800
STATE AGENCIES	
CO Oil & Gas Conservation Commission: http://oil-gas.state.co.us/	303-894-2100 1-888-235-1101 **(Spill Line)**
Colorado Department of Public Health and Environment (CDPHE): http://www.cdphe.state.co.us/	1-877-518-5608 **(24 Hour)**
Colorado Division of Oil & Public Safety: http://oil.cdle.state.co.us/	303-318-8547
Glenwood Springs Division of Wildlife	970-947-2920
Grand Junction Division of Wildlife	970-255-6100
COUNTY AGENCIES	
Garfield County LEPC Jim Sears, Emergency Ops Commander (Sheriff's Office) Glenwood Springs, CO 81601	970-945-0453 (**24 Hour**)

5.0 INFORMATION TO REPORT

5.1 INITIAL VERBAL REPORT

Verbal reports must be provided immediately, or as soon as practicable. Reports should include:

Oil, Condensate and Produced Water

- The location and time of the release;
- The type and quantity of the material released;
- The details of any action taken so far, and the actions proposed to be taken at the site;
- A general description of the location of the release and of the immediate surrounding area;

Chemicals and Refined Hydrocarbons

- Date and time of the release, or the time period over which the release occurred if known;
- The location of the release;
- The duration, frequency and rate of release if known;
- The type of chemical released and amount released, if known;
- A discussion of spill containment and recovery procedures used;
- A discussion of steps to be taken to prevent similar spills;
- The status of the remediation program (remediated, under active remediation or to be remediated);
- The remediation plan and schedule of implementation if required; and
- Information regarding landowner notification.

5.2 FOLLOW-UP WRITTEN REPORTS

Written reports will be provided according to the schedule required by government agency. Colorado requires the completion of Form 19.

Oil, Condensate and Produced Water

- Date and time of the release, or the time period over which the release occurred if known;
- The location of the release;
- The duration, frequency and rate of release if known;
- The type of material released (produced water, etc.) including concentration of key components and amount released if known;
- A discussion of spill containment and recovery procedures used;
- A discussion of steps to be taken to prevent similar spills;
- The status of the remediation program (remediated, under active remediation or to be remediated);
- The remediation plan and schedule of implementation if required; and information regarding landowner notification

Chemical and Refined Hydrocarbons

- A description of the circumstances leading up to the release;
- A discussion of spill containment and recovery procedures used;
- A discussion of steps to be taken to prevent similar future spills; and an outline of the proposed spill site reclamation program

5.3 VERBAL REPORTING PROCEDURES

The following contacts must be made in the event of a reportable spill or other emergency. Refer to Table 1 for current phone numbers.

Garfield County Sheriff's Department (County LEPC)

The Dispatch operator will assess the need for service and will dispatch emergency Police, Ambulance, Fire and/or Hazardous Material Response as required.

Construction, drilling, completion and production operations personnel will contact the Garfield County Sheriff's Department in the early stages of operation to advise them of the start of operation and to provide instructions to reach the operations site. The directions will be kept on file by the Dispatch operator and utilized if required.

In the event of a spill the Garfield Sheriff's department is also the County LEPC. The LEPC Coordinator will access the situation and activate the County Hazmat response team as required. The Coordinator will also act as first contact advisor to initial clean-up efforts. The Coordinator may also contact additional regulatory agencies as required, but be sure to ask them and document the response.

National Response Center (NRC)

The NRC **must** be notified in the event of a produced water spill that *could* reach waters of the US. The NRC will notify the US Coast Guard. They will contact the region in which the spill occurs and a regional coordinator may be dispatched to the site depending on severity of the spill. Both GRG's supervisor and the Garfield County LEPC Coordinator must contact the NRC.

Environmental Protection Agency (EPA)

The NRC should notify the EPA regarding a spill. However, contact the EPA Region 8 Spill Line (Table 1) just to be sure.

Colorado Oil & Gas Conservation Commission

This division **must** be contacted in the event of any spill (regardless of size). This is the state emergency response commission. A representative will be sent to the site if required.

Bureau of Land Management (BLM):

Initial contact with BLM should be to the Glenwood Springs Energy Office, Grand Junction Field Office & White River field Office (Table 1). They will then activate the BLM spill response plan.

Grand River Gathering, LLC

The GRG Rifle, Colorado Office staff will activate GRG's spill response personnel if required and dispatch an environmental/spill specialist to site if the spill severity requires it. The Division Manager will dispatch the Area Production Supervisor to the site to manage spill containment and clean up operations if needed. The Area Production Supervisor will communicate with the Garfield County Sheriff's Department, the appropriate surface use agency (Bureau of Land Management, Colorado Division of Wildlife) to facilitate and manage the overall clean-up operation and ensure to that all government requirements are fulfilled.

Grand River Gathering, LLC - Rifle, Colorado Office:

The GRG Rifle, Colorado Office staff will provide spill clean up guidance and will prepare detailed spill reports for the regulatory agencies. Environmental spill specialists will coordinate with the Garfield County LEPC Coordinator to ensure that all government regulations and requirements are met. Environmental spill specialists will work with and advise the onsite Production Supervisor regarding remediation measures required. Spill specialists will coordinate all post clean up sampling activity and reporting.

