



INFORMATION GUIDELINE GL 97-01

GUIDELINES FOR THE CONSTRUCTION AND MONITORING OF OILY BYPRODUCT STORAGE STRUCTURES IN SASKATCHEWAN

BACKGROUND

This guideline replaces Information Guideline GL 86-02 and outlines construction and monitoring criteria for oily byproduct storage structures in Saskatchewan. The intent of the guideline is to address the environmental considerations regarding the safe and responsible storage of produced hydrocarbon-contaminated solids and liquids. It has been developed with input from government and industry representatives on the Saskatchewan Petroleum Industry/Government Environmental Committee (SPIGEC).

Saskatchewan Energy and Mines (SEM) considers the construction and use of oily byproduct storage structures to be an environmentally acceptable method of temporarily containing the byproducts until a final disposal method can be implemented. SEM maintains the position that operators must adopt waste minimization plans to maximize the recovery and conservation of resources in order to reduce the need for these types of temporary storage facilities. For additional information on waste management, and specifically waste minimization, refer to **WASTE MANAGEMENT GUIDELINES FOR THE SASKATCHEWAN UPSTREAM OIL AND GAS INDUSTRY** (Section 4.0 - Waste Management Principles).

USE OF AN OILY BYPRODUCT STORAGE STRUCTURE

An oily byproduct storage structure (OBSST) shall only be used for the temporary storage of materials contaminated with produced fluids such as unaltered (unrefined) formation crude oil and/or salt water directly from a well, battery, pipeline or flowline. Wastes such as lubricating oil (both new and used), hazardous substances, refined hydrocarbons and produced water (except where it is not feasible to separate the water from the waste) are expressly prohibited from being put in an OBSST. Materials that are acceptable for temporary storage include the following:

- Tank bottoms
- De-sand pit solids/sludges
- Produced sand/solids
- Untreatable emulsions
- Spill clean-up material from produced oil and/or salt water spills
- Lease clean-up material (excluding any material from flare pits)
- Drill cuttings containing formation crude (excluding diesel-invert drill cutting)

The primary purpose of an OBBST is to provide for temporary storage of oily byproducts during the winter season when disposal options for the material are limited by the weather or to collect a sufficient amount of material for economic disposal. An OBSST shall be cleaned-out on a regular basis (at least once a year, preferably in spring or early summer) and the byproducts contained in the structure shall be disposed of in an environmentally acceptable manner. Acceptable disposal methods include, but are not limited to, use as a dust suppressant on roads, use in road construction, treatment at a waste processing facility or by thermal desorption, degradation in a bioreactor, disposal down a disposal well or disposal cavern and landfarming or use of a secure landfill.

Normally an OBSST shall only be used for the storage of upstream material, however, an operator may, upon specific verbal approval from SEM, use an OBBST for emergency storage of hazardous substances, provided the storage is short-term and the material is segregated, if possible. In such cases, the operator shall first investigate the feasibility of using commercially available containment systems. If SEM grants such approval, the operator shall present a final disposal plan for the material and this plan must be approved by SEM. Under normal circumstances, the non-upstream material shall be removed from the OBSST within 60 days.

An operator shall operate an OBSST in a manner that minimizes waste and provides maximum protection to soil and groundwater resources. In this regard, it is important that all treatable liquids that accumulate in an OBSST be removed for treatment in a timely manner. This is particularly important in the case of open structures with freeboard limitations.

WHEN AN OPERATOR HAS SELECTED A LOCATION FOR AN OBSST, THE RURAL MUNICIPALITY IN WHICH IT WILL BE LOCATED SHOULD BE CONTACTED TO DETERMINE ANY REQUIREMENTS THEY MAY HAVE. THIS CONTACT SHOULD BE MADE AS EARLY IN THE PROCESS AS POSSIBLE.

APPLICATION AND PERMIT FOR AN OILY BYPRODUCT STORAGE STRUCTURE

All structures to be constructed for the purpose of containing oily byproducts as specified above require a permit from Saskatchewan Energy and Mines.

Three copies of an application for approval to construct and use an OBSST shall be submitted to SEM. Two copies of the application shall be submitted to SEM's Regina office and one copy shall be submitted to the appropriate field office (Lloydminster, Swift Current, Kindersley or Estevan). The application shall address the criteria contained in the following sections of this guideline.

