Technical Information Document

STORAGE TANK MANAGEMENT SYSTEMS

RPS for INAC
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Foreword

The intent of this document is to provide general information on the use and management of storage tanks in First Nations (FN) communities. It is intended to provide an overview and general appreciation of the proper use and management of underground storage tanks (USTs) and aboveground storage tanks (ASTs). Tank management is not an easy task; there are many factors to consider. The first step to proper tank management is being informed.

Policy and Legislation

There are a variety of federal and provincial laws, guidelines and codes regarding the management/operation of storage tanks. Although some legislation may not be applicable on FN lands, because provincial legislation is not binding to the federal government nor federal facilities on the reserves, regulations may have an impact on the haulers and carriers of fuel oil and other materials stored in your tanks. Therefore, it is in the best interest of the FN community that the tank manager to be aware of legislation which may affect the tanks.

Scope

This document presents information on UST and AST systems including:

- Regulations, Guidelines & Codes of Practice;
- Storage Tank Installation;
- Release Prevention and Detection;
- Storage Tank Releases;
- Emergency Planning and Response; and
- Fuel Handling Procedures.

Responsibilities

INAC's responsibilities: maintain a consolidated record of all registered storage tank systems on federal land and provide an annual compliance report to Environment Canada.

Tank owner responsibilities: the registration of storage tanks on federal land is mandatory, and adherence to the Registration Regulation require a tank owner to provide the Appropriate Federal Department (INAC) with the minimum information (found in Schedule I of the Registration of Storage Tank System for Petroleum Products and Allied Petroleum Products Regulation). The "owner" means the "Crown, an institution, corporate entity, Indian band, government department or agency, or a person who has legal ownership of the storage tank system or who has been assigned custody to control, care for, manage or dispose of the system". The impact of a leaking tank on the health, safety, finances and environment of a FN community is much more costly than the savings to be had from a cheap installation or improperly maintained and managed.

USTs and ASTs must be installed or modified by qualified and experienced consultant and petroleum contractors. The company must be registered in the province where the tank is installed.

Part 1: Introduction to Storage Tanks

1.1 General

An underground storage tank (UST) is a partially buried storage tank or a storage tank that is completely buried by or covered with earth, backfill, or concrete, that operates at atmospheric pressure plus or minus 10 KPa.

An aboveground storage tank (AST) is a tank with more than 90% of the storage tank volume above surface grade and operates at atmospheric pressure plus or minus 10 KPa.

Both types of storage tanks are potentially hazardous due to the substances they contain. For the most part, USTs (refer to figure 1) and ASTs (refer to figure 2) are used to store petroleum and allied petroleum products or other hazardous substances which can seep into the soil and contaminate groundwater. Leaks, spills and overfills caused by faulty installation or inadequate handling, operating and maintenance procedures can have devastating environmental and economic impacts. Small quantities of diesel, heating oil or gasoline can cause offensive and hazardous odours, contaminate surface and subsurface soils, render drinking water supplies from ground water, rivers and lakes non-potable, cause degradation of water/sewer lines, create a toxic atmosphere in a building, cause explosive buildup of vapours in basements and other underground structures.

Most First Nation communities across the country utilize USTs and ASTs for fuel storage. According to INAC's inventory, there are close to 3,000 storage tank systems installed in Aboriginal communities. About half of the 3,000 storage tanks and associated piping are made from untreated carbon steel, a material which is subject to corrosion. Many tanks are approaching or have exceeded their expected life span, and the number of leaks related to corrosion problems are increasing, resulting in contamination of soil and groundwater.

1.2 Selection of Tank Systems

Releases may also occur as a result of having selected equipment that is not properly suited for the characteristics of the site. A good understanding of the site characteristics and equipment are imperative to an effective storage tank system.

1.2.1 Site Characteristics

It is important to note that there is no universal storage tank system. The following factors need to be considered when assessing which tank is best suited for a particular location:

- Soil (geology);
- Proximity to surface water and/or groundwater;
- Proximity to households and/or industrial areas;
- Product to be stored.

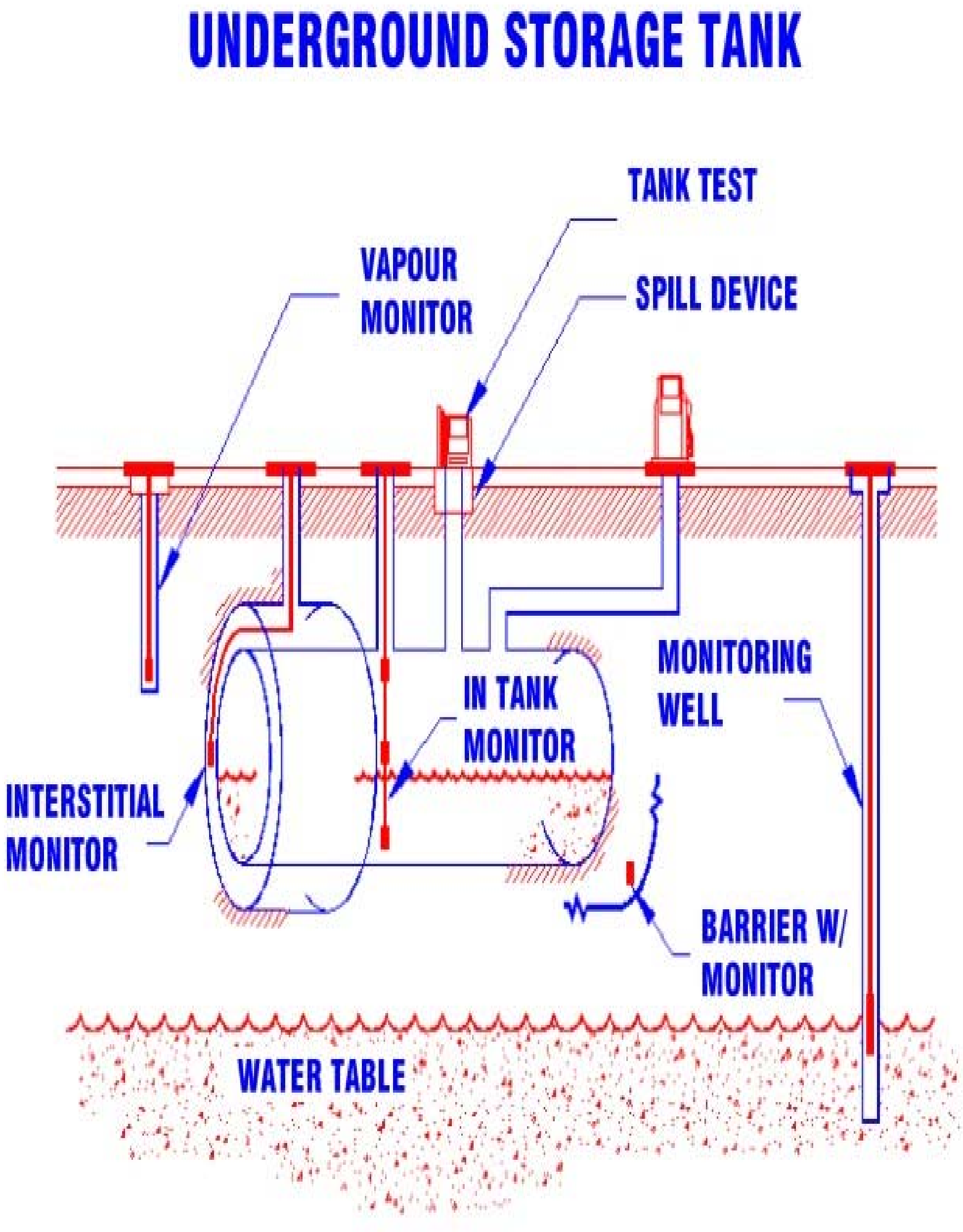

Figure 1: Underground Storage Tank

Note: This figure is for illustration purposes only. Although most major components are shown, some installations will require additional devices/equipments in order to be in compliance with Environmental Code of Practice and Technical Guidelines.