6.0 GENERAL SPILL RESPONSE PLAN

6.1 INITIAL COMMUNICATION AND ACTION PROCEDURES

Internal spill reporting procedures require completion of an GRG's incident/accident report as well as a spill assessment form. Information contained on this form assists operators in providing verbal reports to government authorities. The spill assessment form also helps to characterize the spill sufficiently that appropriate response procedures can be initiated. The assessment form covers spills from all facilities associated with the upstream oil and gas sector including pipelines; however the form will be completed for reportable spills only. The form is to be completed by operators at the time the spill is discovered. It is maintained with the operator's files with a copy forwarded to GRG. The assessment form is not submitted to any government agencies. A copy of the assessment form is contained on the following page.

It is important to document all phases of a spill. If an assessment form is not available, document all information (date, time of actions, phone numbers called, contact names, etc.) on available paper and transfer it to a proper form at a later date.

The most critical aspects of spill response are accurately locating the spill, isolating or shutting in the source of the spill, if possible, and containing and recovering surface fluids. All of these activities must be undertaken with due consideration for the safety of the operator, clean-up crews and the general public. Reporting of the spill should take place once initial activities to contain and recover the spill are underway. Reports should be submitted to the appropriate government agencies, as well as to GRG. The spill assessment form as well as an incident accident report form must be completed and retained in company files.

SPILL ASSESSMENT FORM
FOR NOTIFICATION PURPOSES

1. Date _____

2. Date _____ & Time of discovery or occurrence _____ am. pm.

3. Person who discovered spill _____

4. Telephone number of person who discovered spill. _____

5. Location of spill (detailed) ___1/4 ___1/4 ____ Sec. T _____ R ____

   _____ County _____ State

6. Type of material spilled: ___ Oil ___ Saltwater ___ Oil & Saltwater

   ___ Toxic Fluid, ___ Other (Specify) _____

7. Source of spill (Check one):

   ___ Pipeline Failure ___ Tank Overflow

   ___ Treater Upset ___ Tank Rupture

   ___ Other ___ Unknown

8. Quantity of material spilled ___ bbls. ___ Unknown

9. Is the spill source stopped? ___ Yes ___ No. If not, what remaining maximum quantity could be spilled? ____ Bbls.

10. Present weather conditions._____

11. Forecasted weather conditions: 24 hrs. _____ 48 hrs. _____ 72 hrs. _____

12. Actions underway to stop/control the spill.

_____
_____
_____
_____
_____
_____

6.2 SUPERVISOR'S RESPONSIBILITIES

GRG's Rifle, Colorado Office Staff can provide advice and assistance with respect to operator responsibilities as required. Operator is responsible for the following items:

- Assessing the location and source of the spill and determining if the spill can be contained;
- Assessing the hazards associated with responding to a spill;
- Determining the extent/impact of the spill;
- Contacting and dispatching clean-up crews;
- Controlling access to the spill site;
- Coordinating the containment and recovery of surface fluids;
- Notifying company and regulatory agencies;
- Completion of spill assessment form, and incident/accident report form;
- Ensuring topsoil is salvaged and segregated; and
- Scheduling clean-up and repairs.

6.3 "FIRST RESPONSE" COMPANIES

First response companies will provide assistance with initial containment and recovery of product. Operators should be aware of local "first response" companies that they can call on to assist in initial containment of the spill. Operators should ensure that a listing of First Response companies is compiled and appended to this document. This list should also be posted in common areas at batteries and other facility sites. Operators should ensure that this list is periodically updated so that only those companies that are current appear on the list.

Willow Creek Companies
Russell Fowles
P. O. Box 55174
Grand Junction, CO 81505
970-256-7003 – Office
970-778-5554 - Cell
Backhoe/Dirt Work/Emergency Response

Rockies Construction
970-319-3167 – Bill Hoke (Parachute)
970-769-5035 – Duane Higgins
505-334-1976 – New Mexico Office
Vacuum Truck

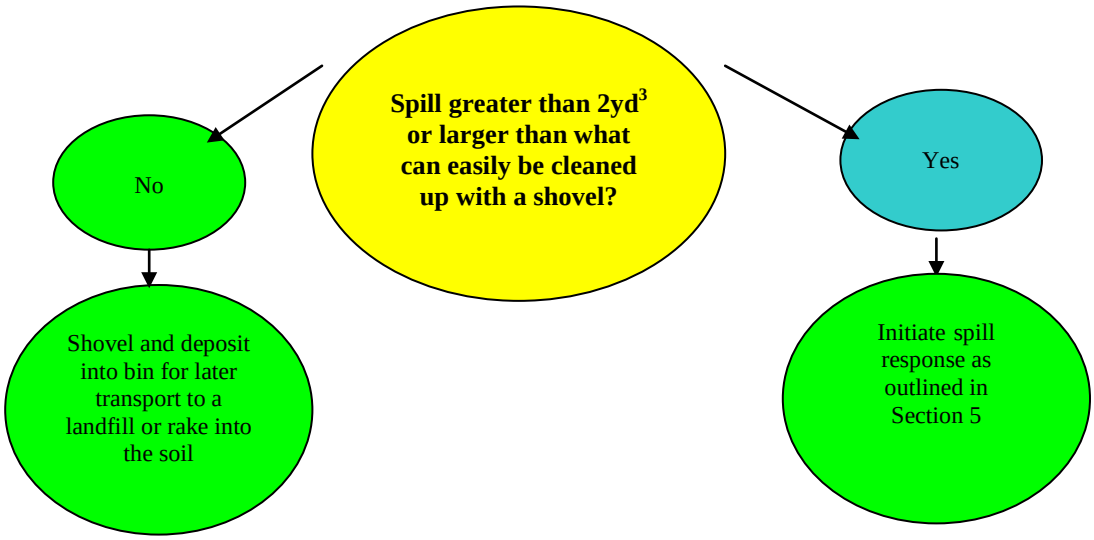
Badger Daylighting
970-309-7342 – Kent Powel (Rifle)
1-877-3BADGER – USA Office
Vacuum Truck

