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CRITICAL MATERIALS HANDBOOK
Table of Contents

TECHNICAL ADVISORY COMMITTEE
ACKNOWLEDGEMENTS

Section I. Introduction
   A. Purpose and Use of this Handbook.

Section II. Critical Materials
   A. Critical Materials Definitions.
   B. Critical Materials List.
   C. Critical Materials Activity List.
   D. Identification of Critical Material Use Activities.

Section III. Best Management Practices for the Prevention and Control of Spills
   A. Selecting a Secondary Containment Site
   B. Constructing a Secondary Containment Site
   C. Containment Options
   D. Operating and Maintaining a Secondary Containment System
   E. Construction/Management Alternatives for Storm Water
   F. Who to Contact

Section IV. Spill Control
   A. Application of spill control technology and methodology.
   B. Structural methods for the control of spills.
   C. Containment Volume of Secondary Containment Systems.
   D. Model spill prevention, control and clean-up plan.

APPENDIX A
CRITICAL MATERIALS LIST and CRITICAL MATERIALS ACTIVITY LIST

APPENDIX B
NORTH AMERICAN INDUSTRIAL CLASSIFICATION CODES for Activities Most Likely to Involve Chemicals

APPENDIX C
Best Management Practice (BMP) design concepts
   List of Exhibits

APPENDIX D
Sample Inspection Checklists
TECHNICAL ADVISORY COMMITTEE

The original Technical Advisory Committee was created in 1977 to oversee the technical aspects of the development of the Water Quality Management Plan. This group has evolved to those agencies that are responsible for aquifer protection and enforcement within the City of Spokane. The development of this manual was possible with the cooperation of other agencies that have an enforcement role in the protection of the Spokane Aquifer. It is intended that this Committee will continue to operate in cooperation with the Regional Aquifer Protection agencies to be able to maintain and update this manual.

ACKNOWLEDGEMENTS

This handbook reflects the contributions of a large number of individuals and organizations. We would like to thank those who have contributed material and reviewed text. Specifically, the State of Idaho Department of Environmental Quality is recognized for their cooperation in allowing this document to use part of the Kootenai County manual they developed.
Section I. Introduction

A. Purpose and Use of this Handbook.

The Aquifer Sensitive Area Overlay Zone (Section 4. 16A.000 of the Spokane County Zoning Code) and Spokane Municipal Code Section 17E.010 contains several performance criteria (Section 4.16A.050(4)) which, if satisfied, would result in nearly complete protection of both surface and ground water from any adverse impacts resulting from critical material spills. It is the intent that the freedom of design allowed by stating performance criteria in the Code will result in control measures being developed which apply to each specific problem. This in turn should result in the most cost effective solution for each job. There are a number of tested and proven methods for preventing and controlling spills. In this handbook we present in a general way many of these ideas.

It is the intent of this manual to provide information that will be useful to several segments of the community. Those who are considering locating an activity that uses critical materials within the Aquifer Protection Area will be able to get a general idea of the situations most likely to result in spills, some mechanisms that may be employed to reduce the likelihood of a spill and some control measures that may be required to contain those spills that do occur. Facility designers unfamiliar with spill control facilities may find ideas that can be employed directly or modified to fit particular situations they encounter in their day to day work. Those entrusted with enforcing the provisions of the Zoning Code may use the ideas presented here as a yardstick against which they may judge the effectiveness of proposed spill protection measures.

In using any of these ideas for specific applications care must be taken to avoid interpreting the information presented in the handbook too literally. For example, several types of impervious liners are indicated in different diagrams. The type specified in the diagram may not be appropriate for the product involved in a particular situation; an appropriate liner should be called for in the design, not the one shown in the diagram.

In general the Aquifer Sensitive Area Overlay Zone requires the use of structural secondary containment systems in areas where critical materials will be stored or used. A large portion of this handbook is directed at providing exhibits of ideas that can be used to design such facilities. However, successful operation of any program to prevent product spills or leaks from reaching the aquifer requires an integrated approach. Proper employee training, facility maintenance and spill clean up planning are also required.

When necessary reference the Spokane Regional Stormwater Manual regarding standards for stormwater design and management to protect water quality, natural
drainage systems and down-gradient properties as urban development occurs. The purpose of the manual is to help communities in the Spokane region protect water quality, prevent adverse impacts from flooding, and control stormwater runoff to levels equivalent to those that occurred prior to development. During the revision process of this Handbook, the manual was referenced and some content was utilized.
### Section II.
#### Critical Materials

**A. Critical Materials Definitions.**

**Glossary**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate</td>
<td>Total amount of critical material constituents from every container on site.</td>
</tr>
<tr>
<td>AST</td>
<td>Above Ground Storage Tank - One tank, or a combination of tanks, including connected piping, that is used to contain critical materials, and whose volume is greater than 90% above ground.</td>
</tr>
<tr>
<td>Base Flood Elevation</td>
<td>The elevation of a 100-year flood.</td>
</tr>
<tr>
<td>BMP</td>
<td>Best Management Practice - A practice or combination of practices determined to be the most effective and practical means of preventing or reducing contamination to soil or ground water.</td>
</tr>
<tr>
<td>CAS</td>
<td>Chemical Abstract Service.</td>
</tr>
<tr>
<td>CMR</td>
<td>Critical Materials Regulation.</td>
</tr>
<tr>
<td>Critical Material</td>
<td>A critical material is compound or substance, or class thereof, designated by the division director of public works and utilities which, by intentional or accidental release into the aquifer, could result in the impairment of one or more of the beneficial uses of aquifer water and/or impair aquifer water quality indicator levels. Beneficial uses include, but are not limited to:</td>
</tr>
<tr>
<td></td>
<td>A. domestic and industrial water supply,</td>
</tr>
<tr>
<td></td>
<td>B. agricultural irrigation,</td>
</tr>
<tr>
<td></td>
<td>C. stock water, and</td>
</tr>
<tr>
<td></td>
<td>D. fish propagation.</td>
</tr>
<tr>
<td>DOE</td>
<td>State of Washington, Department of Ecology</td>
</tr>
<tr>
<td>Freeboard</td>
<td>Vertical distance between the top of the containment wall, and the surface of the material contained therein.</td>
</tr>
<tr>
<td>Medium</td>
<td>Refers to a mixture, wherein the medium is generally the larger, nonhazardous, and non-reactive portion of the mixture.</td>
</tr>
<tr>
<td>MSDS</td>
<td>Material Safety Data Sheet.</td>
</tr>
</tbody>
</table>
NDWW  Non-domestic Waste Water.
OPA    Oil Pollution Act.
OSHA   Occupational Safety and Health Administration.
OWS    Oil/ Water Separator.
SARA   Superfund Amendments Reauthorization Act.
SRHD   Spokane Regional Health District.
Sheen  A petroleum product layer, on water, less than 0.1 inches in depth. Visually identified by a bright, reflective layer on water, ranging in color from silver to a rainbow hue.
Site   A parcel, or contiguous parcels, of land on which a single business or operation takes place, or an individual business or operational entity among multiple businesses within a single parcel of land.
Solvent A substance in which a chemical is dissolved. Usually the substance present in larger quantity and/or the substance that does not change state when mixed
WAC    A numbering designation for all administrative rules in Washington.

B. Critical Materials List.

In order to standardize the names and quantities of products to be included under the critical material definition, a Critical Materials List has been established. The list contains both the name of a product and the quantity of that product which is considered to pose a threat to aquifer quality, referred to as the critical quantity. The core of this list is the discarded chemical products list contained in the State Dangerous Waste Regulations WAC 173-303. In addition, any substance for which a criteria level has been established by a local, state or federal agency has been added to this core. As used here a criteria level is a concentration at which a beneficial use is impaired. Where more than one criteria level for any given chemical or class of chemicals has been set, the lowest concentration was used to calculate the critical quantity. This list is discussed in Appendix A of this document.

The critical quantity of a product is calculated by determining the amount of material needed to raise the average concentration in a plume conforming to the shape of one-half of a right circular cone with a vertex angle of three degrees and an axis length of one-half mile to the criteria level. For most situations in the Spokane Valley-Rathdrum Prairie Aquifer this is equivalent to the amount of material needed
to effect the tabulated (established threshold) concentration increase in 84 million gallons of water.

