Salt Management in Alberta Highway Maintenance Yards

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Abstract

Alberta has recently revised the standards to which highway maintenance yards are managed, particularly with respect to salt and other ice control chemicals. The intent is to bring the management of the yards in closer accord with the requirements of Alberta Environment and Environment Canada. The new standard calls for the provision of covered storage for salt and freeze proofed sand. It also calls for the management of runoff water that is likely to have come in contact with chlorides. Highway maintenance contractors are responsible for coming up with an environmental management plan that addresses the environmental management of salt, other ice control chemicals and other highway maintenance materials. An engineering consultant assists with the design and development of the yards as well as the development of an Environmental Management Plan which must be submitted and approved by Alberta Infrastructure and Transportation. In addition, the yards are subjected to yearly monitoring by an engineering consultant, the maintenance contractor and the Department to ensure that the salt and other maintenance materials are being managed in a manner that decreases the environmental impact from the yard.

In the most recent round of contracts which were tendered in 2005, highway maintenance contractors were required to include the new environmental provisions into their bids. Therefore, they will be working to develop yards (existing and new) so that they meet the requirements by fall, 2006. The primary method of control is the provision of covered sand and salt storage, which requires large structures of a number of types, ranging from fabric to steel wall structures. Each site is assigned a priority for environmental management, with the most stringent priority requiring that sand be mixed and stacked under cover, for salt deliveries to be made under cover and for a number of other measures to manage chlorides and reasonably ensure they remain on-site. There is also a requirement to control runoff from areas that may reasonably be expected to have salt impact of runoff water. Other methods of control include ponds to capture the runoff as well as the disposal of salt impacted water using approved methods at approved locations.

Working in partnership with Alberta Infrastructure and Infrastructure, the standards and guidelines are being developed to achieve a very high level of control of potential environmentally detrimental materials, and to meet the requirements for mitigating impacts as identified in the legislation and codes of practice.

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1. History

For several decades, up to the mid-90's, Highway Maintenance yards in Alberta were owned, operated and managed by the provincial government. The yards were managed such that the primary control on salt runoff was to store salt (sodium chloride) in covered storage. Almost every yard had a shed which would contain salt for winter operations. Some of the yards, especially the satellite yards had small storage bins which would hold the salt required for mixing and some small amount of salt for winter usage. They were covered by tarps when not in use. The freeze proofed sand was placed on an asphalt pad for the most part. A few sites had ponds to collect the runoff water from the asphalt pads.

In 1996, highway maintenance for the primary highways in Alberta was privatized, with the province broken into 30 separate Contract Maintenance Areas. At this point in time, the sites were leased to maintenance contractors for the work. A limited amount of work was done on the sites, mostly just to maintain or enhance the existing controls. In 2001, Environment Canada began discussing the possibility of listing road salts as a "toxic" substances. At this point, a number of the highway maintenance contracts were also being retendered, and the Department added the secondary highways to the overall workload effectively doubling the provincial highway network. With these new contracts, the Department started selling the Highway Maintenance yards to highway maintenance contractors and Municipalities; and the Department added the requirement for Environmental Management Plans. In most cases, the Environmental Management Plans did not require covered storage for sand storage unless the site was

designated as a Priority 1 site. On many of the new sites, the contractors did construct covered storage for all or most of the sand, as well as construct ponds or other retention systems to collect much or all of the runoff that may possibly have been impacted by salts.

The federal Ministries of Environment and Health published an assessment report in December 2001 that concluded "**that road salts that contain inorganic chloride salts with or without ferrocyanide salts are entering the environment in a quantity or concentration or under conditions that have or may have an immediate or long-term harmful effect on the environment or its biological diversity or that constitute or may constitute a danger to the environment on which life depends. Therefore, it is concluded that road salts that contain inorganic chloride salts with or without ferrocyanide salts are "toxic" as defined in Section 64 of the *Canadian Environmental Protection Act, 1999* (CEPA 1999).**"[1] Ultimately, with input from the various stakeholders, it was determined that road salts would not be declared "toxic", but that the agencies would need to develop methods to manage the impacts of road salts on the environment. Further to that study Environment Canada was tasked with creating a Code of Practice (final Code of Practice for Environment Management of Road Salts was issued on April 3, 2004). The code of practice recommended that road authorities like Alberta develop Salt Management Plans with an implementation target of January 2006.