7.0 SPILL MANAGEMENT

7.1 SMALL VERSUS LARGE SPILLS

Many spills occur that are typically very small and located within the pad area. For smaller spills, the technique for spill clean-up is basically shoveling the material into a drum, labeling the drum, and disposing of it along with other oil field waste materials as per routine disposal methods to a landfill. Generally, Class I landfills accept this type of waste, however if the material is contained within drums, Class II landfills may also accept them. Other methods of manual recovery include using cans, buckets or rakes to pick-up contaminated soils on the surface. The important point to consider when remediating small spills is to ensure that **ALL** of the affected soils have been removed or otherwise dealt with and all actions to clean-up, repair the problem, and prevent further occurrence are well-documented. This is most easily accomplished if the spill is dealt with immediately, thereby not allowing the spill to soak into the ground.

The following illustrates the decision matrix for spill clean-up.



7.2 REMEDIATION FOR LARGE SPILLS

The information contained within this section is meant to provide guidance on initial containment, recovery and treatment measures to be applied to spills, which are "manageable" with the equipment and expertise available to the majority of GRG's operations supervisors. This section is not meant for larger, uncontrolled spills that will require specialized equipment and expertise.

Spills will require initial containment and treatment so as to minimize spill clean up and site restoration work, and the potential for environmental and public health risks. This section provides information on initial treatment to stabilize the spill and prevent the worst effects from settling in before the site can be sampled and more specific treatments applied. Contact GRG's Rifle, Colorado Office staff for any additional advice or assistance that may be required. See contact information provided in Section 2.1.

7.2.1 SPILL CONTAINMENT

Containment measures may be broadly categorized into two groups: land based and water based. The options for containment make use of a wide range of locally available materials such as straw, chicken wire, and snow fencing as well as commercial sorbents and booms.

7.2.1.1 Land Containment Methods

It is important to note that land spills are generally much easier to deal with than spills that have reached a waterway. Efforts should be made to prevent or stop spilled product from entering the water.

Land containment of spills can be achieved by using minor earthworks such as trenches and earth dams or dykes. In the winter, snow can be used for a similar purpose. Snow is also a suitable sorbent material for spills other than salt spills. Salt will melt the snow and result in further spread of salt contamination.

Trenches

Trenches can be used to intercept and hold all types of fluids; however trench construction is practical only in the summer. Figures 6.1 and 6.2 (Appendix A) provide details of an interceptor trench and methods of using trenches to intercept overland and subsurface flow.

Trench construction should include the use of a plastic liner. This prevents downward migration into subsurface soils and potentially groundwater. Relatively shallow trenches may be strategically placed down slope of a spill to intercept surface and subsurface spilled materials. This method is effective in preventing subsurface contamination of water and eventual discharge to streams and other water bodies. Equipment required to build a trench includes:

- Backhoe, loader, bulldozer;
- Shovels, picks; and
- Plastic liners.

Dams and Dykes

Earth and snow dams may be constructed across ditches or low areas to contain a spill and stop its flow. The entire flow of the spilled material and any surface drainage may be contained. Construction materials include earth, wood, sandbags, and snow. The dam or dyke should be lined with plastic sheeting to make it impermeable to the spilled product. In the winter, water may be sprayed on the snow dams or dykes to create ice. Dams should be of sufficient size to contain the entire spill volume; insufficient capacity may result in overtopping and/or failure.

7.2.1.2 Containment on Waterways

Water containment measures generally include the use of booms or barriers. However, dams and weirs may also be used for ditches with flowing water and for smaller streams. Figure 6.3 illustrates the use of dams and weirs. These methods are typically used where it is necessary to allow the water to flow, while retaining lighter than water liquids such as petroleum products that separate readily from water.

Water bypass or underflow dams may also be constructed on small, slow-flowing streams. Water bypass involves first constructing an earthen dyke to stop the flow of water, and then inserting a pipe below the level of the spilled material and discharging the water on the other side of the dyke. (Figure 6.4). It is important to note that the discharge end of the pipe should not be inclined above the level of the dyke or overtopping and failure will result.

Weirs made from plywood, lumber and sheet metal may also be used in ditches with flowing water and may be placed to completely or partially block culvert openings. These barriers may be suspended from stakes on either side of the culvert openings and raised or lowered to maintain the desired water level while retaining the oil.

Recovery of material collected behind dams and weirs may be made with the use of sorbents, skimmers or by direct suction.

Other water containment measures include the use of booms or barriers. These methods are typically limited to the containment and recovery of materials that will readily separate from and float on water. The type and size of a boom will depend on the specific location and the conditions within which the boom will be used. The general principles for using a boom are:

- To contain a spill of floating liquid or debris;
- To deflect or divert material to a defined area so that it may be recovered; and
- To protect sensitive areas from contamination.