The critical quantity for products is denoted on the critical material list. All products are regulated in regards to handling and best management practices and will be subject to review for containment requirements. The handling of hazardous/waste materials will be in accordance with applicable laws.

In many cases product mixtures not appearing directly on the list should be controlled because one or more of the components is on the list. Where this is the case the component which results in the smallest critical quantity should be used in establishing the regulated amount.

C. Critical Materials Activity List.

The identification of activities which will have critical materials on site is the key to effective implementation of this overlay zone. The Critical Materials Activity List provides a relatively simple means for accomplishing this task. These sources have been updated with more recent information where possible. This list includes the business activity, the Standard Industrial Classification (SIC) and North American Industrial Classification System (NAICS) codes associated with that activity, the types of products reported as being used in the activity in the surveys and where available information on the quantity of product typically found. This list is included in Appendix A of this handbook.

Also included in this handbook is a general listing of businesses having SIC and NAICS codes associated with activities likely to store and/or transport or use critical materials. (See Appendix B) This list should be referred to when the initial review of a proposed project includes activities not found on the Critical Materials Use Activity List. Any activity found on this list but not included on the preceding list should be examined in detail for the potential use of critical materials. If it is found that the activity does involve critical materials, subsequent action should be taken to include the activity on the Critical Materials Use Activity List.

D. Identification of Critical Material Use Activities.

It may not be clear whether or not critical materials use is involved at the time a proposal for development is made. The following flow chart summarizes the procedure for designating a Critical Material Use Activity in the City of Spokane. Reference to this flow chart should simplify application of the provisions of the zone.
Section III. Best Management Practices for the Prevention and Control of Spills

A. Selecting a Secondary Containment Site

Selecting an appropriate site for secondary containment can be important to the ease of operation and maintenance, as well as more protective of the environment. The following are examples of various agency requirements:

**Wells** - The protection of wells and well heads is currently being reviewed. A regional wellhead protection policy is being developed.

**Surface Water and Flood Plains** - DOE requires that hazardous and deleterious materials be stored so they will not enter state waters. City of Spokane ordinances require that above ground storage tanks not be located below base flood elevations.

**Buildings and Combustible Materials** - The Fire Code requires minimum distances between hazardous materials and any buildings or other combustible materials depending upon the amount of materials.

**Property Lines** - Building and Fire codes require setbacks from the property line depending upon the amount of materials. Additionally local, state, and federal codes often have setback requirements.

B. Constructing a Secondary Containment Site

**General**

The type of materials used for containment will need to be carefully selected. For instance, laminated, coated, or clad primary containment walls are considered single-walled containment and shall not be construed to fulfill the requirements of secondary containment. The use of Best Management Practices (BMPs) is suggested as the primary guideline for the design and maintenance of secondary containment systems.

There are other factors that may affect the operation of the containment system. For instance, elevating metal primary containment containers above the floor of the secondary containment will reduce corrosion at the bottom of the containment unit.

Depending on the BMP selected, an engineering plan and specification review may be required. All secondary containment systems must be designed and built using generally accepted engineering and construction practices.
**Construction Materials**

Secondary containment materials must be compatible (impermeable to) with the material being stored. Containers shall be constructed of materials of sufficient thickness and composition so as not to be structurally weakened as a result of contact with accumulated storm water or discharged hazardous materials, weathering, or from the movement of materials or machinery within the containment area.

**Capacity**

The capacity of secondary containment is addressed in Section IV of this handbook. Spokane Municipal Code 17E.010 is the code reference for secondary containment.

**C. Containment Options** – Containment options must be approved by the City. Examples of containment are:

**Materials**

Recognized secondary containment options for storing critical materials include:

- Concrete or epoxy-lined concrete.
- Metal or metal/polymer (fabricated).
- Fiberglass.
- Bermed with a synthetic liner.
- Double-walled tanks.
- Commercially manufactured prefabricated materials.

**Piping**

Secondary containment options for piping include:

- Double-walled piping.
- Single-walled piping within a concrete, metal, or imperviously lined trough.

**On/ Off Loading Areas**

Stormwater needs to comply with the Spokane Regional Stormwater Manual. Secondary containment options for other on/off loading areas include:
An impervious pad draining to an above ground storage tank (AST) containment area.

An impervious pad draining to a sealed sump or trench.

**Inside Storage**

Secondary containment options for inside storage include:

- A concrete floor sloped to a containment sump.
- A concrete floor sloped to drains that are piped to a containment vessel. (pipe and vessel would need to be provided with secondary containment)
- A concrete floor with curb or berm perimeter.
- Prefabricated, portable secondary containment units.

**D. Operating and Maintaining a Secondary Containment System**

Properly operating and maintaining a secondary containment system is critical. To ensure the system continues to function as designed, it is important to regularly inspect and test the containment structure, manage the accumulation of storm water and leaking product, and develop contingency plans for releases.

**Loading/ Unloading**

Storage and transport containers should include built-in overfill devices to stop the flow of product when the container is full. These containers should also be watched closely by site personnel when in use.

**Inspections**

Conduct daily inspections of the containment area to include checking:

- the secondary containment system for structural integrity,
- for the presence of leaks or storm water,
- for the presence of debris,
- the condition of valves and piping, and
- the condition of primary containment.
When access to secondary containment is not physically possible (e.g., double-walled tanks), inspect the interstitial monitoring system to ensure that the system is functioning properly. It is recommended that facilities document the inspection using a checklist, which should then be on file for at least two years. An example checklist is provided to assist in conducting a thorough inspection *(See Appendix D, Daily Facility Inspection Checklist).*

**Leaking Product and Accumulated Storm Water**

Leaking product that has accumulated in secondary containment should be removed and properly disposed of as soon as possible, or in any case, within 24 hours of discovery. The Washington State Department of Ecology and the Spokane Fire Department need to be notified if a leak has occurred.

Accumulated storm water should be removed any time the amount accumulated compromises the capacity requirement discussed in Section 3B. In the event that the storm water and product have mixed together, the mixture should be removed and properly disposed of within 24 hours of discovery. Hazardous waste will be handled as required by law. Contact the City of Spokane Environmental Programs for current available disposal options.

**Primary and Secondary Containment Integrity**

Test the integrity of the primary containment system prior to filling the container, following nationally recognized testing standards. For primary tanks, refer to Steel Tank Institute Guidance SPOO1-00, American Petroleum Institute Guidance 653, or other industry standard documents. For piping, refer to American Petroleum Institute Guidance 570 or equivalent.

Visually inspect the primary and secondary containment during the daily inspections mentioned above. If the secondary containment cannot be visually inspected, an annual test of the integrity of the containment should be performed. Hydrostatic or pneumatic tests are both acceptable. Hydrostatic testing entails filling the secondary containment with water and monitoring the fluid level for 24 hours or longer. Pneumatic testing evaluates the welds of the synthetic liner.

**Contingency Plans**

It is recommended that a contingency plan be developed for the site. This plan should include step-by-step instructions in the event of a spill or any other type of emergency. It is also recommended that response/cleanup materials be kept on site. A “Spill Prevention Control and Countermeasures Plan” (part of the federal Oil Pollution Act (OPA)) would cover the above recommendations, and may be required
if there is a possibility of petroleum overland flow to “waters of the United States” as defined in the OPA statutes.

**Training**

Training should be provided to all operation and maintenance personnel. The training should include:

- loading operations and how to shut off pumps and valves,
- location of emergency response and cleanup supplies, and
- contact numbers for outside assistance (medical and cleanup response).

**E. Construction/Management Alternatives for Storm Water**

If storm water can enter into secondary containment, the facility must provide a means for removing and properly disposing of the storm water. Facilities should submit documentation to the appropriate jurisdictional agency regarding storm water testing and disposal. Testing will determine if spilled product has contaminated the water. Disposal options can be established based on whether the storm water is clean or contaminated. Some products in storm water can be identified by visual observation alone. These products must be readily identifiable, float on top of the water and be immiscible with the water. For other products that mix with or are otherwise not visually identifiable in the water, a sample or samples should be collected for laboratory analysis.