Alberta, like several other road authorities hired Bob Hodgins of Ecoplans Limited and with considerable industry and government consultation an Environmental Management System was developed. However in Alberta highway maintenance is contracted out to six different Highway Maintenance Contractor and they are responsible for maintaining the network of approximately 30,000 kilometers of roads and 3,767 bridges. Annually the province spends $220 million on maintenance of the network that has a replacement cost of about $20 billion.

Salt conundrum:

Road salt does not pose a significant risk to humans, in fact the salt we use on our highways isn't too much different than the salt we use on our supper. Salt (NaCl) contains chloride and exposure to high levels of chloride can be harmful to plants and wildlife. Chloride ions have an affinity for water so when the snow melts, the ions travel with the runoff or through ground water to the streams and lakes. Toxicity data indicates that about 10% of aquatic species are adversely affected with prolonged exposure to concentrations levels that are greater than 250 milligrams per liter.[2] There are also field studies that document damage to vegetations and shifts in plant species where road salts are used heavily.

We need to use road salts to make our highways, streets and sidewalks safer. Salt is the most valuable tool in the highway snow and ice control toolbox. It has the benefit of being readily

[1]Assessment Report – Road Salt
[Canada Gazette, Part 1 December 1, 2001

[2] "Environmental Impacts of Road Salts"
The Science and Environmental Bulletin – January / February 2002

available, it is reasonably cost effective and it is effective for melting ice at temperatures that are prevalent throughout much of Canada during much of the winter. It's used alone or combined with sand to reduce the ice build up on highways. In Alberta 185,200 tonnes of salt were used in 2004/2005 to combat snow and ice on 27,724 km of 2 lane equivalent paved highways which translates into 6.68 tones per km. Table 1 provides a comparison for other provinces in Canada.

Province	Year	Tonnes Salt	2-Lane Eq	Tonnes/ km
Alberta	04/05	185,200	27,724	6.68
Manitoba	05/06	49,277	12,000	4.11
Ontario	05/06	616,070	16,500	37.34

Table 1

With respect to maintenance yards, the primary issue is that any of the runoff that has salt content has the potential to run off-site and adversely affect adjacent properties. Also, if the soil is permeable enough, the salt-impacted water can percolate through the soil into the groundwater.

2. New Requirements

2.1. Environmental Management Plan Guidelines – Highway Maintenance Yards

In 2005, Alberta Infrastructure and Transportation retendered 17 of the 30 Contract Maintenance Areas. The Department also upgraded the Environmental Management Plans requirements. The primary upgrade restricted the criteria to which the maintenance sites could be constructed. In the new requirements, the sites were restricted to being Priority 1 (High Priority) or Priority 2 (Medium Priority) sites, and they require covered storage for the pickled sand. Priority 3 (Low Priority) sites were no longer an option. A contractual requirement is to have the Environmental Management Plans developed and implemented by the fall of 2006.

Since all the salt used on the provincial network must first be stored at the highway maintenance yards (patrol yards), like most jurisdictions, Alberta has developed a strategy for the yards. The strategy began with a department wide EMS (Environmental Management System) that address road salt issues related to salt storage, snow disposal, and salt application.

In Alberta the provincial department of Environment is tasked as the regulating body, for which the following EMS excerpt provides an outline for responding to adverse impacts caused by salt from highway maintenance yards or other sources:

2.2. Environmental Protection and Enhancement Act (EPEA)

<u>"Salt Contamination and Remediation</u>

The *Salt Contamination Assessment and Remediation Guidelines* govern salt releases that occur in association with "salt/sand processing and storage facilities at highway maintenance yards". Alberta Environment (AENV) regulates the release of salt through the general release of

substances provisions under EPEA. Any remediation of salt impacted lands must meet the requirements of EPEA – specifically Part 5, Division 1. This includes prevention and mitigation of adverse effects caused by a release of salt into the environment and reclamation when there has been an impact.