There are many common items that can be used as improvised booms. These include:

- Railroad ties;
- Telephone or power poles;
- Trees;
- Lumber;
- Inflated fire hose;
- Styrofoam;
- Chicken wire or fishing net and sorbent materials (rolled into a sausage shape).

It is important that buoyant material be used within the boom; otherwise it will become water logged and sink after several hours. Rope or wire can be used to hold the boom sections in place. Natural sorbents include straw and evergreen boughs. Commercial sorbents have greater capacity to absorb oil and other petroleum products; they last longer, and can be reused. Foam sections have good sorbent capacity and excellent buoyancy. Figures 6.5 and 6.6 illustrate methods of connecting booms together and construction of a "jellyroll" or "sausage roll" using improvised sorbent barriers.

Proper boom deployment is a critical consideration. The angle of the boom relative to the flow direction must be related to water flow velocity in order to achieve effective containment (Figure 6.7). Several booms arranged in parallel may be necessary to contain the entire product. These should be spaced to allow for particles, which may escape the first boom, float to the surface, and be contained by the next boom. In addition, the use of several booms permits the removal of a boom for cleaning. Figures 6.7 to 6.9 illustrate boom deployment methods. The chart at the bottom of Figure 6.7 illustrates the proper angle to deploy the boom based on water velocity. The higher the stream velocity, the more perpendicular the boom will be with respect to the crossing. In the example shown in the illustration, proper bloom deployment is at an angle of 24° for a stream flow velocity of 175 feet/minute.

Fixed barriers can be used in streams with soft beds where stakes can be driven. A snow fence barrier may be installed to span the width of a stream less than 1 m deep and may be anchored at both ends with steel or wooden stakes. Stakes are driven into the stream bottom at 3 to 6 foot intervals. Straw bales or commercial sorbents are placed on the upstream side. The barrier should be angled against the current for collection of product along the shore. Multiple snow fence barriers can be used to provide backup against potential losses from upstream barriers. Net or chicken wire barriers can be constructed for the same purpose. Figure 6.10 illustrates a typical snow fence barrier.

7.2.2 RECOVERY

Recovery efforts must be undertaken as soon as it is practical and safe to do so. Focus on rapid recovery of spilled materials is required to reduce and/or eliminate any potential dangers or hazards to the environment. Recovery methods generally include suction, mechanical removal and use of sorbent materials.

Suction

Direct suction includes the use of vacuum trucks or portable pumps. Large capacity wet service shop vacs may also be used if there is an available power source nearby. Suction screens may be required to prevent hose plugging by floating debris and to prevent pump damage. Care should be taken to reduce the uptake of water in order to minimize the amount of material, which requires disposal, and prevent mixing of oil and water.

Manual and Mechanical Recovery

Manual and mechanical recovery, discussed previously, is an effective option for the removal of small spills. Manual recovery using hand tools (shovels, buckets, rakes, cans) is also effective in removing spills from areas that are inaccessible to larger equipment. Though labor intensive and time consuming, manual recovery is often the only method of recovery available and in some cases is the preferred method as it causes the least amount of damage to an area.

Mechanical recovery using heavy equipment is an option typically reserved for larger spills. Details with respect to the use of heavy equipment are provided in local area emergency response plans.

Use of Sorbent Material

Sorbents are materials that soak up oil or other product. They are commonly used for final clean up and recovery of small amounts of product or to remove product in places that are inaccessible by other means of recovery. They are effective in recovering thin as well as thick layers of product; however large volumes of sorbent material may be required for thick deposits.

7.2.3 INITIAL TREATMENT

Initial treatments are designed to prevent the worst effects of a spill from "settling in" before the site can be sampled and more specific treatments completed. The purpose of initial treatment is to "buy time" to allow for more extensive sampling and analytical programs to be completed and to optimize treatment programs. Initial treatments are especially important on salt spills, as these initial remediation measures will greatly assist in deterring or slowing the soil "salinization" process. These treatments should proceed within 24 to 48 hours of the spill, before the spill dries out or receives much rain. If there has been considerable rain resulting in soft soils, chemicals may have to be hand broadcast or sprayed from offsite to prevent vehicles from rutting the soil.

7.2.3.1 Soils Handling

Soil handling must be minimized to the extent possible during wet soil conditions. Typically if there is a potential to create ruts that are greater than 3 inches deep, equipment should be kept off the soils and the spill should be accessed on foot and manually dealt with as explained in Section 7.2.2. However, under an emergency situation this may not always be feasible and it may be necessary to strip the topsoil ahead of the machinery when accessing the site to prevent compaction and destruction of the soil structure. In particular, soils must be handled carefully during excavations. The following measures should be taken when excavating soils:

- Strip the topsoil away from the area where you intend to excavate. Stockpile the topsoil away from the area where you plan to stockpile the spoil materials to avoid mixing the two together. When it is time to fill the hole, fill it first with the spoil materials, leaving a low "roach" or mound to account for settling. Respread the topsoil evenly on top of the mound being sure to completely cover the excavated area. It is particularly important during winter excavations to not replace the topsoil until the spoil pile has settled; and

- If the topsoil was contaminated during the spill, treat the topsoil according to the specifications listed below for brine and hydrocarbon spills.

7.2.3.2 Brine Spills

For the purposes of this document, brine is defined as:

- Water with over 10 000 mg/l (ppm) of total dissolved solids (TDS); **OR**
- Emulsions containing over 20% brine (emulsions with less than 20% brine can be treated as a hydrocarbon spill since the oil component will be sufficiently high that it is treatable as such); **OR**
- Previous spills have caused "bare spots" on the ground where vegetation either does not grow, grows slowly, or is characterized by plants that appear different from the surrounding area.