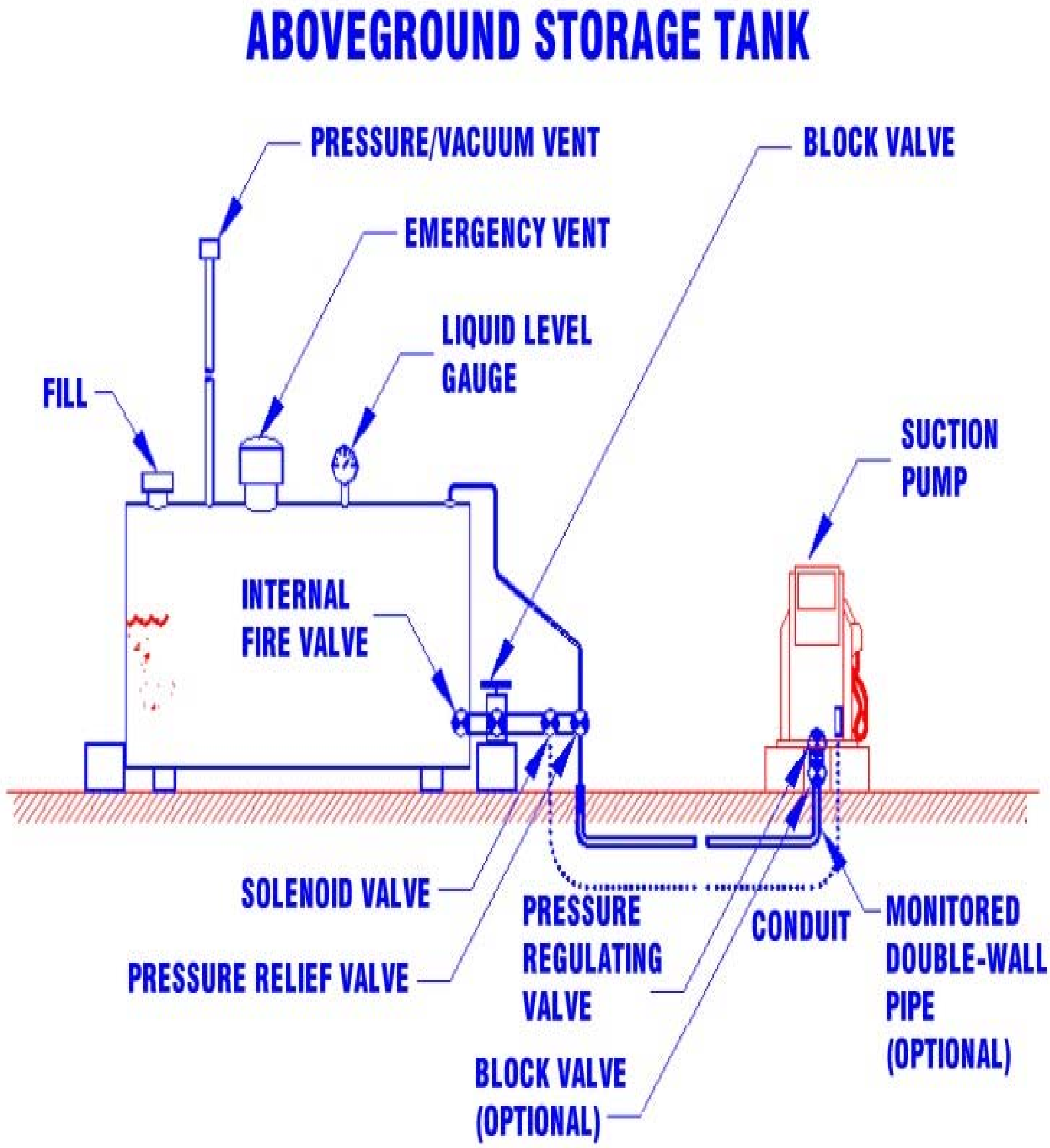

Figure 2: Aboveground Storage Tank

Note: This figure is for illustration purposes only. Although most major components are shown, some installations will require additional devices/equipments in order to be in compliance with Environmental Code of Practice and Technical Guidelines.

Services from engineering and environmental consultants for site classification, design and construction supervision must be considered when planning for the installation or upgrading of a storage tank system.

1.2.2 Selection of Storage Tank Equipment

Several factors must be considered when selecting the various characteristics of a proposed storage tank system. The characteristics include:

- AST or UST;
- tank material;
- single or double wall tank; and
- piping materials.

Each of these characteristics and the factors to be considered are outlined below.

1.2.2.1 ASTs vs USTs

ASTs are becoming much more common than USTs. Tank manufacturers are assembling three ASTs for every one UST. The increase in AST use is a result of several factors, including the following:

- Guidelines now permit their installation. Prior to the 1980's, tanks were required to be installed underground due to the fire hazard associated with storing flammable liquids.

- The AST can be easily monitored for leaks or corrosion, allowing for a quicker and more effective response.

- In most cases, the overall cost of AST systems is lower than USTs due to lower installation costs.

Although ASTs do provide an excellent design option, caution must always be used when deciding to install an AST. Many of the reasons tanks were installed underground are still valid today, and need to be carefully examined.

The advantages and disadvantages of ASTs and USTs are summarized in Table 1.

Table 1: Comparison of ASTs and USTs

Tank System	Advantages	Disadvantages
ASTs	• system can be visually monitored for leaks or corrosion, allowing for an effective response • repairs are quick and less expensive • minimal excavation required • installation slightly less expensive	• increased fire hazard • may require vapour recovery system • increased risk of vandalism or accidental vehicular collision • can be aesthetically undesirable • takes up additional space • tanks exposed to adverse weather conditions; additional wear may result • tank exposed to pressure and temperature fluctuations
USTs	• do not require any surface space • less of an aesthetic concern • tank sheltered from adverse weather conditions • reduced fire hazard • may not be required to control the release of volatile organic vapours	• repairs are more difficult and expensive • releases and corrosion can go undetected • extensive excavation required for installation • greater corrosion risk for steel tanks

1.2.2.2 Storage Tank Materials

Storage tanks are generally constructed of steel, fibreglass reinforced plastic (FRP), or a composite of both.

A primary advantage of FRP tanks is that they are highly resistant to both internal and external corrosion and consequently do not require additional corrosion protection. Steel tanks are highly susceptible to corrosion failure, and the CCME Environmental Code of Practice for Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products states that all steel USTs should have either cathodic protection, or be entirely encased by a non-corrodible jacket. Steel ASTs should be coated with epoxy or resin to reduce external corrosion.

Steel tanks provide a high level of structural strength, and have a reasonably long life expectancy when protected from corrosion. In contrast, FRP tanks obtain most of their support from the surrounding backfill, making proper installation critical to their function. As well, many FRP tanks have load or pressure restrictions, making them unsuitable in certain locations, including high vehicle traffic areas. In fact, FRP is not an acceptable material for ASTs because it is prohibited under the National Fire Code (NFC). For the most part, this is because of the lack of structural strength of FRP. Sometimes, steel ASTs are coated with FRP for its rust resistant properties, which is acceptable, but FRP can not be used as the primary material for the tank.

Steel tanks are highly resistant to numerous fuels, giving them a wide applicability. However, problems have been encountered when storing oxygenated fuels (e.g. alcohol) and certain solvents in FRP tanks. These fuels tend to break down the tanks resin coating, affecting the tank's integrity.

The advantages and disadvantages of FRP and steel tanks are summarized in Table 2.

Table 2: Comparison of Steel vs Fibreglass Reinforced Plastic Tanks

Tank System	Advantages	Disadvantages
Steel	• suitable for all petroleum products • high structural strength • relatively long life • lower initial cost	• susceptible to internal and external corrosion • requires corrosion protection at additional cost • high maintenance required
FRP	• not susceptible to internal or external corrosion • long life • lower level of maintenance required	• not suitable for oxygenated fuels • more fragile than steel; requires careful handling during installation • lacks structural strength of steel; backfill provides up to 80% of support

1.2.2.3 Single Wall vs Double Wall Tanks

Single wall tanks are the most commonly purchased type of tank. Unfortunately, they offer only one advantage; their initial cost is less than that of double wall tanks. The major disadvantage of single wall tanks is the absence of an outer barrier to prevent, in the event of a puncture, a rupture, or tank corrosion, a the flow of fuel or chemicals into the environment. The Environmental Code of Practice for USTs states that if a single wall UST is to be used at any site other than a Class B motive fuel site, it should be equipped with a secondary containment unit. These systems are more difficult and expensive to install, and are usually not as effective as double wall tanks. As for the ASTs, the CCME Environmental Code of Practices for ASTs states that all ASTs should have secondary containment (refer to section 4.1.3 for details on secondary containment).