**Non-Domestic Waste Water (NDWW)**

Non-domestic waste water is any waste water at a site that is not produced as sanitary waste water from restroom facilities, showers, or kitchens. NDWW cannot be disposed to any subsurface location without specific approval of the City of Spokane or other authoritative agency. Subsurface disposal of NDWW can contaminate soils and ground water and may become a significant cleanup liability for the owner of the site. If municipal sewer services are available, then the facility must connect and provide proper pretreatment as determined by the waste water treatment plant. If municipal services are not available, a recirculation or evaporative system will be required. In all cases, facilities disposing of waste water must submit plans for review (SMC – 13.03A.0212) and will be encouraged to reduce or recycle waste water streams.

**F. Who to Contact**

Initial contact will normally be with the Building or Fire Department, but could involve other City Departments.
<table>
<thead>
<tr>
<th>Service</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire</td>
<td>625-7000</td>
</tr>
<tr>
<td>Building</td>
<td>625-6300</td>
</tr>
<tr>
<td>Engineering Services</td>
<td>625-6270</td>
</tr>
<tr>
<td>Pre-Treatment</td>
<td>625-4600</td>
</tr>
<tr>
<td>Environmental Programs</td>
<td>625-6570</td>
</tr>
</tbody>
</table>
Section IV. Spill Control

A. Application of spill control technology and methodology.

Structural systems should be based on the simple criteria that any site on which critical materials are used will be designed so no spilled product will reach unprotected ground surface. The areas in any facility where product transfer activities take place or storage units are located should be designed and constructed with a special emphasis on spill control. Precautions taken during the design stage can greatly reduce the number of spills that occur and will facilitate the cleanup of those that do.

All personnel should be familiar with spill notification procedures and spill clean up plans. They should also have some knowledge of the nature of the products used on site; those working directly with products should be keenly aware of the potential hazards the products they use pose not only to themselves but also to the environment.

B. Structural methods for the control of spills.

In the context of this handbook structural methods for spill control will generally fit the category of secondary containment. A number of ideas for secondary containment systems are described in Appendix C. These are not intended to be engineering design drawings and are intended to be used as a guide for developing specific systems most appropriate for the site in which they are installed. Underground storage tanks and their associated piping, floor drains in critical material use areas and storm water drywells in loading areas are examples of facilities requiring secondary containment.

Other appropriate structural methods of spill control referenced in other documents (such as the protection features for storage facilities described in WAC 173-303) should be used if they provide an advantage over those presented here.

The choice of materials is an important factor in the design of containment systems, especially where the storage of solvents is involved. Containment products may be made from one or more materials that are available. Since the actual formulation used in the product may have properties which differ from those listed, the manufacturer’s test data on each product should be consulted if there is any doubt as to product suitability and compatibility with the stored materials.

C. Containment Volume of Secondary Containment Systems.

In order to be effective containment systems must be large enough to contain all the material released in a spill. A containment volume of 110 percent of the
container volume is normally required, but is affected by other factors such as weather, fire sprinklers, and drainage.

For interior storage where a number of small containers are stored the containment volume should hold a volume of at least three times the volume of the largest container or 10 percent of the total volume of liquid stored. If both critical materials and non-regulated materials are stored together, the non-regulated materials should be included in the volume calculations. If the liquids mix during a spill, the entire mixture becomes a critical material.

Outdoor facilities not protected from precipitation should provide containment for the required product volume plus the precipitation from a 100 year precipitation event. Consideration must be made during design for the separation of precipitation and leaked or spilled products or provisions made for proper disposal of the volume of both the precipitation and the product in the event of a release.

Indoor facilities where fire sprinkler systems are installed are required to have the containment designed to hold a minimum of 20 minutes of fire sprinkler flow plus the capacity of the largest container.

**Nonstructural procedures for the prevention and control of spills**

The following list summarizes areas where operating guidelines and employee training can significantly reduce the potential for and impact of spills. The concepts have been generalized to assist in maintaining wide applicability. As indicated above care should be exercised to insure that the list serves as a guide, not as the final word in how to implement a particular program.

Detection of tank and line leaks  
Pressure testing  
Inventory methods  
Periodic inspection of tanks and lines  
Prevention of tank overflows  
Posting caution signs in the off loading area  
Audible warning signals for full tanks  
Prevention of line breakage due to collision.  
Paint lines in exposed areas with bright colors  
Emergency diking  
Have available waterproof sand bags  
Have available a stockpile of soil and the equipment needed to move it.  
Spill clean-up  
Have available synthetic absorbent materials for cleaning up small spills or final cleaning at the site of a large spill.  
Have available soil—clay, sawdust or similar material for absorbing spills.
D. Model spill prevention, control and clean-up plan.

As with most efforts of this nature there is a weakness in even the best design. No physical structure can be relied on if it is not maintained; no procedure will be effective if the workers do not follow it. Inspection of facilities and training of workers is an essential part of any spill prevention program. The following model Spill Prevention, Control and Clean-up Plan (SPCC) can serve as a focal point of such a training program.

The spill plan developed for any particular activity should serve several functions. It should provide an outline of the overall spill control program and how that program will accomplish the performance criteria contained in the Zoning Code. It should provide a general description of the physical facilities available for the control of spills and describe the operational and maintenance procedures needed to insure their effectiveness. And it should outline the procedures to be followed in the event of a spill, including a notification schedule listing all corporate and regulatory agency personnel that should be notified in the event of a spill and what disposal procedures should be used for cleaned-up materials.

Developing a Model SPCC

a. Identification and Notification.

The first part of the SPCC should contain a description of the business including the business name and address, the nature of business and the general types of products used in the operation.

This section should also provide a detailed account of the notification procedures to be used in the event of a spill. The names and phone numbers of all corporate officials, public safety organizations and regulatory agencies should be included. The priority of notification should also be listed.

b. Site Plan.

The SPCC plan should contain a site plan showing the location of all buildings and other structures, roadways, parking areas, loading areas and storm drainage facilities. The plan should show the direction of storm water flow from all impervious surfaces, and, if ground disposal of storm water is used, describe the facilities installed to prevent accidental spills from entering the storm water system.

c. Physical description of potential spill sources.

A table such as that illustrated below should be included to describe potential spills for each area where critical materials are stored or used. Each "Source of Spill" should be located on the site plan.
Source of Spill | Type of Failure | Maximum Volume | Maximum Flow | Product | Prevention Measure
--- | --- | --- | --- | --- | ---
Above ground tank | Rupture | 1000 gal | 100 gpm | Gasoline | diked containment
Above ground tank | Overflow | 1000 gal | 50 gpm | Gasoline | diked containment
Chemical store drum | Rupture | 50 gal | 50 gpm | Trichloroethane | floor drain to sump

(Examples)

d. Specific Spill Control Procedures.

For each of the potential spill situations provide detailed account procedures for the following:

- A list of structural features employed to prevent or contain spills.
- A list of operational spill prevention procedures and non-structural containment and clean-up methods available for use.
- A summary of the proper methods to be used for the disposal of cleaned up spill material.
- A list of the names and contact procedures for persons to be notified in the event of a spill and employees with special skills that may be useful in dealing with a particular spill situation.

e. Training Program.

The SPCC plan should contain a brief description of the methods which will be used to train employees to deal with spills and the nature of the information which will be covered in training sessions.

At a minimum the information contained in the SPCC Plan and manufacturer's data on the hazards posed by and clean up methods for the product(s) on site will be presented in the training program.
APPENDIX A
Critical Materials and
Critical Material Use Activity Lists
APPENDIX A
CRITICAL MATERIALS LIST

Critical Material lists have been developed over time to the point that including the list in this manual would not be practical. The current list of critical materials is a separate document and is maintained on a regular basis to include any change. Any activity which involves the use, handling or storage of any product on the list in the quantity designated is by definition a Critical Materials Use Activity and is subject to regulation.

The list of products is fairly extensive, but is not exhaustive. However, the wide variety of products found on the list and their frequent use in the chemical industry normally result in the presence of at least one critical materials at any location where regulation is needed to assure water quality protection. Should a water quality threat develop as a result of the use of a product not on the list, action should be taken to amend the list and apply the conditions of the ordinance to any activity involving that product.