Information on the composition and general chemistry of fluids characterizing the field areas may be obtained from fluid sample analysis reports (CORE labs etc.), and should be reviewed by operators to determine the potential for a spill to result in impacts to soils or vegetation and the need to initiate immediate response.

Initial treatment for brine spills typically involves the addition of a calcium product to be applied and incorporated into the soil within the first 24 to 48 hours of clean up prior to flushing with fresh water. Operators should be aware of product suppliers in their areas, and have a listing posted or readily available at facilities. Accepted treatment chemicals include gypsum (calcium sulphate) and various formulations of calcium nitrate (liquid or granular fertilizer 15.5-0-0; Saline Soil Saver (SSS); and LCA-II). Generally calcium nitrates are preferred because of better solubility, but are prone to surface washes and may contaminate nearby water sources. Conversely, gypsum's low solubility characteristics make it unsuitable for most sites except wet areas. Other chemicals that have been used successfully on brine spills include calcium chloride ($CaCl_2$), and magnesium sulphate ($MgSO_4$). The following options are provided for initial remediation of brine-contaminated soils.

Option 1:

Site Conditions:

Ground is not frozen, and can be cultivated or soaked with water to incorporate the fertilizer. There are no water sources (shallow wells, sloughs, dugouts, ponds) near the spill site, and soils are average in terms of moisture levels (mesic sites). Note: Calcium nitrate should never be used in situations where site run-off could cause it to contaminate sources of drinking water for human, livestock, or wildlife consumption.

Application: 2.2 lbs. calcium nitrate per 10 yards^2.

Procedure:

Spread the fertilizer on the spill site (by hand if the soils are wet). Cultivate or water the soil well so that the fertilizer is incorporated. Soak the soil until puddles form. Let puddles soak in, and then soak the soil some more. Soak the soil as often as possible over the next few days.

Calcium nitrate/polymer/flocculant formulations may also be used and are preferred when the ground is not frozen or over saturated so that the treatment soaks in immediately. These formulations are commercially available under the trade names Saline Soil Saver (SSS) and LCA-II.

Application: Dilute 0.8 US gallons of SSS or 0.5 US gallons of LCA-II with 6.2 US gallons of fresh water and apply 500 US and apply to 10 square yards. Be sure to protect the concentrate from freezing.

Option 2:

Site Conditions:

The ground is frozen and there will likely be runoff in the spring; **OR** the site is near water, thereby precluding the use of calcium nitrate.

Application: 11 lbs. gypsum per 10 yards^2 .

Procedure:

Spread the granular gypsum on site (by hand if soils are wet). If the ground is not frozen, and cultivation of the soils is possible (the affected site is not a bog or muskeg) cultivate as soon as soils are dry enough to permit cultivation, then soak the soil until puddles form. Only soak the site once immediately prior to incorporation as the chloride salinity will aid in increasing the solubility of the gypsum.

7.2.3.3 Hydrocarbon Spills

Soil contaminated by hydrocarbons must be removed from the spill site and removed to an approved landfill.