The guidelines provide generic remediation procedures and objectives (soil and water quality guidelines). As an alternative, a site-specific risk management approach may be used to develop site-specific remediation procedures and objectives. The guidelines contain a comprehensive risk assessment procedure and outline various remediation methods and procedures that may be utilized on a site-specific basis."[3]

In addition, Alberta Infrastructure and Transportation has taken a systematic approach to identifying, evaluating, and prioritizing the environmental issues associated with activities, products and services. The prioritization allows the Department to focus on the aspects with the most significant environmental impacts. The Department has developed a responsibility matrix that outlines the required procedures and practices for all of the activities that it contracts out.

The responsibility matrix references the Department's Contract Administration Manual and the Highway Maintenance Specifications, but in reality the strategy and transfer begins with the Request for Proposal (tender documents). The section entitled "Storage of Treated Sand" states that the chloride treated sand shall be sheltered in indoor structures and contractors must supply the department with Environmental Management Plans (EMP's) that meet the requirements of the Environmental Management Strategy (EMS). Further, if the chosen Contractor maintenance facility is a "High Priority Site" the facility needs to be large enough that all mixing can be accomplished inside the structure. The section entitled "Environmental Management of Maintenance Facilities" outlines future requirements related to ground water monitoring, inspections and fines associated with the EMP's.

Alberta Infrastructure and Transportation makes no separate payment to the contractor for the provision of these facilities, but rather the Department expects the contractor to include the cost associated with the environmental responsibility and incorporate it into the "Indirect Operating Cost" (IOC). IOC is paid monthly over the term of the contract (5 to 7 year term) and cannot exceed 43% of the overall contract. Performance measures have been adjusted to include an environmental measure, but no bonuses or fines are incorporated in performance measures.

3. Mitigation

Alberta Infrastructure and Transportations requirements for Environmental Management plans closely follow TAC's Code of Practice for Design of Road Maintenance Yards.

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[3] *http://www.infratrans.gov.ab.ca/INFTRA_Content/docType245/Production/ATEMSV2.pdf*

3.1. Covered Sand/Salt Storage

All Maintenance Sites require covered storage for the sand and salt. The requirements from the "*Environmental Management Plan Guidelines – Highway Maintenance Yards"* are as follows for each Priority:

Priority 1 (High Priority Sites), the criteria are as follows:

- Within 300 meters of a watercourse or permanent open water body.
- In or near communities where the water supply is obtained from shallow aquifers.
- Where the surficial soil texture (1.5 metre surface) has a median grain size greater than 75 microns.

Which then leads to the following structure requirements:

- Construction of an "all-weather" shelter of appropriate size to;
- Enclose on-site salt requirements,
- Enclose the salt unloading activities
- Store annual volume of salt/sand storage,
- Enclose mixing and loading operations.

Priority 2 (Medium Priority Sites), the criteria are as follows:

- Not meeting Priority 1 requirements
- With limited or no information about contamination.
- Not in close proximity to water supplies.

Which then leads to the following structure requirements:

- Construction of an "all-weather" shelter of appropriate size to;
- Contain annual volume of salt/sand storage,
- Provide asphalt containment area for salt impacted material,
- Provide a lined containment pond for runoff water.

Priority 3 (Low Priority Sites)

- Those sites not considered a concern for contamination.
- This category is not allowed in the latest round of Highway Maintenance contracts, as all highway maintenance yards are considered a concern for contamination.

Advantages of covered storage for the entire sand and salt requirement is that it will limit the amount of material containing salt that would potentially come in contact with water and be subject to flowing off-site. While it won't contain all salt on the property, as there is still some salt that will be tracked by the snowplow trucks, it will significantly reduce the potential quantity. Covered storage also reduces the impact of wind on the stockpile so that the salt is not blown onto adjacent properties. There is also the advantage that dust from the freezeproofed sand stockpile is contained within the building for the most part.

For Priority 1 (High Priority Sites), all of the mixing operations will be undertaken inside. This requires that most of the stacker be kept inside the structure, even as the structure reaches full capacity. In order to mix inside, the structure must be tall enough for the stacker to achieve it's full stacking height. This typically requires clearances of 30' or more in the centre of the structure. The efficiency of the structure for storing sand and salt is greatest when the materials

are stored at the maximum height possible given the angle of repose of the material. The efficiency of the structure is also maximized when retaining walls are used along the perimeter of the building. Retaining walls are typically either of the permanent, poured-in-place concrete type or non-permanent lock block type retaining walls.