1.2.2.4 Piping Materials

Most releases from storage tank systems occur as a result of failure in the piping and its joints. As such, all UST and AST underground piping must have secondary containment. Furthermore, in the case of UST installations, nearly 80% of leaks occur in the piping, mainly at the fittings and swings joints. Carefully chosen piping and proper installation are key elements of an effective storage tank system. There are five common materials used in the construction of storage tank piping: carbon steel, FRP, stainless steel, cast iron and plastic.

Carbon steel piping is extremely popular because it has the lowest initial cost. It is also compatible with all petroleum products and has high structural strength. However, carbon steel requires protection from corrosion which increases its total cost.

Fibreglass Reinforced Plastic (FRP) piping is resistant to many chemicals, however, it may be incompatible with certain oxygenated fuels (alcohols) and solvents. FRP does have a higher initial cost than carbon steel, but does not corrode and thus requires no protection from corrosion. Structurally, FRP is not as strong as carbon steel, and derives much of its support from the surrounding backfill. Thus, the backfill underlying FRP pipe must be well compacted before the pipe is installed.

Stainless steel piping is used when high temperatures or extremely corrosive materials are being stored. Due to the high cost of stainless steel, it does not present a cost effective option for other types of storage tank systems.

Cast iron piping is often used because of its low cost and its resistance to corrosion. However, it is somewhat brittle and therefore only moderately resistant to impact or shock. Site conditions must be carefully evaluated before selecting this type of piping.

Plastic piping is becoming a popular choice because it is not susceptible to internal or external corrosion. Various types of plastics (e.g. High Density Polyethylene (HDPE), Nylon or Teflon) are extremely resistant to petroleum fuels and their flexibility means a reduction of piping joints. However, this type of piping may not be suitable in certain applications, because plastic does not have the same structural strength as steel.

Plastic is often used in combination with other materials such as steel. Covering steel pipe with a plastic jacket combines the chemical resistance of plastic with the strength of steel to produce very effective piping. However, joints that are not coated in plastic are susceptible to corrosion. Protecting plastic pipe with flexible metallic duct offers flexibility and protection from fire, collision impacts, and UV light. The cost of this piping material is comparable to other options.

Flexible piping systems consist of continuous length of outer piping between the storage tank and the dispenser. All fittings and swing joints are installed inside the flexible secondary containment piping, which ensures that any leaks from fittings do not reach the environment.

Although the pipe itself is single-wall, it is comprised of numerous layers of different materials. The inner wall is composed of a substance such as polyurethane, lined with a polymer to provide chemical resistance to the product being stored. The second layer consists of braided polyester or nylon that adds structural strength to the piping. The third wall is a protective outer layer of polyethylene or nylon to guard against abrasion, UV exposure, or harsh environmental conditions.

The flexible piping could also be double wall if the single wall flexible pipe is wrapped with a “loose” outer layer, which has raised channels or ridges. The outer layer provides an interstitial space for product to flow. This double wall flexible piping is often referred to as “co-axial” piping.

Flexible piping is slightly more expensive than traditional piping. However, due to the reduced number of joints required and the ease of installation of flexible piping, the cost is comparable.

There are numerous storage tank options available to tank managers. Installation and upgrading decisions must depend on the following:

- Site conditions;
- Classification;
- Corrosive elements; and
- Environmental and health implications of potential releases.

1.2.2.5 Backfilling

All USTs derive part of their structural integrity from the surrounding backfill. While steel tanks are very structurally sound and obtain minimal support from backfill, fiberglass tanks, due to their structure, can derive up to 80% of their strength from backfill.

Backfills containing clay particles provides excellent compaction, and tank installers have therefore used this material to backfill fiberglass tanks. BEWARE - clay absorbs water and expands. If the clay has been tightly compacted, the resulting expansion could place excessive pressure on the tank and even cause it to collapse. Tanks, whether steel or fiberglass, must **always be backfilled in accordance with the manufacturer's specifications and under the supervision of a professional engineer**. For fiberglass tanks, this will usually mean the use of "pea gravel", which compacts well. It provides the high level of support required by FRP tanks, while allowing water to drain effectively, resulting in the protection of the fragile outer shell of the tank.

REMEMBER! The proper selection of a storage tank system is the first critical step in effective storage tank management. Many technologies are only effective in certain circumstances (some types of equipment are specifically designed for either ASTs or USTs while others function only with certain types of product). Carefully read the specifications of any product to determine its appropriateness for your system. **Just because a product meets the specifications outlined in the federal guidelines, this does not mean that it will be effective in the operation of your system.** Time spent researching and selecting a proper tank system is a good investment. Consult a professional consultant or a qualified petroleum contractor for the best method for your installation.

Part 2: Regulations, Guidelines & Codes of Practice

The following is a listing of legislation concerning the management of storage tanks:

- Canadian Council of Ministers of the Environment (1993). Environmental Code of Practice for Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products.
- Canadian Council of Ministers of the Environment (1994). Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products.
- Canadian Environmental Protection Act (1995). Technical Guidelines for Underground Storage Tank Systems Containing Petroleum products and Allied Petroleum Products, Canada Gazette, Part I.
- Canadian Environmental Protection Act (1996). Technical Guidelines for Aboveground Storage Tank Systems Containing Petroleum Products, Canada Gazette, Part I.
- Canadian Environmental Protection Act (1997). Registration of Storage Tank Systems for Petroleum Products and Allied Petroleum Products on Federal Lands Regulations. Canada Gazette, Part IV.
- National Fire Code of Canada 1995: Part 4 Flammable and Combustible Liquids.

Provincial Legislation (not limited to this list):

- Alberta: Storage Tank System Management Regulation, Alta. Reg. 254/2000.
- British Colombia: Petroleum Storage and Distribution Facilities Storm Water Regulation, B.C. Reg. 168/94.
- Manitoba: Storage and Handling of Gasoline and Associated Products Regulation 97/98R.
- New Brunswick: Petroleum Product Storage and Handling Regulation - Clean Environment Act, N.B. Reg. 87-97.
- Nova Scotia: Petroleum Storage Regulations, N.S. Reg. 62/95.
- Ontario: Gasoline Handling Act, Revised Statutes of Ontario, 1990.
- Quebec: Act Respecting Petroleum Products and Equipment, R.S.Q. c. U-1.1.
- Prince Edward Island: Petroleum Products Act Regulations, EC 38/91, as amended by: EC 639/93; 639/97; 762/98; 699/2000.
- Saskatchewan: Oil and Gas Conservation Regulations, 1985, R.S.S., c. O-2, r. 1, as amended by: 39/87; 40/87; 32/88; 7/89; 25/89; 34/89; 96/90; 79/91; 72/92; 48/95; 50/97; 50/98; 106/2000.

2.1 Guidelines and Codes of Practice

The Technical Guidelines for **Underground** Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products (March 11, 1995) and the Technical Guidelines for **Aboveground** Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products (August 17, 1996) incorporated the Canadian Council of the Minister of Environment (CCME) Environmental Codes of Practice for USTs and ASTs (available at this address: http://www.ccohs.ca/legislation/).

The Technical Guidelines were prepared by Environment Canada in 1995-1996 with the objective of providing effective management of petroleum storage tank systems located on federal lands. Both Environmental Codes of Practice were adopted by the Governor in Council as minimum requirements for storage tank systems on federal lands. The codes provide a detailed technical guide on the proper design of new tank systems, instructions on how to upgrade existing tank systems and outline the requirements for operation and maintenance. These documents function as standards for storage tank installation, operation and management on federal lands in Canada. Each Environmental Code of Practice was developed in conjunction with two main documents: National Fire Code of Canada; and CAN/CSA B139 "Installation Code for Oil-Burning Equipment".

2.2 Application

The conformance with the Technical Guidelines is voluntary. However, all federal departments are required under the "Code of Environmental Stewardship" to meet or exceed the letter and spirit of federal environmental laws and, where appropriate, be compatible with provincial and international standards (Chapter 8 - Treasury Board Manual).