The application shall be reviewed by SEM and, if the application meets the requirements of this guideline, SEM will issue a permit for the OBSST. If the application is complete and no additional information is required, the permit will be issued within 30 days of receipt of the

application. Figure 1 presents the format for the **PERMIT TO CONSTRUCT AND OPERATE AN OILY BYPRODUCT STORAGE STRUCTURE (OBSST)**.

When the ownership of an OBSST changes, the new owner shall, within 30 days, have a revised permit issued by SEM to reflect the change in ownership.

SITE SELECTION CRITERIA

1. The OBSST shall be located such that:

- It is not in an area where it would conflict with an existing protected-area designation (Wildlife Habitat Protection Act lands, Wildlife Development Fund lands, parks, ecological reserves or heritage sites). If an operator feels it is essential to locate an OBSST on lands with such a designation, approval must be obtained from Saskatchewan Environment and Resource Management.
- It is not in a low-lying area that is prone to flooding.
- It is at least 45 metres from an oil or gas well or storage tank.
- It is at least 75 metres from a developed or undeveloped road allowance or a right-of-way.
- It is at least 100 metres from surface waters or intermittent drainage courses.
- It is at least 200 metres from a private or community well.
- It is at least 500 metres from residences, commercial institutions and residentially or commercially zoned areas.

2. An application for approval to construct an OBSST shall contain a plot plan giving the legal description of the site and showing land features, all developments, right-of-ways, bodies of water and a topographic survey to a distance of 500 metres from the location of the structure.

3. The application shall contain a geotechnical investigation of the site to establish the native soil and groundwater conditions. This study shall be carried out by appropriate professionals licensed to practise in Saskatchewan and shall consist of the following:

- Two or more test-holes shall be drilled into the natural groundwater system provided it is encountered within eight metres of the proposed depth of the base of the structure. The surface elevations and relative locations of the test-holes shall be provided.
- Piezometer pipes shall be installed in the test holes to provide short term monitoring of the groundwater table and gradient.
- The relative positions of the various soil strata shall be recorded and zones of sloughing and seepage identified.
- Disturbed and undisturbed soil samples shall be obtained at regular intervals during drilling.
- Soil samples shall be tested in a laboratory to evaluate such properties as moisture content, Atterburg Limit, grain size distribution, density, unconfined compressive strength.

- Soils shall be classified in accordance with the Modified Unified Classification System and estimates provided of soil permeability coefficients. Secondary soil structures shall be identified and their influence on permeability assessed.
- Soil and groundwater samples shall be collected and analyzed to establish background levels of salts, metals and hydrocarbons.

CONSTRUCTION CRITERIA

An OBSST shall be constructed with a primary and secondary containment system and a primary and secondary monitoring system. The OBSST can be above or below ground level, but above ground is preferred. Acceptable materials for the primary liner are steel and synthetics. Acceptable materials for the secondary liner are compacted clay, bentonite, steel and synthetics.

Although it is recognized that there are many factors that must be considered in the selection of a containment system, **SEM considers the use of steel as a primary containment system to be the best option and encourages operators to use steel containment whenever possible.** Past field experience has shown that clay and bentonite liners can deteriorate when exposed to variations in temperature/moisture and incompatible stored materials so they are unacceptable as a primary liner. Also, field experience has shown that the use of concrete as a containment system is not appropriate due to cracking and deterioration caused by weather, ground movement and incompatible stored materials. Although synthetic liners are acceptable for primary and secondary containment, puncture and tearing problems have been experienced in the field with synthetics as primary liners. Because of this, operators must ensure the liners are installed carefully, materials above and below the liner will not result in puncture damage and, most importantly, access to the structure and removal of the stored material will not damage the liner.

SEM will also consider materials and designs other than those contained in this guideline provided an equivalent level of safety is obtained.

When constructing an OBSST the following criteria shall be met:

1. An application for approval of an OBSST shall contain detailed design drawings and specifications, bearing the seal of a Professional Engineer licensed to practise in Saskatchewan.
2. A primary and secondary containment system shall be incorporated into the design of an OBSST in order to prevent the migration of wastes in the event of a system failure. The secondary containment system shall have a permeability coefficient of less than 1×10^{-7} centimetres per second. In cases where in-situ soils can be rendered to meet this requirement, they may be utilized as the secondary containment system.
3. The base of the OBSST shall be situated at least 1.5 metres above the peak level of the natural groundwater table (the high elevation that would occur during the normal spring season) and soil conditions beneath the OBSST shall be suitable for the design selected.