Appendix A

Figures

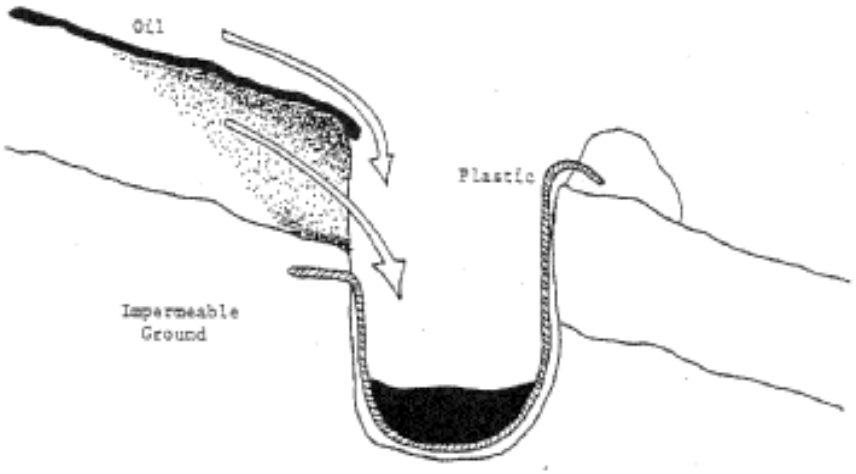


Figure 6.1

Detail of Interceptor Trench

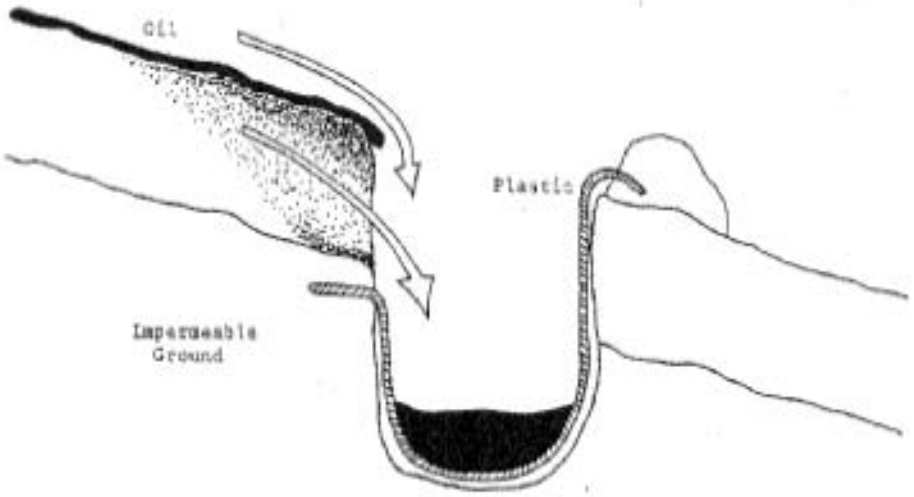


Figure 6.2
Trenches to Intercept Overland/Subsurface Flow

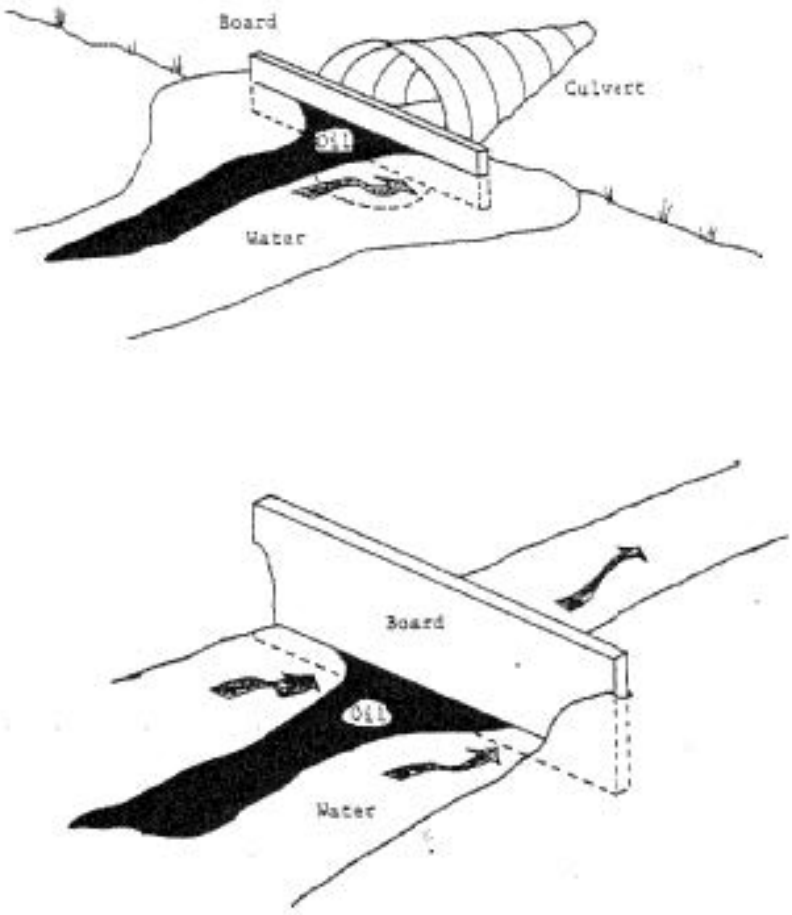


Figure 6.3
Culvert and Earth Dam Weirs

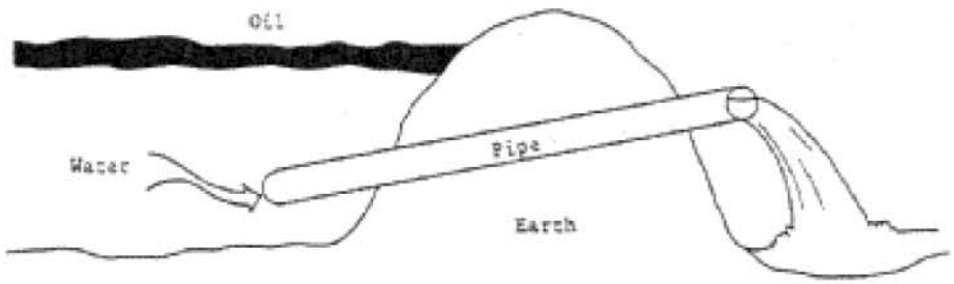