The question of legal ownership of storage tank systems affixed to or under Indian reserves is still fraught with uncertainty. INAC is not accepting ownership notably for third parties, orphan tanks, and contested ownerships. Uncertainties also exist with the Registration Regulation which is scheduled for review in year 2001-2002. In the mean time, it would be in the best interests of the First Nations community to consider applying the Guidelines and Codes in order to help prevent contamination due to tank failures. Additionally, it would be bad publicity for INAC if the Auditor General audits finds and reports on storage tanks non compliance.

2.3 Registration Regulation

Since 1988, most provinces have developed and implemented mandatory registration. Provincial laws are not legally binding on the federal government or on federal lands. The Registration of Storage Tank Systems for Petroleum Products and Allied Petroleum Products on Federal Lands Regulation was developed in 1997 to address this legislative gap. Its objective is to ensure that the federal government can obtain comprehensive inventory of underground and aboveground storage tank systems on its lands.

These regulations apply to the owners of federally and privately owned storage tank systems which contain petroleum or allied petroleum products and are located on federal lands. The owner of a storage tank system could be any of the following: the Crown, an institution, a corporate entity, a person, an Indian Band, or a government agency/department.

In the case of an owner not being established, INAC, who owns the lands on which the storage tank system is located, is deemed to be the owner of the system.

The owner's responsibility is to register new, in-use or abandoned outside aboveground storage tanks systems having a single or total capacity of 4,000 litres and all underground storage tank systems with INAC. Changes in ownership, alterations, replacement or withdrawal from service of an existing storage tank system must also be reported. The following minimal information is required for registration:

• Name, address of owner and type of facility.
• Name of operator, if different from storage tank owner.
• Name of landowner, if different from storage tank owner.
• Location of storage tank system, if different from address of owner, unless the system is intended to be in place for less than 60 days, whereupon the system may be registered as having one of multiple temporary unspecified locations.
• Capacity of storage tank, or combined capacity of storage tanks if there is more than one in the storage tank system.
• Type of petroleum product or allied petroleum product.
• Year of installation of each storage tank system.
• Type of storage tank and piping material for each storage tank in the system.
• Corrosion protection provided, if applicable.
• Type of pump or pumps.
• Type of leak detection.
• Internal linings, if any.
• Type of secondary containment.
• Number and locations of monitoring wells.
• Type of overfill protection and volatile organic compound (VOC) emission control.
• Manufacturer of each storage tank in the system.
• Type of storage tank, whether horizontal or vertical and diking (for AST only).

It is INAC's responsibility to maintain a consolidated record of all registered storage tank systems on reserve lands, and to provide annual compliance reports to Environment Canada or in Part III of the Department's Main Estimates. These records promote pollution prevention and assist with the effective management of storage tank systems. It should also be noted that if an owner does not register a tank, INAC can report the owner to Environment Canada which potentially could result in action being taken by Environment Canada.

To assist First Nation communities in their understanding of the registration requirements, "on-the-job" training exercises with an experienced tank technology technician or consultant have been developed. Please contact the regional INAC office for current training lists.

Part 3: Storage Tank Releases

3.1 Leaks

A leak can be defined as a slow continued loss of produce over a long period of time. In steel tank, leaks may begin as pinholes in the tank or piping systems. In FRP tank, it usually occurs at joints as a result of poor installation. In all cases, the slow rate of losing product makes leak detection difficult. Without proper detection equipment, it is not uncommon for a loss of 5 L of product per day go undetected for several years, especially if the tank has a large fuel throughput.

3.2 Spills and Overfills

Spills, like overflows, is a sudden loss of product and can happen at any time. A litre or two can easily be released during filling, or when disconnecting hoses. The cumulative impacts of these small releases can have severe detrimental consequences on the environment. For example, one litre of gasoline is sufficient to render 1,000,000 L of water unfit for human consumption. Although leaks are often the most serious form of release, contamination resulting from spills and overfills occurs nearly twice as often. In many cases, these releases are caused by carelessness or accidents, events which for the most part can be prevented.

3.3 Improper Installation

Improper installation of fuel tanks systems are a major cause of product releases. Mishandling of tanks prior to installation, poorly selected equipment or backfill material, or inadequately attached piping can all cause releases to occur. These problems can be easily avoided by choosing a qualified installer, who will follow installation procedures carefully. A qualified installer is usually authorized by the provincial or territorial government storage tank regulator in the province or territory in which the storage tank systems are located.

3.3.1 Juridic Case Related to an Improper Installation

The federal government has been ordered to put $200,000 toward aboriginal environmental protection projects in Northern Ontario after pleading guilty to a fuel spill which occurred near Hudson's Bay. On November 14, 2000, INAC pleaded guilty to pollution charges under the federal Fisheries Act. After a long drawn-out legal process, two private sector firms were also charged.

In this case, fuel oil leaked from a faulty piping system at the Kashechewan First Nation community on the Albany river in 1994, triggering an Environment Canada investigation.

Indian Affairs was fined $1 and ordered to contribute $200,000 to the Kashechewan environmental protection project's fund. One of the private sector firm Ltd. pleaded guilty on September 5, 2000 and was fined $1 and ordered to contribute $40,000 to the

Kashechewan fund and the other private firm pleaded guilty in January 1998 and was fined $15,000.

3.4 Lack of Corrosion Protection

Corrosion is the gradual destruction of a metal or alloy due to chemical process such as oxidation/reduction or the action of a chemical agent. Rust is an iron oxide that is more stable in the natural environment than steel. That is why it requires so much energy to prevent steel tanks and piping from corrosion. Many of the tank systems currently in use consist of unprotected steel. This unprotected steel is susceptible to corrosion whether it is buried underground, in direct contact with the ground surface, or supported above the ground. Many leaks in tank systems occur due to piping failure. Piping is smaller and less sturdy than tanks and is more susceptible to wear. Piping joints and lines are constructed in the field, and are therefore more likely to fail than tanks which are constructed and tested in the factory. Corrosion is the single most common cause of tank and piping system failure.

Part 4: Release Prevention and Detection

4.1 Release Prevention

Proper management of storage tank systems help prevent expensive clean-ups, fire hazards and problems associated with health. The installation of corrosion protection and spill/overfill prevention devices greatly reduce the risk of releases. Regular and accurate monitoring of storage tank systems permits the early detection of releases, thereby minimizing remediation requirements.

4.1.1 Corrosion Protection

One of the greatest downfalls of steel tanks is their susceptibility to corrosion. Steel tanks which are left unprotected can rust very quickly. Pinholes may develop within a year in corrosive environments (e.g. acidic soils), allowing product to slowly leak from the tank system.

Corrosion is much more likely to occur for submerged and embedded metallic structures. Thus all USTs must be corrosion protected when made of metal material. Nonetheless, because steel ASTs are still subject to corrosion caused by adverse weather conditions, the Environmental Codes of Practice also requires steel ASTs to be protected.

As long as the corrosion protection technique is in conformance with the Environmental Codes of Practices, the method used is the tank owner’s choice. The following techniques are used for protection from corrosion:

- **Cathodic Protection** is a highly effective electrical technique. There are two main types of cathodic protection: sacrificial anodes and impressed current.

    - ***Sacrificial Anodes*** are strips of metal, such as magnesium or aluminum, which have a greater tendency to corrode than steel. When attached to the outside of a tank, these strips corrode instead of the tank. Sacrificial anodes must be used in conjunction with a corrosion protection coating.

    - ***Impressed Current*** involves the use of an external power source and anodes to provide a negative current in the soil around the tank. This current creates an environment that is not conducive to corrosion.

- **Corrosion Resistant Coatings** such as epoxy, asphalt, PVC plastic and rust-resistant paint serve to separate the surface of USTs, ASTs and associated piping from the environment. These coatings reduce the current demand on the cathodic protection system. The coating must have the following properties:

- Resist deterioration when exposed to the stored product (in case of spillage or overflow);
- Resist moisture;
- Adhere well to metallic surfaces; and
- Retain physical properties over time.

If a coating is to be used without cathodic protection, this coating must be a corrosion resistant jacket which fully encompasses the tank.

- **Alternative Techniques** could be a non-corrodible material, such as FRP.

In addition to external corrosion, steel tanks can also rust on the inside. This can be caused by several factors:

- Accumulation of water in the tank;
- High oxygen content in the product; and
- Sludge or bacteria buildup in the tank.