The current Critical Materials List is maintained by the City of Spokane Environmental Programs staff. A hard copy or electronic copy can be obtained upon request.
APPENDIX B
North American Industrial Classification Codes (NAICS) for activities likely to use chemicals
APPENDIX B
NORTH AMERICAN INDUSTRIAL CLASSIFICATION CODES for Activities Most Likely to Involve Chemicals

The following list of Standard Industrial Classification Codes includes most of the activities which involve the use of chemicals. The association of chemical use with a given code was made from the description of the code contained in the 1972 Standard Industrial Classification Code handbook or from on site inventories of activities in the Spokane area. While this list will provide a general guide to those activities which can be expected to handle chemicals more detailed information on the nature of the business and the chemicals used can be obtained by referring to the parent document. Industrial surveys of various types can also provide additional information.

NORTH AMERICAN INDUSTRIAL CLASSIFICATION CODE Partial Listing

**Agricultural and Related Services**
- Soil preparation services           0711 (NAICS 115112)
- Crop planting, cultivating and protection  0721  (NAICS 115112)
- Veterinary services                0742  (NAICS 54194)
- Lawn and garden services           0782  (NAICS 56173)
- Ornamental tree and shrub service   0783  (NAICS 56173)

**Metal Mining**
- Silver Mining                      1044  (NAICS 212222)
- Uranium Mining                     1094  (NAICS 212291)
- Anthracite Mining                  1231  (NAICS 212113)
- Bituminous Coal and Lignite Mining 1221  (NAICS 212111)

**Mining and Quarrying of Nonmetallic Minerals, except Fuels**
- Construction sand and gravel       1442  (NAICS 212321)
- Industrial sand                    1446  (NAICS 212322)
- Clay, ceramic and refractory minerals-- nec  1459 (NAICS 212325)

**Building Construction -- General Contractors and Operative Engineers**
- 1531  (NAICS 23331)

**Construction other than Building -- General Contractors**
- 1542  (NAICS 23332)

**Highway and street construction-- except elevated highways**
- 1611  (NAICS 23411)
- 1622  (NAICS 23412)

**Bridge, tunnel and elevated highway construction**
- 1711  (NAICS 23511)

**Construction -- Special Trade Contractors**
- Plumbing and heating contractors    1721  (NAICS 23521)
- Electrical work                     1731  (NAICS 23531)
- Masonry, stone setting and other stonework  1741 (NAICS 23541)
- Roofing and sheetmetal work         1761  (NAICS 23561)
Concrete work  1771  (NAICS 23542 Stucco, 23571 Contractors)

Food and Kindred Products
Fluid milk  2026  (NAICS 311511)
Flour and other grain mill products  2041  (NAICS 311211)
Animal and marine fats and oils  2077  (NAICS 311613)
Rendering, 311711 Seafood Canning, 311712 Fresh & Frozen Seafood Processing)
Textile Mill Products  2269 (Finishers of textiles)

Lumber and Wood Products, except Furniture
Hardwood veneer  2435  (NAICS 321211)
Softwood veneer and plywood  2436  (NAICS 321212)
Structural wood members, nec  2439  (NAICS 321214 Trusses, 321213 Engineered Wood Member Manufacturing)
Wood preserving  2491  (NAICS 321114)
Particle board  2493  (NAICS 321219)
Reconstituted Wood Product Manufacturing
Furniture and Fixtures  2500 (NAICS 337000)

Paper and Allied Products
Pulp mills  2611 (NAICS 32211)
Papermills, except building paper mills  2621 (NAICS 322122)

Printing, Publishing and Allied Industries
Newspapers; publishing and printing  2711 (NAICS 51111 Newspaper Publishers)
Commercial printing, letterpress and screen  2759 (NAICS 323113)
Commercial printing, lithographic  2752 (NAICS 323110)

Products
Industrial gases  2813 (NAICS 32512)
Inorganic pigments  2816 (NAICS 325131)
Industrial inorganic chemicals, nec  2819 (NAICS 325188)
Plastics materials, synthetic resins, and non-vulcanizable elastomers  2821 (NAICS 325211)
Biological products  2836 (NAICS 325414)
Soaps and other detergents, except specialty products  2841 (NAICS 325611)
Specialty cleaning, polishing and sanitation preparations  2842 (NAICS 325612)