Figure 6.4
Water Bypass (Underflow) Dam

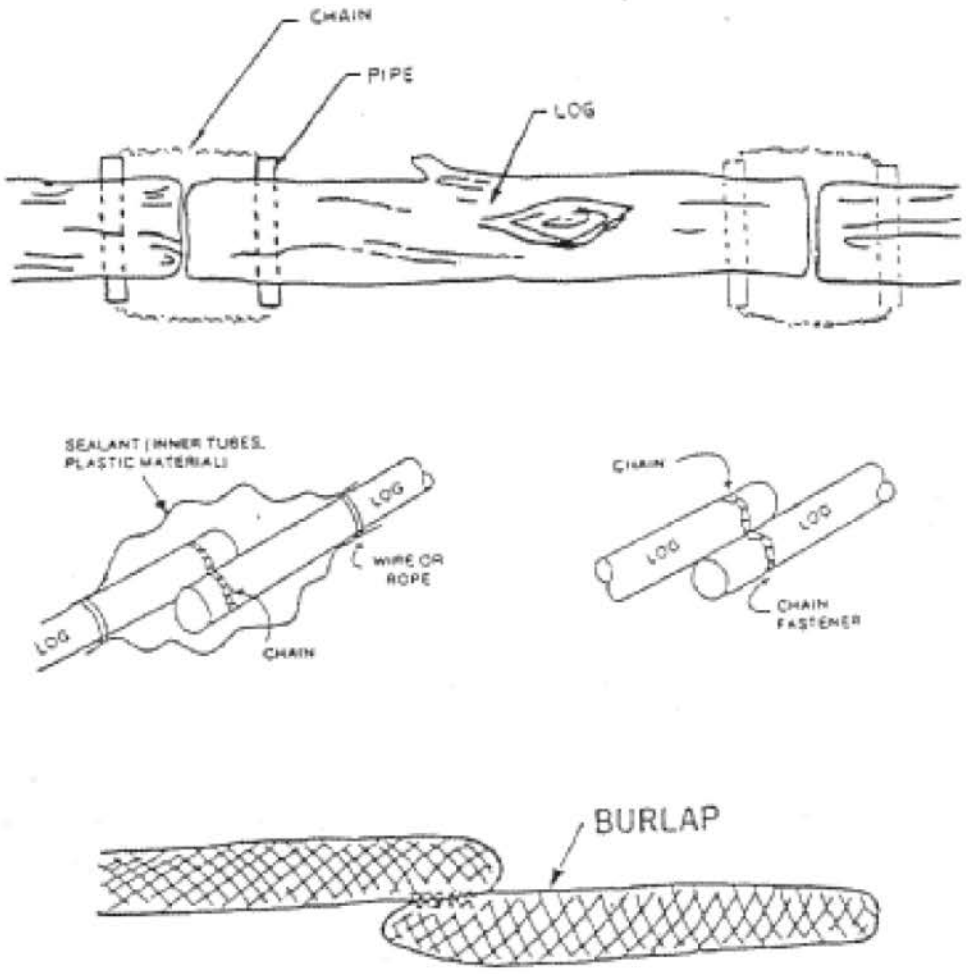


Figure 6.5
Various Means of Connecting Wood or Styrofoam Booms

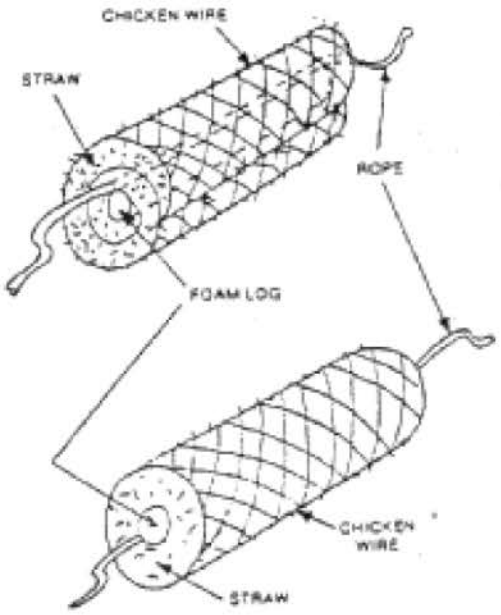


Figure 6.6
Jellyroll and Sausage Roll Improvised Sorbent Barriers

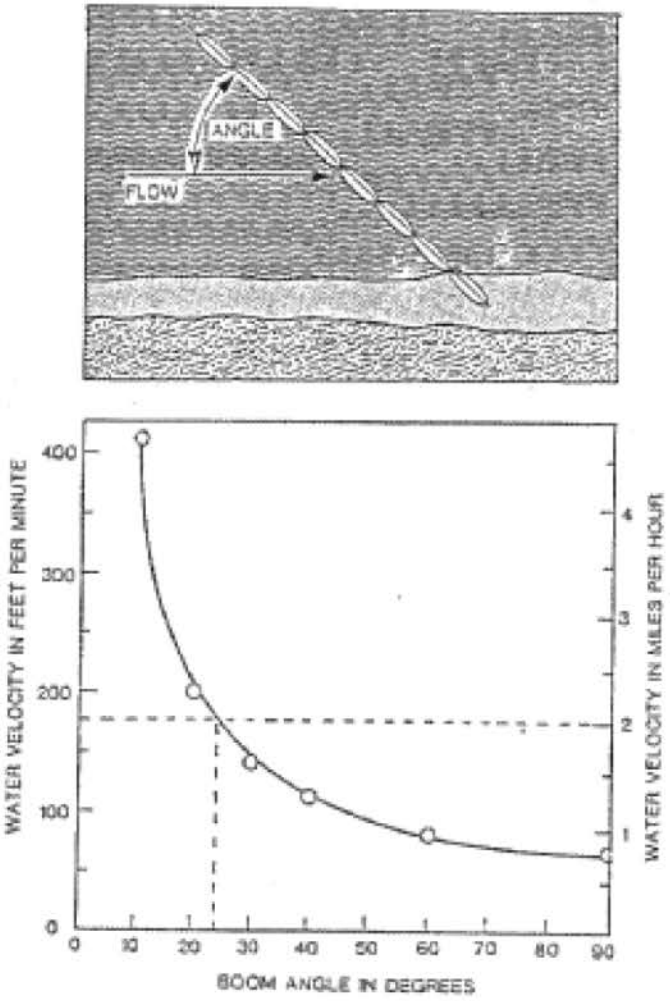