Options for internal protection from corrosion include tank liners, rust-resistant coatings of the interior and tank bladders. To decide which technique suits a given tank system application, the owner must seek guidance from a qualified installer/engineer.

4.1.2 Spill/Overfill Protection

Spills occur most often at the fill pipe opening when the delivery truck's hose is being disconnected or from poor connections between the delivery truck hoses and the tank. Repeated releases can cause severe degradation to the environment.

Although overfills are less frequent, they can still result in the release of large volumes to the environment. When a tank is overfilled, product can quickly escape through the vent pipe or fill pipe.

Overfill and spill prevention devices must be installed on all AST and UST systems. Catch basins (i.e. spill box) around the fill pipe will contain overfills and spills when disconnecting. To further prevent overfills, devices must be installed in the tank to either restrict flow, trigger an alarm or automatically shut off the pump when the volume of product entering the tank is approaching the tank's capacity. If a dispenser is attached to the tank, a tray, trough or pan must be installed underneath to collect any releases.

4.1.2.1 Overfill Protection Requirements

With regards to overfill protection, the Technical Guidelines and Environmental Codes of Practice states the following:

USTs: overfill protection is required for all tanks except those storing used oil (as defined in the Code). One of the following methods must be used:

- Mechanical device in fill tube to shut off product flow
- Flow restriction device
- Alarm only device
- Alarm with pump interlock

ASTs: shop-fabricated tanks must have a system that, upon detecting high levels of product in the storage tank, will either:

- Automatically close a valve on the product supply line and/or shut off the pump to terminate the flow product

  OR
- Activate an audible alarm and visual alarm at a location where the personnel are constantly on duty during the product transfer operation

4.1.3 Secondary Containment

Secondary containment must be used for all tank systems (tanks and piping). Secondary containment provides superior protection against product release by providing a barrier between the tank and its surroundings. Secondary containment has a number of advantages:

- It prevents releases from contaminating the environment by containing them within a barrier;
- It reduces the area which must be monitored;
- It concentrates and directs the released product to an observation point. This increases the speed and reliability of leak detection; and
- It allows the recovery of the released product.

The secondary containment system must be impervious and be compatible with the product stored. Some of the secondary containment methods available for UST and AST systems include:

- **Double wall tanks** provide "built-in" secondary containment. If a release occurs through the inner wall, the outer wall will contain any lost product, eliminating the need for costly clean-up. The interstitial space or air space between the two walls can be monitored for leaks so that the tank manager is alerted before any contamination reaches the environment.

- **Concrete vaults** form a secondary containment when USTs or ASTs are placed inside. The vault must be large enough to allow sufficient backfill for the tank, and contain 110% of the contents of the tank. Due to the fact that concrete can become porous, it is advised to treat it with a resin or coating to protect the surface.

- **Impervious berms** are installed outside ASTs. ASTs can be constructed inside a bermed area, provided the berm will contain 110% of the tank's capacity (to allow for rain and thermal expansion). The floor of the bermed area must be sloped away from the tank base towards a sump at a slope greater than 1%. The berm must be constructed of an impermeable substance such as plastic geomembrane or concrete which is compatible with the stored product.

- **Impermeable liners** can be placed inside the excavation to provide secondary containment for the tank. The liner must hold 110% of the contents of the tank.

  Note: Clay is not recommended for use as an impermeable liner because if not maintained properly cracks will occur, rendering the liner useless.

  Another option is a tank bladder which is inserted inside a single walled tank. This type of secondary containment is not appropriate as a long term solution and must not be used when installing a new tank.

4.1.3.1 Secondary Containment Requirements

In regards to secondary containment, the Technical Guidelines and Environmental Codes of Practice, states the following:

USTs:

- Secondary containment is required for all USTs, except those containing motive fuel on Class "B" sites (see Chapter 5 (Tank Installation) for more detailed explanation on Class A and B sites).
- Secondary containment is required for all piping, except for suction piping at Class "B" sites containing motive fuel provided it is designed and installed to meet all requirements outlined in the UST Technical Guidelines.

ASTs:

- Secondary containment is required for all ASTs, except for shop-fabricated ASTs with a capacity of less than 4,000 L.
  Note: ASTs with a capacity of less than 2,500 L or a system of less than 5,000 L installed inside a building must be double walled or have a secondary containment to be in compliance with the CAN/CSA B-139 "Installation Code for Oil-Burning Equipment".
- Secondary containment is required for all underground piping attached to ASTs which is 75mm or less in diameter. Piping greater that 75mm in diameter must either have secondary containment or:
  (1) A precision leak test every 2 years beginning in the fifth year of operation.
  OR
  (2) Piping leak detection.

4.1.4 Maintenance

The most effective way of preventing releases from occurring is by developing a proper maintenance program for the storage tank system. The following tasks must be performed regularly:

- Monitor all leak detection systems to ensure that they are functioning properly.
- Test all systems used for protection from corrosion to ensure an effective level of protection is being achieved.
- Carry out inventory controls (product level, water level). Summary of cumulative losses or gains of product must be compiled on a monthly basis. Inventory records must be maintained for at least 2 years.
- Any unexplained loss > 1.0% of throughput in one month, or inventory reconciliation showing 4 or more consecutive weeks of unexplained loss, or inventory reconciliation showing an unexplained loss in one calendar month, must be reported to the appropriate federal department (e.g. INAC) or Environment Canada.
- Standard product transfer instructions or specific fuel handling procedures must be given to operators and posted in printed form for convenient reference and fill pipes, monitoring wells and vapour recovery connections must be identified using the Canadian Product Petroleum Institute (CPPI) Colour-Symbol System. The principal purpose of this Colour-Symbol System is to identify equipment used to store and handle petroleum product and to identify product transfer points for tank-truck loading and unloading to prevent errors in product handling.
- Carefully inspect ASTs for signs of defects or wear, particularly around piping joints.
- Routine painting of ASTs with a corrosion resistant paint will minimize external corrosion.
- Cleaning dirt or residue off the outer surface will also prolong the tank's life.
- Inspect the area surrounding the fill pipe of the tank for signs of overfills or spills.
- Watch for signs of vandalism, especially around more susceptible regions such as the fill pipe.
- In case of a transfer of ownership, the new owner must notify the appropriate federal department within 30 days and the owner of land must inform purchaser of existence of tanks, prior to closing sale and transfer all as-built drawings.

4.2 Release Detection

All tank systems must be equipped with leak detection devices for both the tank and its piping. There are three main types of leak detection for storage tanks: internal monitoring, external monitoring and interstitial monitoring.

4.2.1 Internal Monitoring

Internal monitoring involves measuring the amount of product inside the tank at specific times. It is appropriate for both USTs and ASTs. Methods of internal monitoring include:

- **Inventory control** is the product volume that is a result of the balance between what is delivered and what is used. Daily measurements of the tank volume are taken using a gauge stick. If daily inventory does not equal the monthly balance, a leak may exist.

- **Manual tank gauging** involves periodically measuring the level of product in a tank using a wooden dip stick supplied by the tank manufacturer. A product change may indicate the existence of a leak. Note that this method cannot detect leaking pipes and must only be used on tanks with a capacity of 9,000L or less.

- **Automatic tank gauging** involves the permanent installation of a probe in the top of the tank which transmits the level of product in the tank to a computer. A test must be carried out every thirty days by checking the product level for changes. Note that this method cannot detect leaking pipes and the accuracy of the measurement becomes much less sensitive as tank size increases.

  Automatic tank gauging methods (e.g. magnetostrictive monitors, ultrasound) are gradually replacing manual inventory control, or "dipsticking" the tank. Automatic tank gauging has several advantages over "dipsticking". It is more accurate and it eliminates human error during measurement and recording. These methods also permit inventory control at remote sites where daily "dispsticking" would be impossible or unfeasible.

  The ultrasound method could also be used as a tank inspection device. It provides a picture of the interior of the tank walls, in addition to indicating the tank wall thickness.

- **Tightness Testing** ensures that a tank or piping has no holes or cracks**.** Tightness testing must be carried out by experts in conjunction with any of the above three methods.