Fertilizers, mixing only  2851 (NAICS 32551)
Nitrogen fertilizers  2873 (NAICS 325311)
Phosphatic fertilizers  2874 (NAICS 325312)
Fertilizers, mixing only  2875 (NAICS 325314)
Pesticides and agricultural chemicals, nec  2879 (NAICS 32532)
Printing ink  2893 (NAICS 32591)
Petroleum Refining and Related Industries 2911 (NAICS 32411)
Lubricating oils and greases 992 (NAICS 324191)
Rubber and Miscellaneous Plastics Products 3000 (NAICS 32622 Rubber
and Plastics Hoses and Belting Manufacturing)
Leather and Leather Products
Leather tanning and finishing 3111 (NAICS 31611)
Stone, Clay, Glass and Concrete Products 3200 (NAICS 327331 Concrete
Block and Brick Manufacturing)
Primary Metals Industries
Gray iron foundries 3321 (NAICS 331511)
Malleable iron foundries 3322 (NAICS 331511)
Steel foundries, nec 3325 (NAICS 331513 Steel
Foundries (except Investment))
Primary production of aluminum 3334 (NAICS 331312)
Secondary smelting and refining of nonferrous metals 3341 (NAICS 331492 (except
Aluminum and Copper)
Aluminum. sheet, plate and foil 3353 (NAICS 331315)
Aluminum, extruded products 3354 (NAICS 331316)
Aluminum foundries 3365 (NAICS 331524 (except
die casting)
Brass, bronze. copper and copper base alloy foundries 3366 (NAICS 331525 (except
Die Casting))
Fabricated Metal Products except Machinery and Transportation Equipment
Heating equipments except electric and warm air furnaces 3433 (NAICS 333414 (except
warm air furnaces))
Fabricated plate work 3443 (NAICS 332313)
Sheet metal work 3444 (NAICS 332322)
Iron and steel forgings 3462 (NAICS 332111)
Electroplating, plating, polishing, anodizing and coloring 3471 (NAICS 332813)
Coating, engraving and allied services, nec 3479 (NAICS 332812)
Industrial Machinery and Equipment 3500 (NAICS 332999)
Miscellaneous Fabricated Metal Product Manufacturing)
Electrical and Electronic Machinery, Equipment and Supplies
Power, distribution and specialty transformers 3612 (NAICS 335311)
Switch gear and switchboard apparatus 3613 (NAICS 335313)
Current carrying wiring devices 3643 (NAICS 335931)
Commercial, Industrial and Institutional electric lighting fixtures 3646 (NAICS 335122)
Radio and television transmitting, signaling and detection equipment and apparatus 3663 (NAICS 33422)
Cathode ray television picture tubes 3671 (NAICS 334411)
Semiconductors and related devices 3674 (NAICS 334413)
<table>
<thead>
<tr>
<th>Industry</th>
<th>NAICS Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical equipment for internal combustion engines</td>
<td>3699 (NAICS 335999 All other miscellaneous Electrical Equipment and Component Manufacturing)</td>
</tr>
<tr>
<td>Transportation Equipment</td>
<td></td>
</tr>
<tr>
<td>Motor vehicle parts and accessories</td>
<td>3714 (NAICS 336300)</td>
</tr>
<tr>
<td>Boat building and repairing</td>
<td>3732 (NAICS 336612)</td>
</tr>
<tr>
<td>Travel trailers and campers</td>
<td>3792 (NAICS 336214)</td>
</tr>
<tr>
<td>Transportation equipment~ nec</td>
<td>3799 (NAICS 336999)</td>
</tr>
<tr>
<td>Measuring, Analyzing and Controlling Instruments: Photographic, Medical and Optical Goods: Watches and Clocks</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous Manufacturing Industries</td>
<td></td>
</tr>
<tr>
<td>Marking devices</td>
<td>3953 (NAICS 339943)</td>
</tr>
<tr>
<td>Signs and advertising displays</td>
<td>3993 (NAICS 33995)</td>
</tr>
<tr>
<td>Manufacturing industries, nec</td>
<td>3999 (NAICS 339999 All Other Miscellaneous Manufacturing)</td>
</tr>
<tr>
<td>Railroad Transportation</td>
<td></td>
</tr>
<tr>
<td>Switching and terminal establishments</td>
<td>4011 (NAICS 482111)</td>
</tr>
<tr>
<td>Support Activities for Road Transportation)</td>
<td></td>
</tr>
<tr>
<td>Local and Suburban Transit and Interurban Highway Passenger Transportation</td>
<td>4111 (NAICS 48511 Urban Transit)</td>
</tr>
<tr>
<td>Terminal and joint terminal maintenance facilities for motor vehicle transportation</td>
<td>4173 (NAICS 48849 Other)</td>
</tr>
<tr>
<td>Support Activities for Road Transportation)</td>
<td></td>
</tr>
<tr>
<td>Motor Freight Transportation and Warehousing</td>
<td></td>
</tr>
<tr>
<td>Farm product warehousing and storage</td>
<td>4221 (NAICS 49313)</td>
</tr>
<tr>
<td>General warehousing and storage</td>
<td>4225 (NAICS 49311)</td>
</tr>
<tr>
<td>Special warehousing and storage~ nec</td>
<td>4226 (NAICS 49312)</td>
</tr>
<tr>
<td>Refrigerated Warehousing and Storage</td>
<td></td>
</tr>
<tr>
<td>Terminal and joint terminal maintenance facilities for motor freight transportation</td>
<td>4231 (NAICS 48849 Other)</td>
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<td>Support Activities for Road Transportation)</td>
<td></td>
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<tr>
<td>Water Transportation</td>
<td>4449 (NAICS 483211 Inland)</td>
</tr>
<tr>
<td>Water Freight Transportation)</td>
<td></td>
</tr>
<tr>
<td>Transportation by Air</td>
<td>4512 (NAICS 481112)</td>
</tr>
<tr>
<td>Scheduled Freight Air Transportation)</td>
<td></td>
</tr>
<tr>
<td>Pipe Lines~ except Natural Gas</td>
<td>4619 (NAICS 48699 All Other Pipeline Transportation)</td>
</tr>
<tr>
<td>Crude Petroleum Pipe Lines</td>
<td>4612 (NAICS 48611)</td>
</tr>
<tr>
<td>Refined Petroleum Pipe Lines</td>
<td>4613 (NAICS 48691)</td>
</tr>
<tr>
<td>Transportation Services</td>
<td></td>
</tr>
<tr>
<td>Packing and crating</td>
<td>4783 (NAICS 488991)</td>
</tr>
</tbody>
</table>
Services incidental to transportation, nec  4789 (NAICS 488999 All Other Support Activities for Transportation)
Communications  4899 (NAICS  51339 Other Telecommunications)
Electric, Gas and Sanitary Services  (NAICS Utilities)
Electric services  4911 (NAICS 221111 Hydroelectric Power Generation)
Natural gas transmission and distribution  4923 (NAICS 22121 Natural Gas Distribution)
Natural gas distribution  4924 (NAICS 22121 Natural Gas Distribution)
Mixed, manufactured or liquefied petroleum gas production and/or distribution  4925 (NAICS 22121 Natural Gas Distribution)
Gas Distribution)
Electric and other services combined  4931 (NAICS 221122 Electric Power Distribution)
Sewerage systems  4952 (NAICS 22132 Sewage Treatment Facilities)
Refuse systems  4953 (NAICS 562212 Solid Waste Landfill)
Sanitary services, nec  4959 (NAICS  56291 Remediation Services)
Steam and Air-Conditioning Supply  4961 (NAICS 22133 Wholesale Trade -- Durable Goods
Photographic equipment and supplies  5043 (NAICS 42141)
Scrap and waste materials  5093 (NAICS 42193 Recyclable Material Wholesalers)
Wholesale Trade -- Nondurable Goods
Drugs, drug proprietarys and druggist sundries  5122 (NAICS 42221)
Chemicals and allied products  5169 (NAICS 4226)
Petroleum bulk stations and terminals  5171 (NAICS 42271)
Petroleum and petroleum products wholesalers, except bulk stations and terminals  5172 (NAICS 42272)
Farm supplies  5191 (NAICS 42291)
Paints, varnishes and supplies  5198 (NAICS 42295)
Building Materials, Hardware, Garden Supplies and Mobile Home Dealers
Paint, glass and wallpaper stores  5231 (NAICS 44412 Paint and Wallpaper Stores)
Hardware stores  5251 (NAICS 44413)
Retail nurseries, lawn and garden stores and Garden Centers)  5261 (NAICS 44422 Nursery and Garden Centers)
General Merchandise Stores  5399 (NAICS 45291
Warehouse Clubs and Superstores)  5499 (NAICS 445000 Food and Beverage Stores)
Automotive Dealers and Gasoline Service Stations
Gasoline service stations  5411 (NAICS 447100)
Miscellaneous Retail  5999 (NAICS 45391 Pet and
Pet Supplies Stores)
Personal and Laundry Services
Coin operated laundries and dry cleaning  7215 (NAICS 81231)
Dry cleaning plants, except rug cleaning  7216 (NAICS 82132 Dry
cleaning and Laundry Services (except Coin-Operated))
Carpet and upholstery cleaning  7217 (NAICS 56174)
Industrial laundries  7218 (NAICS 812332)
Business Services
Commercial photography, art and graphics  7335,7336  (NAICS 541922, 54143)
Disinfecting and exterminating services  7342 (NAICS 56171, 56172)
Photofinishing laboratories
Commercial testing laboratories  8734 (NAICS 54138 Testing Laboratories)
Automotive Repair, Services and Garages
Paint shops  7532 (NAICS 811121
Automotive Body, Paint and Interior Repair and Maintenance)
General automotive repair  7538 (NAICS 811111)
Automotive repair shops. nec  7539 (NAICS 811118  Other Automotive Mechanical and Electrical Repair and Maintenance)
Car washes  7542 (NAICS 811192)
Miscellaneous Repair Shops
Re-upholstery and furniture repair  7641 (NAICS 811142)
Repair shops and related services, nec  7699 Boiler Cleaning (NAICS 23511 Plumbing, Heating and Air-Conditioning Contractors)
Septic Tank and Related Services (NAICS 562991)
All other Miscellaneous Waste Management Services (NAICS 562998)
Other Support Activities for Water Transportation (NAICS 48839)
Health Services
General medical and surgical hospitals  8062 (NAICS 622111)
Specialty hospitals, except psychiatric  8069 (NAICS 62231)
Medical laboratories  8071 (NAICS 621511)
Educational Services
Colleges, universities and technical schools  8221 (NAICS 61131)
Junior colleges and technical institutes  8222 (NAICS 61121)
Miscellaneous Services
Noncommercial educational, scientific and research organizations  8999 (NAICS 514199 All Other Information Services)
APPENDIX C
Best Management Practices
Design Concepts
APPENDIX C

Best Management Practice (BMP) design concepts

The design concepts illustrated in this section are provided to stimulate ideas that will lead to the development of creative solution of specific design problems; they should not be viewed as engineering design drawings. The preparers of this handbook make no warranty as to the suitability of any of these designs for a specific situation. Plans using these or similar concepts should be prepared by qualified professionals for each installation. In preparing these plans the designer must consider the volume of product stored, the potential for chemical reaction between the containment system and the product and the type of monitoring that will be employed to detect leaks and assure continued reliability of the system.

As-built drawings showing the details of the system actually installed should be provided to both the operator of the facility and the agency responsible for design review.
List of Exhibits

1. Concrete loading/unloading pad
2. Tank and loading/unloading containment area/pad
3. Containment pad to trench drain
4. Containment pad to oil/water separator
5. Canopy over concrete pad
6. Concrete containment
7. Floor containment
8. Membrane liner
9. Double wall piping
10. Secondary containment piping
11. Prefabricated storage units
12. Steel containment structure
13. Aboveground tank secondary containment
14. Temporary secondary containment
15. Underground storage tank in sub grade vault
16. Catch and store spills at loading docks
17. Covered loading docks
18. Grated perimeter drain
19. Floor drain collection
20. Sub-floor containment liner
21. Drain pans
22. Containers/Cabinets
23. Concrete Coatings
BMP 1 - Concrete Loading/Unloading Pad

Description
An impervious concrete pad, preferably with curbing along the perimeter and a sloped surface to a low point on the pad is needed. The pad should cover the entire area under the transfer vehicle and have the capability to store a minimum of 100 gallons of product. The system must have controls for capturing and disposing of storm water, such as a sump or a drain that directs spilled product or storm water back to the main above ground storage tank containment area. It may be appropriate to line, coat, or seal the pad, depending on the material being transferred.