For Priority 1 sites, the requirement to mix inside also effectively requires that the sand and salt are kept in the same structure. In this way, the materials can be loaded into the stacker while minimizing the opportunities for any salt to be dropped outside the building, and the operation is protected from wind and rain. Unmixed "virgin" sand is stored outside of the structure until it is mixed. The "virgin" sand is kept on an asphalt pad to minimize the chances that it will be contaminated with oversize rock. Typical requirements for sand in Alberta range from 5 to 10 mm topsize, with the options for using 10 mm topsize sand being much more restricted relative to historical practise, to the point that it will have very limited application from the winter of 2006 onwards in much of Alberta. Mixing/stacking operations are shown in Figure 1.

Covered storage of the freezeproofed sand allows for the possibility of reducing the quantity of salt used for freezeproofing, as the losses due to leaching and other causes are minimized. Historically typical percentages of salt added for freezeproofing are in the 4.5% to 6.5% by weight range. (Some areas in the province undertake their freezeproofing at a higher percentage, in some cases exceeding 10%.) Covering the sand will allow a reduction typically down into the 3.5% by weight range with minimal anticipated effect on freezeproofing effectiveness.

Covered storage also minimizes the requirement to re-mix the freeze proofed sand. When the sand is stored out in the open, rain can leach the salt out of the stockpile, especially the exterior layers. This has historically been the single greatest source of salt leaching off-site, and it also results in a layer of sand that freezes easier in the winter. Eliminating re-mixing also minimizes the usage of additional salt, so it should reduce the overall yearly salt quantity requirements. Remixed sand would typically be required for 10 to 40% of the annual quantity stockpiled depending on the severity of the winter weather (typically 10 to 25% is left over after the winter). If remixing is not required, this would reduce the annual salt requirements by approximately 3 to 7%.

In the design for the covered storage it is preferred that the fresh water flow from the sides of the structure are drained away and kept separate from the salt impacted drainage. Fresh water flow from the roof of the structure is also mostly drained away from the "designated" area so it doesn't mix with salt impacted water.

The snowplow trucks can be loaded inside the structures in most circumstances. There are some loading restrictions for trucks in the smaller structures (below 80' wide), especially when they are filled to their design quantities of sand and salt. It may be difficult to get both the truck and loader into the small space that may be remaining, so the truck may not fully fit into smaller structures to the extent that the loader can easily get at the side of the truck for loading.

In Alberta covered structures are typically designed as either fabric or steel structures. (Some wood domes remain from when the provincial government was doing the work.) Typical costs for these structures range upwards from \$20/ft^2 (\$215/m^2), including the retaining walls and

asphalt floor. Depending on the quantity of material, the costs range from $100/t to $40/t for the freezeproofed sand stored. This cost does not include the other site work that needs to be undertaken around the structures to ensure they function in accordance with the design criteria. Sizes of structures tend to range from around 7,000 ft^2 (650 m^2) to over 20,000 ft^2 (1,858 m^2) and in some cases may approach or exceed 30,000 ft^2 (2,787 m^2). Typical storage capacity ranges from 1,500 tonnes of sand to 10,000 tonnes or more. Overall costs to develop the covered sand/salt storage for the province of Alberta is likely to approach the order of magnitude of $25 million by the time all of the highway maintenance sites are developed to meet the latest requirements. It should be noted that this is said with the understanding that there have been significant recent inflationary pressures on the costs of materials and construction costs for undertaking the work. Because the structures are being built as part of the contract, the costs for the structures will amortized over many years (10 to 20 years generally) and will only affect the Department's budget incrementally. Amortization periods will depend on the strategy of the contractor regarding the timeframes they desire to pay off the capital costs.

Examples of covered storage are shown in Figure 2 and Figure 3.

Two of the primary limiting factors in terms of constructing these structures are lead time and local manufacturing capacity to manufacture and erect them. This is a difficult task when there are an estimated 75 or more new or upgraded structures that are needed prior to fall 2006, especially when the last of the contracts were awarded in early 2006.

3.2. Salt Delivery and Salt Dust Control

For Priority 1 (High Priority Sites), the primary method of salt dust control is to deliver the salt inside the structure. The buildings need to be designed so that the salt delivery trucks can enter and exit the buildings while requiring only the typical skills of the average professional truck driver. If the B-train trailers need to be disconnected to unload, the process becomes much more difficult as well as much more costly for the supply of material.