4. It shall be the operator's responsibility to ensure the stored material remains in the OBSST. The solids stored in the OBSST shall be kept back from the walls to allow liquids to flow to the perimeter where they can be pumped off for recovery and processing. If the walls are not designed to withstand the lateral force of the material in the OBSST, the material shall not contact the walls. If the walls are designed to withstand the lateral force of the stored material, a minimum freeboard of 0.3 metres shall be maintained.
5. The life expectancy of the OBSST shall be determined and included in the application. An oily waste storage structure should have a design life of at least ten years.
6. Construction of an OBSST shall not be carried out during the winter season unless special approval is obtained from SEM.
7. Materials testing shall be performed on all materials used to construct an OBSST. Normally, this will be carried out by the manufacturer/supplier/installer prior to installation, but qualified professionals can also do it at the time of installation.
8. Regular inspections shall be carried out by qualified professionals and inspection reports submitted to the appropriate SEM field office during and at the completion of construction.
9. **Native clays** can be used for the construction of the secondary containment system if they are found to be suitable. The following methods shall be employed in their use:
 - The clay shall be tested to ensure it is chemically compatible with a leachate of the stored material.
 - A minimum of 300 millimetres of the clay subgrade below the primary containment system shall be reworked.
 - The reworked clay shall be constructed in individual lifts not exceeding 150 millimetres each in thickness.
 - Each lift shall be uniformly prepared and compacted to a minimum of 95 percent of Standard Procter Maximum Dry Density (ASTM D698) and shall meet the permeability specification in point 2 of this section.
 - The clay soils shall be compacted at or slightly in excess of Standard Procter Optimum Moisture Content.
 - Lenses and zones of sand and/or gravel exposed during liner preparation shall be sub-excavated and replaced with a suitable clay in accordance with the previous provisions.
 - The clay liner shall be protected from desiccation, inundation or freezing prior to placement of the overlying primary containment system.
 - Side slopes shall not be steeper than 3 horizontal to 1 vertical.
10. **Bentonite modified soil** can be used for the construction of a secondary containment system. The following methods shall be employed in its use:

- The bentonite-modified soil shall be tested to ensure it is chemically compatible with a leachate of the stored material.
 - Laboratory permeability tests shall be undertaken on samples of the actual materials to be used. A minimum soil permeability of 1×10^{-7} centimetres/second shall be used to determine the bentonite application rate prior to construction.
 - The depth of scarification and application shall not be less than 150 millimetres.
 - The bentonite shall be thoroughly distributed into the soil by use of tillers in place or by pulvy mixer, ensuring moisture content is properly adjusted to facilitate good mixing.
 - The soil/bentonite mixture shall be compacted to a minimum of 95 percent Standard Procter Density at or slightly above optimum moisture content.
 - Side slopes shall not be steeper than 3 horizontal to 1 vertical.
11. A **synthetic liner** can be used for the construction of either a primary or secondary containment system. The following methods shall be employed in its use:
- The liner material to be used shall be compatible with the waste products.
 - Synthetic liners shall be placed on uniform stable subgrades that have been compacted to a minimum 95 percent Standard Procter Maximum Dry Density.
 - The side-walls of the liner shall be firmly anchored in place to ensure they do not fail during use of the OBSST.
 - A sand-bedding layer shall be provided under the liner to provide a smooth surface free of irregularities.
 - The liner shall be protected from tearing or puncture during installation and care shall be taken to avoid stress points resulting from wrinkles.
 - Seams shall be constructed as per manufacturer's specifications.
 - A minimum cover of 500 millimetres shall be provided to protect the liner from exposure and damage during clean-out if the liner is a primary liner. This cover shall be put in place before the OBSST is in operation and shall not consist of material that can physically or chemically damage the liner.
 - Chicken wire, colored flagging or other suitable material shall be incorporated into the earth cover of a primary liner to warn operators of proximity to the synthetic liner.
12. A **steel container** can be used as either a primary or secondary containment system. The following methods shall be employed during construction:
- All steel tanks and containers shall be constructed such that materials and construction practices meet industry standards. CSA and/or API standards for tank construction may be useful in this regard.
 - Steel design shall take into account corrosion protection, protection from damage during loading and unloading, frozen subgrades, lateral earth pressures, thermal expansion, design life, soil bearing capacity and forces due to water table.
13. A **double walled steel container** can be used for primary and secondary containment (a primary monitoring system between the walls is required in accordance with these guidelines).