Application
Bulk transfer of liquid and solid non-petroleum critical materials: This includes, but is not limited to, bulk fertilizers, acids, caustics, road treating, and de-icing materials.

Design Parameters/Construction Guidelines
The pad should be constructed following generally-accepted engineering design and installation practices that account for the anticipated maximum load. The ingress and egress design must ensure the pad's integrity and holding capacity is not compromised. A canopy or covering can be added above the on/off loading area to reduce storm water accumulation. For covered and non-covered areas, the pad should be curbed and sloped to transmit spilled product or storm water to a collection area. This area can be the main product storage containment area or a separate sump or basin. The pad and sump should be sized to hold 100 gallons of product, as well as storm water from an average five-year storm event.

Figure 7 Loading platform that slopes to the center.
Figure On/Off loading pad that drains to the tank storage area.

**Maintenance**
The pad and drainage system must be inspected periodically to determine the integrity of the containment. Systems that accumulate storm water must be assessed after storm events to ensure that the 100 gallon product capacity has not been compromised. If accumulated storm water infringes on this capacity, the storm water should be pumped out and properly disposed of within 24 hours. Systems that accumulate grit and sand will eventually require pumping and proper disposal. Spill response and clean up materials should be stored on site.
BMP 2 - Tank and loading/ Unloading containment area/ pad

**Description**
A concrete slab that is sloped to the main above ground storage tank containment area. Slab may be curbed for additional containment ability. Spilled product and storm water drains to the tank containment for reuse or disposal. The tank area's secondary containment capacity must take into account the additional amount of fluids that could come from the on/off loading pad. This additional capacity must be a minimum of 100 gallons.

**Application**
This BMP is applicable for facilities that have above ground storage tanks in close proximity to the on/off loading area. This application also works well for sites that do not have the extra room to provide for a large storm water treatment area.

**Advantages**
- Less cost than a pad with a canopy.
- The storage for spilled product or storm water from the on/off load pad is the entire product storage, secondary containment area.
- There is only one area where product or storm water would have to be pumped out.

**Disadvantages**
- More wastewater to be treated than a pad with a canopy.
- A larger storage area must be built to accommodate storm water from the on/off loading pad and spilled product from the transfer equipment.
- Aboveground storage tanks might need to be elevated due to the additional storm water coming from the on/off loading pad.

**Design Parameters/ Construction Guidelines**
The pad should be constructed following acceptable engineering design and installation practices that account for the anticipated maximum load. The ingress and egress design must ensure that the pad’s integrity or holding capacity is not compromised.
Coating the pad is recommended; however, the coating must be durable enough to stand up under the stress of vehicle movement and on/off loading operations. *(See Appendix C, Concrete Coating).*

**Maintenance**
The pad and drainage system must be inspected periodically to determine the integrity of the containment. The inspection should include measuring for adequate freeboard in the containment area. Spills should be cleaned up promptly. Storm water must be removed and properly disposed of when it infringes on required containment capacity.
BMP 3- Containment Pad to trench drain

Description

An area consisting of an impervious pad that drains to a blind sump or trench drain. All materials used must be compatible with and capable of containing minor spills (100-gallon minimum) of petroleum plus additional capacity for any storm water that has collected in the sump or drain.

Application

Designed to contain small spills that occur when petroleum products are transferred between a stationary tank or tanks and a tanker truck, piece of machinery, or other vehicle. This application should be used only when a business is fueling its own equipment and its total storage tank capacity is less than 2,000 gallons. In such case the containment system should be designed and constructed in a fashion that would contain a petroleum release plus storm water accumulation.

Advantages

- Ease of product recovery.
- Lower construction cost (e.g., no OWS, canopy, or additional piping).

Disadvantages

- Handling of storm water collected in the containment area and sump may add to operation and maintenance costs.
BMP 4- Containment pad to Oil/Water Separator

Description
A pad constructed of an impervious material (generally concrete) that is curbed or sloped to contain a minimum of 100 gallons of product. Spilled product and rain water drain from the pad to an oil-water separator (OWS). The water from the OWS discharges to a grassy swale or other approved wastewater disposal site.

Application
This BMP is recommended for smaller operations (storage of less than 10,000 gallons of petroleum) where the cumulative amount of small spills from loading and unloading operations would be less likely to overload the storm water treatment system being used.

Advantages
- No collection and disposal costs for waste water accumulated within the containment system.
- Less cost than a pad with a canopy.
- The control valve at the OWS discharge can be closed, providing immediate, additional containment of product in the event of an emergency.

Disadvantages
- Upkeep and maintenance of OWS and grassy swale.
- More waste water to be treated than a pad with a canopy.
- More expensive than just a containment pad with sumps.
- May not be able to handle all of the product from a large release.
- The OWS is less efficient with higher water flow (large precipitation event).

Figure 14 Shows drain sump, OWS & grass infiltration area.
**Design Parameters/ Construction Guidelines**
The pad should be constructed following acceptable engineering design and installation practices that account for the anticipated maximum load. The ingress and egress design must ensure that the pad’s integrity or holding capacity is not compromised.

Coating the pad is recommended, however the coating must be compatible with the petroleum product and durable enough to stand up under the stress of vehicle movement and on/off loading operations (See Appendix C, Concrete Coatings).

The OWS must be sized to handle the maximum product discharges anticipated from the pad.

**Operating/ Maintaining/ Inspecting**
The pad and drainage system must be inspected periodically to determine the integrity of the containment. Inspection should include measuring for sludge buildup in the bottom of the OWS and floating product on top of the water in the OWS. Absorbent pads or booms can be used to collect floating product. Sludge buildup and used absorbents must be removed and properly disposed.
**BMP 5- Canopy over concrete pad**

**Description**
A canopy constructed over an impervious concrete slab that is curbed or sloped to discharge to a central trench and catch basin. Storm water and contaminants travel by underground piping to an oil-water separator (OWS) that discharges to a grass infiltration area or other acceptable storm water treatment site.

**Application**
These construction standards are designed for public fueling operations. However, this design meets or exceeds performance standards applicable to all petroleum on/off loading operations.

**Advantages**
- The canopy reduces the accumulation of storm water that needs to be processed.
- No collection and discharge costs for wastewater collected within the containment system.
- Storm water from the canopy is directed away from the on/off loading pad.
- The system requires minimal maintenance and reduces disposal costs by comparison to holding tanks and blind sumps.
- The control valve at the OWS discharge can be closed, providing immediate, additional containment of product in the event of an emergency.

**Design Parameters/ Construction Guidelines**
Construct a concrete slab that will be compatible in size and thickness for its intended use. The slab should have sufficient slope or curbing to contain and direct the material released to the blind sump or trench drain.

The sump or trench drain should be constructed in a fashion that allows a release to be collected and removed by trained personnel. Water stops shall be installed in all concrete joints to prevent leakage through the joints. If a trench drain is used, a metal or composite grate system may be used to cover the trench. If a sump is used, it must be constructed of a material that is compatible with the product it will contain and it must be leak proof. Multi-part sumps should only be used if the manufacturer certifies them. Otherwise a seamless sump should be installed. The integrity of all sumps should be tested prior to use.
The containment volume of the sump or trench drain shall be large enough to contain the anticipated amount of the largest release combined with a calculated amount of storm water directed to it from the impervious slab.

When calculating the largest anticipated release, take into account the diameter size and length of the transfer hose, the rate of volume (gpm), and the response time to shut off the valving. At a minimum, the sump and pad area must be able to hold 100 gallons of fluid.

Designs should follow standard engineering practices and be approved by the local building, fire, and health departments.

**Operating, Maintaining, and Inspecting**
This BMP should not be used if the area is subjected to water other than storm water (e.g., equipment washing), as the 100 gallon spilled product holding capacity would be continually jeopardized, and the ability to dispose of the water would likely become more expensive and complicated.

All on/off loading areas should be inspected periodically and a record of inspection maintained. If storm water is detected, it should be maintained at a level below that which would impede either the minimum calculated containment volume or a set 100-gallon capacity. Any deficiencies in this area should be corrected in an expeditious manner. Clean up spills promptly.
BMP 6- Concrete Containment System

Description
An open concrete box, basin, or recess designed to contain above ground storage tanks. These containment systems are generally located outdoors for large-volume storage.