4.2.2 External Monitoring

Some UST tank tests are run outside the tank and piping to look for leaked fuel. As with internal monitoring techniques, external monitoring can be manual or automatic. Manual monitoring involves taking readings with a dip stick and recording the fuel levels. Although manual monitoring is less expensive than automatic monitoring, it requires more time and effort and is more susceptible to error. External monitoring is usually accomplished by one of two means: groundwater monitoring and vapour monitoring.

- **The groundwater monitoring** tests detect the presence of petroleum floating on groundwater and are the most common type of external tests. The number and location of groundwater monitoring wells are crucial and depend on several factors, including soil conditions, the movement of the groundwater, and costs of drilling and materials. Wells must be strategically located to ensure all areas are being monitored effectively.

- **The vapour monitoring** tests looks for motor fuel vapours that have travelled from a leak to the soil surface. Vapour monitors will detect a leak sooner than groundwater monitoring because vapours travel more quickly than liquids. Vapour monitors must only be installed in sites that have no historical contamination in soil or fill as they are quite sensitive and may be set off unnecessarily. Also, due to their sensitivity, vapour monitoring is strongly affected by the product stored in the tank. More volatile substances are more appropriate for vapour monitoring and therefore vapour monitoring is better suited for gasoline sites.

4.2.3 Interstitial Monitoring

Secondary containment provides an effective barrier between the tank and the environment by containing any leaks that may occur. Leaked product from the inner tank or piping is directed towards an "interstitial" monitor located between the inner tank or piping and the outer barrier. Interstitial monitoring methods range from a simple dipstick to a continuous, automated vapor or liquid sensor permanently installed in the system.

4.3 Which Leak Detection Method is Best for You?

There is no one leak detection system that is best for all sites, nor is there a particular type of leak detection that is consistently the least expensive. Each leak detection method has its own unique characteristics.

Identifying the best leak detection for your needs depends on a number of factors including:

- Cost (both capital and long term O & M);
- Facility configuration (complexity of piping runs);
- Groundwater depth;
- Soil type;
- Type of product stored;
- Design of the storage tank system;
- Sensitivity of the site;
- Seasonal rainfall and temperature ranges;
- Availability of experienced installers;
- Experience of the site personnel;
- How well the actual system is managed and maintained; and
- Requirements for the type of system in place.

The importance of locating experienced, professional vendors and installers of leak detection equipment must not be forgotten. They will help you find the most reliable, cost-effective leak detection for your type of facility.

In the Environmental Codes of Practices, the requirements for leak detection refer to "level", i.e. the level of precision and accuracy with which a leak detection method can detect leaks. It does not specify the specific method of leak detection that can be used, only the performance standards that this method must meet. The level of detection required is determined by the type of tank, the sensitivity of site and the product stored.

Part 5: Storage Tank Installation

The installation of storage tanks involves a complex set of procedures. A poorly installed storage tank can have devastating impacts on the surrounding environment. It is recommended that storage tank designs be reviewed and certified by a professional engineer. Once the design is certified, the installation activities must be carried out by a registered tank company or petroleum contractor (preferably under the supervision of a professional engineer). Both the design and installation must be overseen by a tank manager with a clear understanding of the site. All storage tank components and accessories, for which there is either a standard or other recognized documents, must be certified by Underwriter's Laboratories of Canada (ULC).

Any UST design must undergo a site classification to determine the technical requirements that apply. The Technical Guidelines for USTs require that the appropriate federal department (e.g. INAC) classify all underground motive fuel storage tank systems on federal lands. Each proposed site is classified as either a Class A or Class B site based on environmental sensitivity. This requirement also applies to existing USTs.

Class A sites are considered to be more environmentally sensitive than Class B sites. Therefore, storage tank systems located on Class A sites are subject to more stringent design and installation requirements than those located on Class B sites.

5.1 Environmental Assessment

Under the Canadian Environmental Assessment Act (CEAA), federal departments and agencies must undertake an environmental assessment before they carry out any project that commits the federal authority, in whole or in part. For example, the installation or removal of a storage tank is considered a "project" under the CEAA. Although tank related projects are not specifically addressed in the legislation, or CEAA Exclusion List Regulations, EAs are typically conducted since these projects involve polluting substances (such as fuels and oil), and also to demonstrate due diligence. At this moment (2001), the CEAA and Regulations are undergoing a rigorous 5-year review which may eventually require EAs for future tank projects.

Depending on the nature of the project, and the significance of possible environmental effects, the type of assessment required will vary. Most projects are assessed relatively quickly under what is known as a screening type assessment. Larger projects that have potential for greater environmental impacts may require a comprehensive study.

To support sound decision making that is consistent with the principles of sustainable development, the consideration of environmental effects must begin early in the conceptual planning stages of the project, before irreversible decisions are made. In this way, environmental assessment can support the analysis of options and identify issues that may require further consideration.

The environmental assessment should address the following considerations:

1. **Scope and nature of potential effects**. The analysis should build on a preliminary scan to describe, in appropriate detail, the scope and nature of environmental effects that could arise from implementing the proposed project. Environmental effects, including cumulative effects, could result from the use of, or changes in, atmospheric, terrestrial or aquatic resources, physical features or conditions. The analysis should identify positive as well as adverse environmental effects.

2. **The need for mitigation**. The assessment should consider the need for mitigation measures that could reduce or eliminate potential adverse environmental consequences of the proposed project. Mitigation could include, for example, changes in the project parameters, conditions that may need to be placed on specific components of the project or activities arising from the project, or compensation measures.

3. **Scope and nature of residual effects**. The analysis should describe, in appropriate detail, the potential environmental effects that may remain, taking into account mitigation measures.

4. **Follow-up**. The environmental assessment should also consider the need for follow-up measures to monitor environmental effects of the policy, plan or program, or to ensure that implementation of the proposal supports the department's or agency's sustainable development goals.

5. **Public and stakeholder concerns**. The analysis should identify for decision makers, where appropriate, concerns about the environmental effects among those likely to be most affected, and among other stakeholders and members of the public.

5.2 Site Analysis

Tank installation is a site-specific process which is directly influenced by local physical conditions. A thorough knowledge of the site characteristics is therefore critical. Examples of site characteristics include:

- Location of buildings;
- Location of underground structures (e.g. basements, underground cables, utility trenches, etc.);
- Soil structure and permeability;
- Depth to the water table;
- Proximity to sensitive areas (flora, fauna, residential areas vs commercial areas);
- Proximity of surface waters;
- Acidity of Soil (pH); and
- Historic Contamination.

Another reason for the pre-installation site analysis process is to give the contractor an opportunity to observe the site and to note the clearances of power lines, buildings and structures which may not be displayed in the engineering documents. Actual conditions are often different from those laid out in the site plans.

Once background information has been collected and verified, an effective system that is suited to the conditions present at the site can be designed.

It is imperative that tank managers obtain information on the tank that is best suited for their specific site. Although tank managers do not perform the actual installations, it is essential that they have a thorough understanding of the installation process. Here are some factors that must be considered when choosing the location of the storage tank:

- Accessibility;
- Safety;
- Environmental Protection;
- Traffic;
- Space Availability; and
- Aesthetics.

Once a suitable location is found, the next step is to hire a petroleum contractor or environmental consultant to perform the installation. Installation is a complex and important process, thus it is essential that a qualified firm be selected.

5.3 Hiring a Petroleum Contractor or Environmental Consultant

Basic research and careful planning can help the tank manager ensure that the best contracting and consulting services are received. An AST/UST owner or manager will need to hire petroleum contractors or environmental consultants several times over the life of a tank for operations such as: installation, tank testing, upgrading or closure. A consultant undertakes environmental studies (sites assessments, environmental assessments or investigations), engineering design, construction supervision and remediation work on sites contaminated by leaks, spills or overfills. A contractor performs the actual tank installations, removals or other tank-related activities.

An effective way of ensuring quality work is to clearly define the services required from a consultant or contractor in the form of a "terms of reference outline". This is the information that is sent out to various companies for bidding, and outlines the scope of work required at the site. The terms of reference must involve all facets of tank installation, from the pre-installation site analysis to the final testing of the system after installation. Verbal agreements are not sufficient when potential liability is on the tank manager. Without a proper contract, a manager is left with little recourse after a substandard job is delivered.

5.4 Tank Upgrading

Instead of replacing existing storage tank systems, they can often be upgraded to meet current environmental standards. Release prevention and detection equipment can be added to a tank system to extend its useful life.