Figure 6.7
Boom Angle Deployment vs. Water Velocity

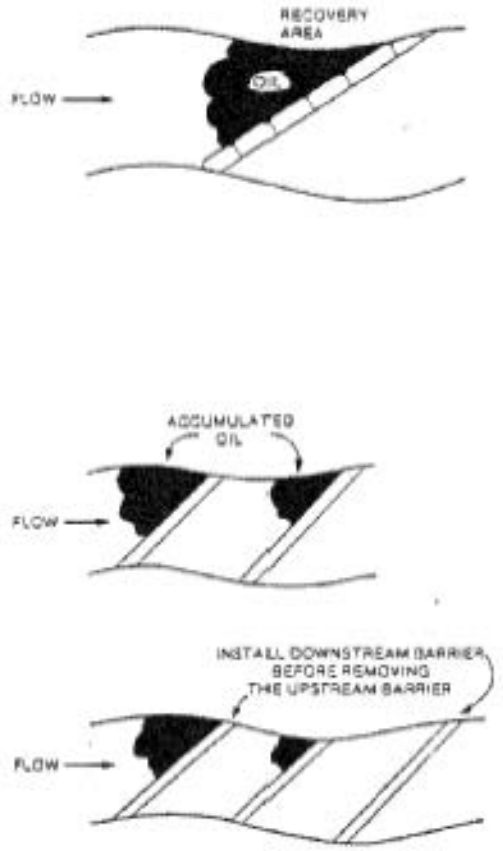


Figure 6.8
Multiple Angled Booms

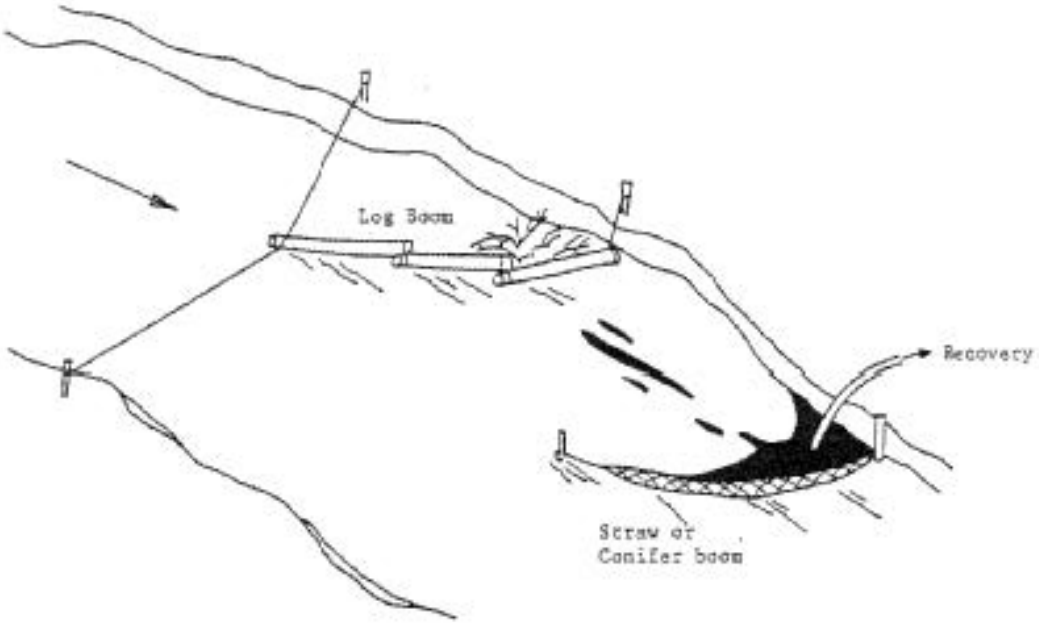


Figure 6.9
Possible Schemes for Boom Attachment and Deployment

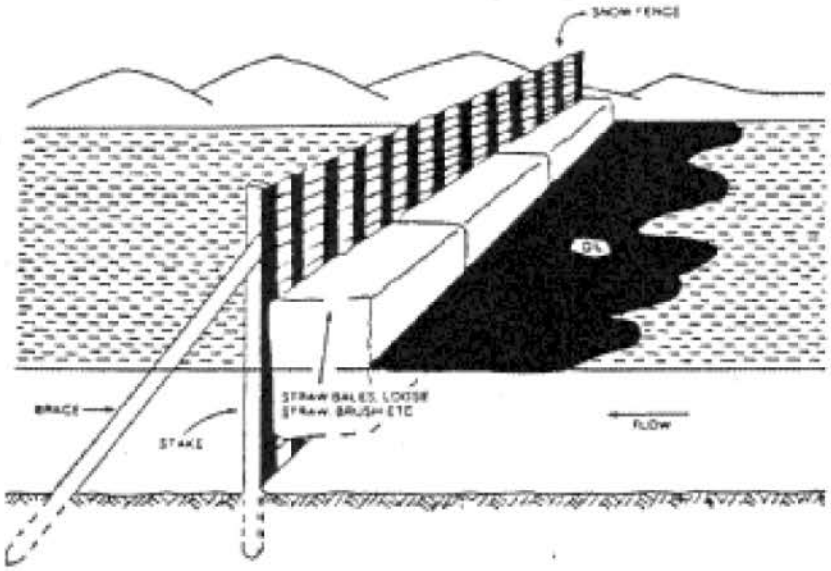


Figure 6.10
Snowfence and Sorbent Barrier