Application
This is the most common method of containing above ground storage tanks that are not double-walled.

Advantages
- Versatile design parameters.
- Very durable.

Disadvantages
- Integrity of patches over cracks is sometimes difficult to achieve due to the continuous expansion and contraction of the cracks in the concrete containment system.

Design Parameters/Construction Guidelines
This is a specialized use of a common building material that should be designed and installed by experienced engineers and contractors.

- Design the containment to allow inspection with the primary container in place.
- Consider the site's soil-bearing strength and consolidation.
- Ensure water-cement ratios and curing methods are sufficient to minimize permeability and cracking (Attain a permeability of $10^{-7}$ to $10^{-10}$ cm/sec).
- Ensure proper reinforcement to minimize cracking.
- Use chemical resistant water stops in all joints and penetrations.
- Use air entrainment as needed to provide resistance to freeze-thaw cycles.
- A minimum compressive strength of 4,000 psi after 28 days is recommended.
- Grade the floor to an outside drain or to an internal sump.
- Ensure drains arevalved and closed.
- Establish quality control measures for the manufacture, delivery, and pour of the concrete.
- Use a canopy to exclude storm water, if possible and where allowed by fire codes.
Because salts, acids, and alkalis can adversely affect concrete, it should be sealed for use in these applications (See Appendix C, Concrete Coatings).

**Maintenance**

- Daily inspections recommended.
- Inspect for cracks caused by impact, excessive loading, vibration, freeze-thaw, settlement, etc.
- Inspect joints and penetrations for gaps caused by shrinkage, settling, poor design, etc.
- Immediately clean up any spills and re-use or properly dispose spill waste.
- Drain or pump and haul storm water according to guidelines (See the storm water section in this guidance).
- Thoroughly prepare the surface prior to any repairs.
BMP 7- Floor Containment System

Description
An impervious floor and sidewalls, generally constructed of concrete, that provides containment for either solid or liquid critical materials. The concrete should be coated with a sealant. Due to its permeability and the difficulty of clean up, asphalt is not an acceptable floor material.

Application
Situations where indoor work areas, piping, drums, tanks, bags, or blocks of critical material need secondary containment, and where containment is provided by the floor, curbing, and sidewalls. The entire floor area, or a portion of the floor, may be used for containment. A variation is to construct a recessed area in the floor, with containers either placed in the recessed area, or over the recessed area on grating. This application may not be appropriate for highly flammable, toxic, or volatile materials that are dangerous if spread over the floor.

Advantages
- Little or no additional cost for new construction sites.
- Flooring serves as containment and a functional work area.

Disadvantages
- Retrofit may be difficult or expensive.

Design Parameters/Construction Guidelines
- Construct floors and sidewalls of concrete or similar material (not asphalt).
- Concrete should be coated with an impervious material that will be compatible with the critical materials (See Appendix C, Concrete Coatings).
- Curbing may be used to create a small containment area in a portion of the building.
- Ensure the thickness and construction of the floor is compatible with the intended use (e.g. use of heavy equipment).
- For liquid materials, grade the floors to drain to a sump or trench drain where spills can be collected and removed.
- Install water stops in concrete joints.
- Ensure the sidewalls are high enough to provide the required containment volume.
Design entryways to prevent escape of liquid materials, taking care to not create barriers that will be a tripping hazard, or that will be difficult to negotiate with equipment. Installing ramps at doorways, into sumps, or over curbs may alleviate these problems.

Grating may be installed over trench drains or recessed containment areas to allow passage of people or equipment, or to allow critical materials to be placed at floor level over containment areas.

In general, drains should not be installed in floors used for secondary containment. If the situation warrants a floor drain, it must have an approved method of discharge. Floor drains cannot be connected to dry wells, septic systems, sewer systems (unless approved by the wastewater treatment plant), or otherwise discharge from the building. Holding tanks connected to floor drains must be leak proof, constructed of material that is compatible with the products it will contain, and easily accessible for removal of spills. Test the integrity of all holding tanks prior to use.

**Maintenance**

- Periodically inspect floors and sidewalls and seal any cracks to provide an impervious surface.
- Recoat concrete as necessary.
- Clean up spills promptly.
**BMP 8- Membrane Liner containment system**

**Description**
Geomembranes (flexible membrane liners) installed as secondary containment, either in a buried configuration with a suitable cover material or exposed to the surface. Both types of installation are placed on a prepared sub grade selected to provide protection of the liner from damage and to establish grade for the containment.

**Applications**

Liners are best suited to installations where access to the secondary containment area will not require the use of heavy equipment that could damage the liner.

This type of containment is more suited to larger installations where a significant area needs to be included within the containment and cost savings are available. Other secondary containment designs might be better suited for small containment areas or for installations requiring access onto the containment area.

Liners can be installed in single or multiple layers depending on the sensitivity of the location. Underdrains, interstitial monitors and drains, cushion geofabric liners, and surface drains can be included to enhance monitoring and performance.

The thickness of the liner (expressed as “mils” or thousandths of an inch) should not be less than 30 mils to provide adequate strength and durability. For installations that need greater protection, thicker, reinforced liners can be used. A 60-mil liner is common for many such installations. Liner manufacturers are good sources of technical assistance in the selection of a proper liner material for a particular installation.

Consider the foundation and support when installing the liner underneath a tank or other heavy objects.

A sloping bottom is needed to collect, remove, and treat storm water that accumulates above the liner. If possible, installation of a roof over the containment area is recommended. Liners should not be used in areas of shallow ground water, where the water table has the potential to rise and lift the liner. Maintenance requirements for the liner should be detailed for the owner, by the manufacturer.

**Advantages**
- Highly impervious to seepage and not subject to cracking because of their flexibility.
- Becoming more available as more contractors can install, test, and repair liner systems.
- Liners without cover material are easy to visually inspect for damage. If damaged, maintenance personnel can repair the liners with patch pieces.
- May be less expensive to install than other containment systems.
- Can be more resistant to deterioration than other materials.
- May be more cost-effective when removal and/or replacement are considered. A liner can be removed and replaced or overlaid with a new liner when worn or damaged, usually at a cheaper cost than conventional containment materials.

**Disadvantages**
- Exposed liners are vulnerable to rips and tears during installation or when operating equipment inside the containment.
- For covered or buried liners, when leaks are suspected, it may be difficult to locate where the liner has failed.
- If periodic hydrostatic testing is used to determine impermeable condition, the test may be difficult to precisely conduct and may interfere with daily operations.
- Because of the potential of damage to the liner, activities inside the containment are limited.
- Exposed geomembranes may degrade over time and require replacement.
- Exposed liners may be slippery due to spills or precipitation, and therefore dangerous for people working inside the containment system.
- Liners are relatively new technology without a history of service longevity.
- Liner installation requires special equipment and training that might not be locally available in some rural areas. Equipment to install and test the liners is expensive.

**Design Parameters/Construction Guidelines**
- Either reinforced or unreinforced membranes can be selected for these installations.

  The reinforced type consists of an internal polymer thread in a matrix with a polymeric coating on both sides.

  The unreinforced type consists of a homogenous flat sheet.

A variety of polymeric resins can be used to manufacture geomembranes.
- In some instances a geotextile cushion liner can be placed below the geomembrane and on the subgrade to provide additional protection and longevity.
- A liner requires careful preparation of the subgrade. Subsequent settling after the liner is installed may cause the liner to stretch or tear.
- When liners are designed for a covered or buried configuration, suitable cover material at least six inches in depth must be compatible with the liner strength, as well as operation and maintenance activities within the containment.
- High-density polyethylene (HDPE) or polyvinyl chloride (PVC) is typically used for the
liner material although other materials with equal performance might be commercially available. The type of membrane material used depends on the resin’s resistance to the contained liquid.

PVC liners need to be covered to avoid exposure to sunlight which can damage the integrity of the liner.

HDPE liners have the advantage of being installed exposed to the surface because HDPE does not deteriorate due to ultraviolet radiation.

Liners can be used with other containment material for berms and edges. The connection between the two materials must be capable of withstanding the conditions present within the containment area. The edges of containments using liners require a suitable structural support for the liner.