For Priority 2 sites, the salt can be delivered from the outside, and it is either conveyered into the structure, or delivered pneumatically. Most salt storage structures capable of using pneumatic delivery systems will be out of service after the completion of the latest sand/salt structure construction program.

A desirable design criteria for the structures is that the door for delivering the salt and the main entrance door is located on the normal downwind side of the structure. This allows the structure to act as a windbreak. Alternatively, placing the door on the side of the structure perpendicular to the prevailing wind direction is an option. It's not always possible to do this at some sites since some yards have significant restrictions on potential building locations and orientations, especially the yards that were long time highway maintenance facilities designed before privatization. In most cases, these were not developed in such a way that modern environmental standards are easily implementable and locating large structures on the sites can be problematic. Whenever possible, it is desirable for the salt to be delivered during periods of minimal wind or otherwise avoiding poor weather so that the chances of wind and rain carrying the salt off-site are reduced.

3.3. Asphalt Pads

Each site will drain water that may have been significantly impacted by salts on an asphalt pad. The inside of the covered storage will also be surfaced with an asphalt pad. The asphalt pads will be of minimum possible dimensions to collect the salt impacted runoff water and still contain any reasonably likely material spills from loading, hauling, salt delivery or mixing operations.

The drainage on the asphalt pad needs to be designed and maintained so standing water is kept off the pad, as the permeability of the pad becomes an issue if water is given time to percolate through it. Maintenance of the asphalt pad is also important, so that imperfections are minimized that could allow moisture to infiltrate through the surface. Cracksealing and other surface seals may be required if the pad starts to crack or deteriorate. Also, patching repairs may be required if the pad deteriorates significantly in spots.

3.4. Retention Ponds

Sites with retention ponds will be constructed with an asphalt pad that drains into the ponds from salt impacted areas around the sand/salt storage structures. The ponds will be lined with a UV stabilized plastic liner that is durable and waterproof. Ponds will be designed to prevent overtopping under most conceivable circumstances and/or flooding from outside the designated drainage area.

Ponds are designed to handle the degree of runoff that the Contractor and their engineering Consultant believe would be appropriate to handle in a typical year. The strategy will take into account the desired frequency with which the contractor may need to or desires to pump out the water and dispose of it, versus a strategy where the water will be retained and will, with high probability, evaporate to a sufficient extent that it does not need to be pumped out at any frequency.

A typical retention pond is shown in Figure 4.

3.5. Retention Pond Water Management

One significant issue for the Environmental Management Plans is the disposal of the pond water. At the present time, the approved locations are “salt-water injection wells or other locations approved by Alberta Environment.” Salt-water injection wells can be very expensive. Typical costs for disposal can range from approximately to $0.025 to $0.10/litre of water. When ponds are in the range of 200,000 litres to nearly 2,000,000 litres of water the costs can add up very quickly. This is a very strong incentive for finding alternative methods of disposal. Operators of the injection wells are reluctant to accept pond water as they claim the concentrations aren’t typically high enough to justify taking the water out of the hydrological cycle, and relatively low salt concentrations can cause problems with the operation of the well.

At the present time, other options for water disposal are very limited. Disposal into salt-water injection wells is very expensive and there are limited locations that will accept this water. Historical methods for using the water directly such as dust control on gravel roads have also been very restricted, and are currently not approved methods. In some cases, the water has been used to mix with other dust control chemicals.

At this time, the Department is working with an engineering consultant to determine methods for disposing of pond water using methods that are acceptable to Alberta Environment. Due to the costs of managing and disposing the water, the overall issue is a very significant one for the contractors. There is a great deal of motivation to find alternative methods for disposal and for minimizing the quantity of water that is being dealt with. There is some thought that if the water could reach a standard that is normally considered acceptable for drinking water or for agriculture, somewhere in the 200 to 250 up to 800 parts per million range, that the water could be disposed of by alternative means, however, this standard has not been approved at the time of this writing. It is also not an easy standard to achieve. Typical concentrations of salt in ponds have been in the range of less than 0.05% (500 ppm) to 1.5% (15,000 ppm) depending on the volume of water in the pond and the precipitation that has occurred at the site in the recent past. Significant rainfall has the effect of leaching more salt from the sand stockpile, therefore increasing salt concentrations. However, it also has the effect of increasing the fresh water in the pond, therefore decreasing salt concentrations. Depending on conditions in the stockpile, this may or may not result in greater concentrations of salt in the retention pond (s). The effect that is most dominant depends on a number of factors; previous rainfalls, salt concentration in the stockpile, duration of precipitation, extent of “crusting” over on the sand stockpile, etc. All of these impacts will be significantly reduced with the covered storage of freezeproofed sand and salt and other chlorides.