14. If the OBBST is a double-walled steel structure and the entire system is installed above ground, the application shall be reviewed on a case by case basis with regard to site selection and leakage monitoring.

LEAKAGE MONITORING AND DETECTION CRITERIA

1. Primary and secondary monitoring systems shall be incorporated into the design of an OBSST in order to provide an adequate level of assurance of leak detection.
2. The primary monitoring system shall serve as an early warning mechanism for the detection of leakage from the primary containment system while the secondary system would indicate if contaminants have reached the natural groundwater system.
3. The **primary monitoring system** shall be designed and installed to detect leakage from the primary containment system. It shall be installed in the space between the primary and secondary containment systems.
4. The onus shall be on the operator to ensure the primary monitoring system is designed, constructed and maintained such that it will be capable of detecting leakage from the primary liner in a timely fashion.
5. The **secondary monitoring system** shall consist of two or more standpipe piezometers located outside the primary monitoring zone but within 20 metres of the outside edge of the OBSST. The piezometer wells shall be installed in accordance with industry standards.
6. The piezometers shall extend a minimum of one metre into the natural groundwater system.
7. The monitor wells shall be situated such that the area down-gradient of the OBSST is covered and the onus shall be on the operator to determine the direction of groundwater flow.

SAMPLING AND MAINTENANCE CRITERIA

1. Background groundwater samples shall be collected from the secondary monitoring system wells and subjected to complete chemical analysis prior to the use of the of the oily waste storage structure. A complete chemical analysis shall consist of pH, electrical conductivity, SAR, saturation percent, calcium, magnesium, sodium, potassium, chlorides, sulphates, BTEX and total petroleum hydrocarbons. These analyses shall be submitted to the SEM field office as part of the geotechnical report.

2. The primary monitoring system shall be monitored on a monthly basis from June to September and, if fluids are present, the fluids shall be collected promptly and analyzed for chlorides content. Analyses shall be submitted to the appropriate SEM field office. If the primary monitoring system is dry, a notice should be submitted indicating no samples were obtained.
3. Any fluids that collect in the primary monitoring system shall be pumped out on a regular basis.
4. If leakage is detected in the primary monitoring system, the appropriate SEM field office shall be notified within 24 hours. A plan to repair the OBSST shall be submitted to and approved by SEM. Repairs shall commence as soon as possible following approval.
5. The primary containment system shall be visually inspected at least once per year, preferably in the summer season when the oily byproduct materials are removed. If the primary system has a covering of buffer-zone material, a visual inspection of this cover only shall be conducted.
6. The secondary monitoring system wells shall be sampled at least once per year if no leakage is detected in the primary monitoring system and the fluids collected shall be analyzed for chlorides. Sampling shall be in accordance with the protocols established by Saskatchewan Environment and Resource Management for the installation and sampling of monitor wells. Results shall be submitted to the SEM field office.
7. If leakage is detected in the primary monitoring system, water samples shall be taken from the secondary monitoring system wells at least once per month and the samples shall be subjected to a complete analysis (a complete analysis shall include the parameters specified in point 1) and the analyses shall be submitted to the SEM field office. Samples shall continue to be taken once a month unless SEM approves a reduced frequency.
8. The secondary monitoring system wells shall be bailed dry, if possible, when sampling to confirm that the system is functioning properly.
9. If water quality, as measured in the secondary monitoring system, exhibits a significant declining trend from the initial measured conditions, SEM may require the oily waste storage structure to be abandoned.
10. The operator of an OBSST which has deteriorated to a state where it no longer meets these guidelines shall be notified in writing by SEM and, if repairs are not made in a reasonable time, SEM shall rescind the permit and require that the OBSST be abandoned and the site reclaimed
11. SEM will notify an operator in writing of a decision requiring the abandonment of an OBSST and will work with the operator to set a time frame for abandonment and reclamation to be completed. This will normally be limited to a maximum time of one year from the date of notification.

SIGNAGE AND WILDLIFE DETERRENT CRITERIA

1. In selecting a location for an OBSST, wildlife habitat shall be a consideration and areas such as wildlife feeding and staging areas shall be avoided.
2. An OBSST shall have a wildlife deterrent system constructed in accordance with the following:
 - A steel mesh fence with a minimum height of two metres and locking access gates shall enclose the OBSST. The gates shall be kept locked at all times the facility is unattended.
 - If an OBSST contains free liquids that are accessible to birds, the design of the structure shall incorporate features that will keep birds from landing on the liquids. An OBSST that is only used for the storage of dry sand does not require a deterrent system for birds.
3. Operators shall report failures of the wildlife deterrent system to SEM and, in the case of repeated failures, modifications to the system will be required. If a failure causes death or injury to wildlife, it must be reported to Saskatchewan Environment and Resource Management within 10 days.
4. The fence surrounding the OBSST shall be posted with at least one warning sign that contains the operating company name, the legal land description and a telephone number that can be used in the event of an emergency.