The tank manager needs to carefully consider the economic and physical feasibility of the upgrade. For example, upgrading an UST is much more difficult than upgrading an AST because the UST will require extensive excavation. If a tank system is badly corroded or in poor shape, the money may well be better invested in a new tank altogether. The following are potential reasons for needing an upgrade:

- **Age of the system** - Many older tanks were manufactured during a time when environmental management was not considered and may lack features which are now considered standard.

- **The high cost of releases** - Storage tank releases threaten the environment and public health and are costly to the tank owner, First Nations and the Federal Government.

- **Not meeting Federal Guidelines** - All UST and AST tank systems must be upgraded to meet the requirements of the Environmental Codes of Practice and the respective CEPA Technical Guidelines.

The following components of a tank system must be upgraded for the purpose of meeting existing technical requirements and extending the working life of a tank:

- Leak detection
- Secondary Containment for Tank & Piping
- Protection from Corrosion
- Overfill Prevention
- Spill containment
- Internal lining (prevent from internal corrosion)
- Tank and Pump Collision Protection

If the upgrading process involves subsurface work, two procedures must be performed as outlined in the Environmental Codes of Practice. They are:

- The as-built drawings of the tank must be updated. These drawings simply indicate the location of piping trenches and joints, fill pipe and release prevention/detection devices.
- A precision leak test must be performed on an UST within thirty days of the completion of the upgrade in order to ensure the integrity of the tank and the piping.

All existing steel piping must be upgraded or replaced whenever the associated storage tanks are upgraded or replaced.

Part 6: Fuel Handling Procedures

Safe handling of fuel is everyone's responsibility. Improper handling of fuel can result in serious injury or death caused by fire, explosion, or asphyxiation. Fuel released into the environment can contaminate surface water, groundwater supplies, flora and fauna. Human error is the primary cause of most spills. If the owner or operator and the delivery driver follow standard practices, nearly all spills can be prevented. The following sections are basic standard practices but are not detailed lists applicable to all situations.

6.1 Prior to Delivery

Prior to a delivery, the **owner or operator** has the responsibility to:

- Inspect fuel delivery slips (manifest).
- Ensure that the proper type of fuel is being delivered and transferred to the correct tank, especially if multiple tanks are used.
- Ensure that the volume available in the tank is greater than the volume of product to be transferred to the tank **before** the transfer is made.
- Unlock and open the fill box.
- Ensure that the transporter uses the proper fittings, hoses, adapters and any other fittings that may be required.
- Ensure that all hoses and equipment to be used are properly connected.
- Explain the operation of and demonstrate to the vehicle operator where the emergency shut down switch is located in the event of a spill or emergency.
- Ensure that the transfer operation is monitored constantly to prevent overfilling and spilling.

It's a good idea to physically measure, and not rely solely on automated devices, the level of fuel that is already in the tank before beginning to re-fill the tank. During re-filling, the delivery person must never leave the tanker unattended while fuel is being transferred. It is important to take extra precautions upfront to avoid costly and potentially disastrous accidents.

6.2 During the Filling

During the filling of the storage tank, it is the responsibility of the **owner or operator** to:

- Remain on the site or patrol the site to check for any leaks or emergencies which could occur during the transfer period.
- If a leak or emergency occurs, the owner or operator shall stop the unloading immediately and advise the transporter of the situation and make any minor repairs or suspend the unloading completely until repairs can be made.

During the filling of the storage tank, it is the responsibility of the **vehicle operator or transporter** to:

- Remain in constant view of the transfer nozzle and fill pipe.
- Remain in constant attendance at the discharge control valve or at the point of hose or pipe connection.
- In the situation where small hoses are used with a hand nozzle, handle these devices so as not to spill any oil on the ground.
- In the event of a spill, initiate the spill response plan.

6.3 After the Delivery

After the transferring process, the **owner or operator** will ensure:

- That the transporter uses proper disconnecting techniques not to spill fuel at the time of disconnect.
- That the transporter uses caps on both ends of the transfer hoses to prevent fuel spillage.
- Along with the transporter, inspect the unloading site. The transporter is responsible to immediately clean oil spills that occurred during the filling operation. If the transporter has a spill, the spill is to be logged in the log book with the amount spilled.
- That all the transporters delivery slips are signed, and release the transporter from the unloading site.
- To dip the fuel tank and to fill in the fuel unloading log book, indicating the amount of fuel that was received and noting all tank levels.
- To put the lock back on the fill box.

Fuel inventories must be kept all year round to ensure the integrity of the system and minimize the amount of fuel which could be lost.

6.4 Other Tips for Fuel Handling

Here are some tips for safe handling:

- Never attempt to start a siphon by mouth.
- Be careful to not overfill the tank on yard and recreational equipment. Just a few ounces of spilled fuel may be enough to contaminate your own well.
- Never re-fill a gas tank while a machine is running or while it's still hot.
- Never smoke while re-fueling.
- Dispose of old fuel properly. Do NOT pour fuel onto the ground, or into storm drains, septic tanks, outhouses, or sewers.
- Never use gasoline as a means to control weeds or pests.

REMEMBER: Overfill protection devices are effective only when combined with careful filling practices.

Part 7: Emergency Planning and Response

In the event of a storage tank release, there may be an initial period of confusion. On-site personnel may be overwhelmed by the situation and unable to effectively deal with the emergency. Contingency planning is one of the most important action elements in response to "release" or "spill" incidences. Proper planning for effective initial response to a release and/or spill incident is critical to limiting both the degree of hazard and the extent of contamination. Contingency planning is essential for a successful response to a hazardous material incident. A Contingency Plan should be developed for any sites having the potential to release contaminants.

7.1 Contingency Planning

A contingency or emergency plan is a detailed program of action, designed to minimize the effects of an emergency. By initiating a proper contingency plan, costly mistakes that could be made during the "heat of the moment" can be avoided.

An emergency plan should be comprehensive, yet clear and concise for easy reference during an emergency. The roles and responsibilities of all players should be clearly defined, areas of risk and hazard should be predetermined, and procedures for dealing with a release should be clearly outlined. Depending on site characteristics and the specifics of the tank system, the complexity of the contingency plan will vary greatly. A typical emergency plan will include the following elements:

- A description of the overall strategy of the plan and provide background information for the users;
- A comprehensive list of site activities and associated risks to assist in assessing the expected type, frequency, and size of product releases that could occur;
- A response organization chart should be included in the contingency plan. The chart should identify the on-site coordinator and emergency response personnel and clearly indicate their roles and responsibilities;
- The proper procedure for making emergency telephone calls and initiating the emergency response;
- A description of the plan of action, including release control techniques and remediation technologies.
- **Training is a key factor** for an effective response in case of a release.

7.2 Initial Response Action

The first step in the event of a release is to carefully assess the situation. Ensure that the release poses no immediate threat to human health or safety, by removing explosive vapours and fire hazards. The response co-ordinator should decide if it will be necessary to evacuate people from the site and/or from the surrounding area.

The second step involves reporting the release immediately to all appropriate municipal, provincial, territorial and federal authorities.

After the incident has been dealt with, the on-site coordinator during the release should write a report outlining the causes and effects of the release, equipment and materials used, people involved and actions taken during the incident. The report should also include details about actions needed to clean-up the site.

Immediate action steps:

- Assess area and situation for health and safety concerns.
- Stop the oil flow (shut off pumps, close valves, etc.).
- Shut down the sump pumps.
- For large spill, shut of ignition sources: motors, electrical circuits, naked lights, extinguish any flames, enforce no smoking.
- Contain the spill (block off the drains with rubber mats and inflatable drain plugs, spread oil absorbant around the drains to prevent the oil from entering the drains as quickly as possible).
- Call for assistance.

7.3 Taking Corrective Action

Depending on the severity of the release, it may be necessary to remove the tank. In most cases, tanks which have leaked will require replacement. If the release has contaminated the surrounding environment, it will be necessary to hire a consultant to perform a site assessment. The purpose of a site assessment is to locate the contamination and to determine the extent of the damages. Once a site assessment has been performed and adequate information about the contamination has been gathered, a contractor or a consultant can be hired to perform the clean-up. The importance of hiring capable and competent contractors and consultants is discussed in more detail in section 5.3.