One potential method of disposing of the water is to use evaporation, particularly methods that enhance natural evaporation. There are a number of methods to accomplish this goal, such as spraying the water onto the asphalt pad and allowing the wind and sun to increase the overall evaporation rate. Other methods involve using filter fabric to help wick the water up to increase the water evaporation. Pumping the water into shallow pans is also a method that may prove suitable. There are a number of similar methods that have potential usage. Another option is to enhance evaporation by heating the water (distillation). However, as fuel costs rise, this becomes a much less cost effective option as water takes significant energy to evaporate in this manner. At this time, a determination of the most effective enhancement of the evaporation process has not been determined. One side effect of evaporation is that it increases the concentration of the salt in the remaining water. While this means that the most likely disposal location for the water will be a salt-water injection well, the reduced quantities make this a much more reasonable option from a cost perspective. It also means that less water is taken out of the overall hydrological cycle.

Other methods of removing salt such as reverse osmosis and electrochemical removal of the salt have also been looked into, although a cost effective alternative process has not yet been identified.

3.6. Wash Water Management

Apart from the collection of water runoff from the designated area (areas with moderate to significant salt impact) the other major issue is the collection and maintenance of water that from the truck washing operation. Snowplow trucks need to be washed frequently to keep them from deteriorating due to premature rusting. Especially in the rural areas, where the maintenance yards do not have access to sanitary sewer systems, there is a requirement to collect and control the wash water, and then find suitable means of disposal. Wash water needs to be collected, either by using storage tanks or ponds. Wash water also needs to be separated from other contaminants such as hydrocarbons and silts. In many existing highway maintenance sites, there were little if any controls in place to keep the wash water from flowing off-site or into the groundwater.

Once the wash water is collected it will be handled in much the same way as the other salt impacted water. It is likely that it will have a somewhat higher concentration of salt water because it will have come in direct contact with the sand and salt residue on the truck, as opposed to the small amount of sand and salt that potentially may fall off the trucks outside the structures.

3.7. Alternative Ice Control Chemicals

The use of other ice control chemicals, especially liquids for pre-wetting operations can help reduce the requirements for salt under many winter maintenance conditions. Some of the liquid options available are magnesium chloride ($MgCl_2$) and calcium chloride ($CaCl_2$). Salt brine is also a potential ice control chemical that can be used to aid the effectiveness of dry salt and freeze proofed sand under specific road and weather conditions.

Pre-wetting chemicals are particularly effective at helping sand and salt stick to the highway. In most cases, this should allow for a reduction in material requirements, as more of the material stays on the highway, therefore, increasing it's effectiveness. They also aid in decreasing the time it takes for the de-icing chemical to work under most conditions, which helps increase the level of service for highway maintenance. Using pre-wetting to reduce the salt requirements aids in the overall management of salt impacts, as the resultant reduction in salt deliveries means that there are fewer opportunities for spills or other chloride releases into undesirable areas.

These alternative chemicals need to be stored so that they have containment. In most cases, separate containment will be provided, which will contain most typical spills and allow for some recovery of the spilled material. If the spill is very significant, any overflow will flow into the "designated" salt water drainage area and retention pond system.

3.8. Snow Storage

The snow that is located on the "designated area" of the asphalt pad needs to be cleared and stored so that the runoff from the melting snow is diverted into the ponds, especially if it has any

amount of salt contamination. Designated areas for storage of the snow need to be set up at each maintenance yard.

3.9. Risk Management

On the older sites that were highway maintenance sites prior to the privatization of the work, there is evidence of salt infiltration both on-site and in most cases off-site as well. In some cases, the salt contamination off-site has become significant and has caused impact to the adjacent landowner. Many of the previously existing highway maintenance yards were purchased by contractors.