OILY BYPRODUCT STORAGE FACILITY CONSTRUCTED PRIOR TO THESE GUIDELINES

1. Any company that has above or below ground structures that are used for the storage of oily waste in accordance with these guidelines but were constructed under the previous guideline (GL 86-02), shall, within 30 days of the issuance of this guideline, submit a listing of the structures to SEM. The listing shall include the location of the structure, construction details and an opinion as to whether or not the structure meets the requirements of this guideline.
2. SEM will inspect the structures and issue permits for those that meet the requirements of this guideline.
3. If a structure does not meet the requirements of this guideline, the company shall be requested to upgrade the structure to meet the guidelines. Upgrading shall be complete within one year of the issuance of these guidelines. SEM will issue a permit for the structure after it has been upgraded.

4. If a structure cannot be upgraded to meet these guidelines, the company will be required to demonstrate that the structure does not leak. If the structure does leak, it shall be abandoned and plans presented for site reclamation within 180 days of the issuance of this guideline.
5. No permit will be issued for a structure that cannot be upgraded to meet these guidelines. A structure that does not meet the requirements of this guideline but can be shown not to leak, shall be required to be tested yearly for leakage and, if leakage is detected, shall be abandoned as indicated above.
6. **A STRUCTURE THAT DOES NOT MEET THE REQUIREMENTS OF THIS GUIDELINE BUT PASSES THE YEARLY LEAKAGE TEST, AND FOR WHICH NO PERMIT IS ISSUED, SHALL, PRIOR TO JANUARY OF 2001, BE ABANDONED AND THE SITE SHALL BE RECLAIMED.**

USE OF PORTABLE FACILITIES FOR SHORT-TERM STORAGE

1. Portable facilities such as rig tanks and portable enclosed tanks, which do not meet the requirements of this guideline, are only acceptable for the short-term storage of oily byproducts.
2. An operator planning to use a portable facility for short-term storage shall obtain written approval from the SEM field office in the area.
3. Approval for portable storage shall be granted for a maximum period of eight months (one winter season storage).
4. The temporary storage facility shall be emptied as soon as possible in spring and moved from its location. At this time the ground under structure shall be inspected for contamination. If any contamination is found, it shall be assessed and cleaned-up immediately.
5. Operators are encouraged to use permanent rather than portable storage facilities. If SEM feels an operator is abusing the use of portable storage facilities, approvals for portable facilities shall be discontinued and the operator will be required to install an OBBST in accordance with these guidelines.

REVIEW PERIOD

THESE GUIDELINES COME INTO FORCE ON JANUARY 1, 1998. IT IS INTENDED THAT THEY BE IMPLEMENTED ON A TRIAL BASIS, THEREFORE, THEY WILL

**BE REVIEWED IN EARLY 1999 AND, IF IT IS FELT CHANGES ARE NECESSARY,
THE DOCUMENT WILL BE REVISED AT THAT TIME.**

Note: Saskatchewan Energy and Mines may rescind or amend these guidelines at any time if conditions so warrant.

FIGURE 1

**PERMIT TO CONSTRUCT AND OPERATE
AN OILY BYPRODUCT STORAGE STRUCTURE (OBSST)**

This permit authorizes the company named below to construct and operate an oily byproducts storage structure in accordance with the Saskatchewan Energy and Mines Information Guideline GL 97-01 "Guidelines for the Construction and Monitoring of Oily Byproduct Storage Structures in Saskatchewan".

LOCATION :	_____
OPERATOR :	_____
ADDRESS :	_____ _____ _____
DATE OF ISSUE :	_____
PERMIT NUMBER :	_____
SIGNATURE OF ISSUER :	_____

In the event of an emergency, the nearest Saskatchewan Energy and Mines office should be contacted as follows:

LLOYDMINSTER - (306) 825-6434
KINDERSLEY - (306) 463-5400

SWIFT CURRENT - (306) 778-8252
ESTEVAN - (306) 637-4541