When releases do occur, being prepared will minimize the potential damage done and the cost associated with the clean-up of the contaminated site.

Part 8: Storage Tank Closure

Changing storage tank systems technologies, new regulations, and changing storage requirements can all cause a storage tank system to become obsolete. The process of removing tanks from service is referred to as tank closure. There are two closure options available to tank managers:

- **Removal** is the process of taking underground storage tanks (USTs) out of the ground; in the case of aboveground storage tanks (ASTs) it is simply removing the tank.
- **Abandonment** is the process of cleaning an underground storage tank system and disposing of it in place.

Removal is a more desirable option than abandonment because it allows inspection of the tank for signs of damage, and permits an effective assessment of the surrounding soil for contamination. Tank closure, like most tank management activities, is a complex process. Many hazards exist when a closure is not performed correctly.

8.1 Potential Hazards of Tank Closure

Storage tank systems often contain flammable or combustible liquids which pose serious environmental and health risks unless properly handled. Storage tanks must always be emptied prior to removal, to avoid leaking or spilling product and possible explosions. Even after a tank has been pumped dry, it will contain vapours from residue or sludge left in the tank. These vapours pose a serious explosion threat, especially when the tank is being transported. Safe tank closure must always include:

- Emptying the tank system;
- Removing the vapours; and,
- Removing any ignition sources.

8.2 Closure Planning

Closure planning must include the following tasks:

- **Environmental Assessment:** See section 5.1.
- **Review:** Carefully review all tank records, including the results of leak detection/tightness tests and monitoring programs. These records will indicate whether or not contamination may be expected.
- **Map Services:** Locate all utilities, sewer lines and water mains at the site. It is much safer (and cheaper) to find these services with a map or geophysical methods than with a backhoe during excavation.
- **Health and Safety:** Create a comprehensive health and safety plan to ensure the protection of the workers and the public. WHMIS (Workplace Hazardous Material Information System) information about the stored product must be included.

- **Contingency Planning:** Develop a contingency plan for actions to be taken in the event of a release or emergency.
- **Product Removal:** The tank manager must make plans for the removal of the tank contents. In many cases, the contents are usable petroleum products which can be stored, used, or sold, saving the owner money and eliminating the need for disposal. If the product cannot be used, recycling is the preferred option. If disposal is necessary, a certified liquid waste hauler must perform the disposal.
- **Tank Disposal:** Plans must also be made for disposing of the old tank. The tank can often be cleaned and recycled as scrap metal. If recycling is not possible, plans must be made for proper disposal. All removed USTs must be made unfit for further use.

Once the above items have been addressed, the process of hiring a contractor or consultant can begin.

8.3 Removing/Abandoning the Tank

Even if these procedures are carried out by the contractor or consultant, it is essential that the manager fully understands the process to ensure that the work is done safely and effectively.

- **Create a Safe Workplace:** Before beginning the tank removal process, the site must be carefully examined for any potential hazards, and the following tasks must be performed:
    - All buried services must be clearly marked on the ground with tape or spray paint.
    - The clearance to any buildings or overhead power lines must be measured.
    - Any ignition sources such as generators must be shut off.
    - Workers must be briefed on the health and safety plan.

- **Emptying the Tank:** The attached piping must first be emptied of product by allowing it to drain back into the tank.

- **Vapour Removal:** For safety reasons, it is essential that all vapours be removed before the tank is removed from the ground. Common methods of vapour removal are as follows:
    - **Purging:** Purging involves the removal of all flammable vapours from the UST or AST. Purging can be accomplished by different methods: e.g. diffused air blower, and steam.
    - **Inerting:** Inerting is the removal of oxygen (O2) from the tank. The goal of inerting is to reduce the level of oxygen below the amount necessary for combustion. Oxygen can be displaced with dry ice or nitrogen.

      Note: The purging method would have to be closely monitored because, it provides oxygen to a highly inflammable area (high risk of explosion if there is an ignition). The most used vapour removal method is dry ice.

  Vapour treatment processes (purging, inerting) do not eliminate vapours entirely. Bottom sludge and scale contain enough product to regenerate vapours. It is important that continuous monitoring be conducted throughout the excavation and preparation for transport process to ensure that the tank is kept safe, even after initial vapour treatment.

- **Tank Removal:** The next stage in tank closure involves the physical removal and disposal of the storage tank. When performing any excavation, the soil must be placed on a tarp to prevent any contamination of additional soil. If this soil is later determined to be uncontaminated, it can then be backfilled into the excavation. Otherwise, the soil will require remediation before backfilling. Once the tank has been removed, sludge and scale must be cleaned from the tank.

  The vent plug must be open at the top of the tank to allow for pressure and temperature changes. The tank must also be clearly labelled to ensure safety after transport and so that proper recycling or disposal can occur. After the removing operations, the storage tank must have openings cut on the sides. This process ensures that the tank will not be used again.

- **Tank Abandonment:** In certain circumstances, it is not feasible to remove a UST. In all cases, however, the soil under and around the storage tank has to be analysed for contamination and a pressure test must be conducted to identify possible leaks. The Environmental Code of Practice for USTs, recommends the abandonment of a UST under the following conditions:
  - The tank is located in whole or in part beneath a permanent building or facility, and the excavation of the tank is not feasible; and/or
  - The tank is inaccessible to the heavy equipment necessary for its removal; and/or
  - The tank is situated in such a way that removing it would endanger the structural integrity of nearby buildings or other facilities.

  Once the Environmental Code of Practice provisions have been met for the abandonment process, the abandonment must occur as follows:
  - Tanks must be purged of vapours.
  - The tank must be filled with inert material (i.e. sand, gravel, concrete). If practical, sufficient holes may be cut along the tank to facilitate filling. If this is not practical, other options for filling must be explored.
  - Associated piping must be removed from service in conformance with NFC, 4.10.3.

  To determine if the soils around the abandoned tank are contaminated, a **site assessment** is required. Additional samples must be taken from a location close to the down-gradient of the tank, to determine if the soil has been contaminated.

- **Tank Inspection:** Once a storage tank has been removed, it must be carefully inspected for evidence of leaks or structural failure such as stress cracks or fractures. Tanks are especially susceptible to leaking along seams, and at pipe fittings. The bottom of the tank must be closely checked for pinholes which are not readily apparent.

8.4 Closure Assessment

Regardless of whether or not the tank inspection reveals evidence of a leak, surrounding areas and the excavation pit must be examined for contamination. If the field screening indicates contamination in the walls or base of the excavation, a full environmental site assessment must be conducted. Even if no contamination is evident, several soil and groundwater samples must be collected for analysis to confirm that no release has occurred. Analyses for Benzene, Toluene, Ethylbenzene, and Xylene (BTEX), Total Petroleum Hydrocarbons (TPH) and other possible contaminants must be performed.

Part 9: Conclusion

9.1 Conclusion

There are 3,000 storage tanks installed in Aboriginal communities across Canada. About half of the 3,000 storage tanks and associated piping are made from a material subject to corrosion and many tanks are approaching or have exceeded their life span. Consequently, the management of storage tank must be a priority for all tank owners and operators.

The management of USTs and ASTs on federal facilities, including on First Nations lands, must be conducted in accordance with the CEPA Technical Guidelines, and all tank managers must have copies of the Technical Guidelines and Environmental Codes of Practice.

Federal property managers or owners of fuel storage tanks on federal lands need to employ a few basic techniques to ensure that they are not forced to deal with a spill and/or a large remediation project. These include:

- The preparation of an environmental assessment early in the planning stage, before new installations are constructed;
- The use of adequate equipment, proper handling procedures and periodic maintenance of tank management systems to avoid leaks and spills;
- The use of proper leak monitoring on all tank installations to detect leaks and spills as soon as possible, before contamination spreads;
- Undertaking a proper environmental site assessment at installations where no leak monitoring or tank testing has been used in the past, in order to identify any possible contamination; and
- Undertaking a proper site investigation at all existing storage tank site locations to obtain the necessary site information required to adequately deal with any possible future spill or leak and to effectively clean up the site.

Preventative approaches don't just make environmental sense, **they save money!** Anticipate and prevent problems before they turn into costly mistakes.

UST and AST releases are dangerous to human health, hazardous to the environment, and extremely costly. Many options exist for preventing and containing releases - **proper, proactive tank management is the key!**