There are no known cost effective methods to clean salt from highway maintenance yards at this point in time. Remediation is extremely difficult for most sites without having to undertake such significant works that the site would become impossible to operate to provide normal highway maintenance operations.

4. Operational Procedures and Training

4.1. Housekeeping

Housekeeping is a critical component of managing the highway maintenance sites. Any spills of salt must be cleaned up and stored back in the structure under cover. Any materials that have the potential for salt impacts on runoff need to be either returned back to the sand/salt storage structure or placed in and along the designated area so that salt will return to the pond.

4.2. Training

Foremen and operators require training so that they can operate and maintain the sites according to the environmental design principles. The greater the understanding operational forces have regarding the requirements, the greater the likelihood that the site will be operated in an environmentally responsible manner. While there is currently basic training on environmental procedures for maintenance yards, the required training will need to be site specific.

This training will need to be provided and implemented prior to fall, 2006.

5. Monitoring

As part of the Environmental Management Plans, the sites will be monitored on a monthly basis by the contractor's personnel. Twice per year, the sites will be inspected by an Engineering Consultant hired by the contractor to review the status of the environmental management of the site. They will be required to provide a report reviewing the performance of the environmental measures relative to the design requirements. Each site will also have a number of monitoring wells on site to monitor ground water quality. The minimum number is 3, (one well hydraulically up-gradient and two hydraulically down-gradient) but more may be required to provide the required degree of site monitoring. These wells will be tested bi-annually to monitor

the quantity of chlorides and other potentially deleterious materials in the groundwater which may prove harmful if they get off-site or into the groundwater.

Representatives of Alberta Infrastructure and Transportation will conduct inspections of the site on an audit basis. They will also make arrangements for an Engineering Consultant of their choosing to audit some of the sites yearly to ensure that they are being managed according to design.

6. Future

The upcoming winter of 2006/07 will provide a good test of the success of the new salt management requirements. Operation of the sites will test their functionality and their ability to meet the requirements for control of salt in a positive manner. While it is not expected that the measures undertaken will reduce salt impacts to zero, it is anticipated that there will be a one to two order of magnitude reduction in issues resulting from the new developments. By the summer of 2007, it should be possible to quantify the impact of the changes and how close they have come to achieving the overall goals of responsible salt management practices.

7. Conclusions

The proposal by Environment Canada to designate road salts as "toxic" substances has had a significant impact on the highway maintenance contracting industry in Alberta. While the ultimate decision was not to designate salts as "toxic", it was clear that changes in the typical operating procedures for the sites would need to change. The requirements to enclose the salt treated sand will represent an estimated expenditure exceeding 25 million dollar for the structures alone. (exact costs are contractor proprietary information.) There are also other costs required to manage the runoff water and wash water from the trucks, such as construction and management of retention ponds and asphalt pads, and other supplementary costs for developing the sites to achieve all of the requirements of the guidelines. This also does not include the engineering costs related to the EMP's, with ground water and pond water monitoring also having long term cost implications. All these costs will eventually reach the tax payers of Alberta, fortunately they will be received incrementally. Some of these costs have been incurred due to previous development of sites as the requirements have developed. Other costs have yet to be incurred as they will be incurred in future retenders of the highway maintenance contracts.

Overall, these costs are anticipated to translate into an estimated annual expenditure of $3 to $4 million dollars per year to implement the new salt management requirements, also given requirements to consider current inflationary pressures. This is in the range of 10% to 25% of the current overall costs of supplying the sand and salt materials for the province on an annual basis. This is somewhat offset by the savings in reduced salt requirements that covered storage will bring. It also will result in a stabilization or reduction in the long term potential liability for clean-up or payment of compensation, which is also estimated to be a multi-million dollar requirement. The accrued liability that the government estimates it has for costs to mediate or clean up off-site salt contamination from highway maintenance yards they previously owned is

estimated to be in the 10’s of millions of dollars, including potential property purchases and remediation efforts.

Figure 1: Interior Mixing/Stacking Operation (Lethbridge)

Figure 2: Steel Sand/Salt Storage Structure (Lethbridge)

Figure 3: Fabric Sand/Salt Storage Structure (Nanton)

Figure 4: Retention Pond (Taber)