For sensitive areas, liners can be installed with two layers and interstitial monitoring to detect failure of the primary liner and provide an additional barrier to product release.

Underdrains should be installed to detect and collect product in the event of liner failure.

Liners should be sloped to a location where periodic visual inspections for the presence of product can be performed.

**Maintenance**

A periodic visual inspection of unburied liners must be performed to assure that the liner will contain spilled liquids.

Test seams using air-testing or spark testing equipment to detect any failure.

Remove any accumulation of storm water on top of the liner to a proper treatment and disposal site.

If storm water fails to accumulate as expected after storm events, operators should suspect liner failure. Repairs can then be made before a spill occurs.

If liners are buried, a hydrostatic test must be performed and documented prior to use of containment system. An annual test of the system should be performed.
**BMP 9– Secondary Containment Piping – Below Grade**

**Description**
A piping system that provides for detecting, containing, and recovering product that is transmitted via pipeline. This indoor/outdoor pipeline system may be located either above or below ground.

**Application**
Sites that need to transfer product via pipeline as a part of the operations process, including loading and unloading.

**Advantages**
- Limits spilled product exposure to environmental factors (e.g., sunlight, temperature, and storm water).
- Insulating properties.
- Less maintenance, particularly with regard to storm water.
- 100% containment of pure product leaking from primary containment resulting in reuse of product.

**Disadvantages**
- Unable to perform visual leak detection on the primary containment.
- In some cases, space intensive.

**Design Parameters/ Construction Guidelines**
- The piping must be compatible with terrain, location, environmental factors, and product properties.
- The piping must be designed and installed appropriately for leak detection (i.e., piping sloped to sump).
- The system may include sloping to a containment sump, isolation/shut off valves (if applicable), and pressure relief valves.

**Maintenance**
- Periodic inspections of the pipeline and monitoring equipment.
BMP 10 - Secondary Containment Piping - Above Grade

Description
A piping system with secondary containment that provides for detecting and recovering product that may leak out of the primary piping. Piping may reside inside the main secondary containment system for above ground tanks, or in an open trough made of concrete or metal, or lined with an impermeable membrane.

Application
Sites that transfer product as a part of the operations process or in the loading and unloading process.

Advantages
- Typically less expensive than double wall piping.
- Leaking product is easier to detect and leaks are easier to fix.
- Impact of a foreign object is less likely to compromise the containment (i.e., impact by vehicle or projectile).

Disadvantages
- More maintenance, particularly with regards to managing storm water.
- In some cases, space intensive.
- Debris can collect in the trough, making recovery and reuse of spilled product more difficult.

Design Parameters/Construction Guidelines
- The piping must be compatible with the terrain, location, environmental factors, and product properties.
- The piping must be designed and installed appropriately for leak detection, and the ability to recover the material that leaks into the impervious secondary containment.
- The system may include sloping to a containment area and emergency isolation/shut off valves.

Maintenance
- Periodic inspections and general preventive maintenance, especially in eliminating any outside contamination in the secondary containment.
BMP 11- Prefabricated Storage Units

Description
Prebuilt or prefabricated storage units that can be permanent or portable, and that can be placed in strategic locations within or outside a building. Prebuilt units can come in several forms. Some of the more common units are plastic or metal.

Constructed units can be portable but may also include a more permanent arrangement, such as a secondary concrete pour to form curbed containment areas on the floor.

Application
Well suited to businesses that have several types or small quantities of materials to contain. Allows for changing or fluctuating products and arrangements. Portable containment areas are beneficial for operators who are leasing, as they can generally take their containment units with them when they leave.

Examples of materials that are typically stored in this type of secondary containment include barrels of lube oil, five-gallon buckets of paint and solvent, anti-freeze, and used oil.

Advantages
- Allows for segregation of incompatible materials.
- Limits spills to smaller areas.
- No large construction or retrofit issues.
- Prevents spills from moving outside of the building.
- Storing products indoors provides added security from vandalism and protection from weather.

Disadvantages
- May limit movement of indoor equipment (e.g., forklifts).
- May be more difficult to move containers into or out of the secondary containment.
Limited to holding smaller volumes of materials.

**Design Parameters/ Construction Guidelines**
Whether buying or building, ensure that the containment is structurally sound, the containment material is compatible with the material being stored, and equipment accessibility to the containment area is adequate. Special attention should be given to the load-bearing strength of the floor on which the containment unit is placed. Provisions for channeling spills inside the containment to a collection area (sump) and ventilation in the event a spill occurs, should be considered.

**Maintenance**
- Absorbent and diking materials should be stored near the containment area.
- Periodic inspections should be conducted to assess containment integrity, indications of leaks/spills, and the operating condition of associated equipment, such as ventilation systems.
- Assure there is adequate room in and around the containment unit to perform proper inspections.
- Keep minor spills cleaned up and do not use the unit to store unrelated material and equipment.
BMP 12- Fabricated Steel Containment System

Description
The steel structure is generally stainless, galvanized, or epoxy coated. Often it is combined with other construction materials (e.g., a liner or concrete for the floors, and rubber or epoxy at steel joints).

Application
A steel containment system is suitable for containing most types of critical materials in any quantity.

Advantages
- Very durable; will not crack over time.
- Less maintenance.
- Can be dismantled and moved.
- The material is usually available locally.

Disadvantages
- May be more expensive than other materials.
- Incompatible with some chemicals (e.g., acids).
- If containment is made with a steel floor, the junction between the floor and wall may be harder to seal. Also, a steel floor would make the total containment fairly expensive.

Design Parameters/Construction Guidelines
- The floor of the secondary containment should be continuous below the primary tanks and strong enough to hold the weight of the primary tanks.
A sump and methods for removing accumulated product and storm water should be designed into the system floor.

A roof or other mechanism for keeping storm water out of the containment area should be considered.

Coating the steel may be appropriate for corrosion protection or to reduce bacteria growth, which can form mold.

**Maintenance**

Periodic inspection of the containment system with special attention to the wall joints.
BMP 13- Above Ground Storage Tank (AST) Containment System (double-wall)

Description
A tank system that provides for detection, containment, and recovery of product stored in the tank. The system may be located outdoors or indoors.

Application
On site storage of products in single or multiple double-walled tanks. Well suited for critical materials that must be isolated if they should leak out of primary containment. Above ground storage tanks also work well in areas where space is constricted, whether doing a retrofit where the size of the secondary containment needs to be reduced, or when the original secondary containment cannot accommodate an increased or upgraded primary containment unit.

Advantages
- 100% containment of leaked product, resulting in reuse.
- Vapor released to environment much less likely.
- Less maintenance, particularly with regard to storm water.
- Portability - can be moved much easier.
- In some cases, may take up less space.
- May be easier to install.
- Convenience, durability, and expedience.

Disadvantages
- Determining the exact location of a leak may be more difficult.
- Cannot perform visual inspection of primary containment.
- Piping containment may be more difficult.
- Overfills may not be contained.
- Overfill protection devices may be more difficult or expensive to install.
- Additional secondary containment required for piping.
- The primary and secondary walls of these tanks can both fail when struck by projectiles or out-of-control vehicles.

Design Parameters/Construction Guidelines
- Tanks need to be properly designed for the product stored.
- The tank design must meet applicable regulations.
Maintenance

- Regular visual inspections of the outer containment wall.
- Regular manual or electronic testing of interstitial area.

Figure 31
Left hand tank is a double walled tank
BMP 14- Temporary Containment Systems

**Description**
The temporary placement and use of secondary containment vessels, liners, barriers, or encapsulating pads for retaining spilled fluids or solids.

**Barriers with Liners**
Concrete Jersey Barriers, Ecology Blocks, “K” rails, and Masonry Units can be used as the vertical support wall for containment. These walls can be placed in any configuration as long as they form an enclosed vertical barrier 360 degrees around the containment source. Impervious liners are laid or positioned within the boundaries of the vertical walls and secured.

**Earthen Berms with Liners**
An excavated or at-grade containment area with a bermed perimeter constructed of native soils or other inert materials. An impervious liner is then positioned and secured to protect all of the bermed containment area.

**Containment Pads**
Plastic, fiberglass, or fabric-formed containment structures that are specifically conformed to the shape and size of the application. Usually placed at fueling station nozzle points or under parked storage containers (e.g., railroad cars, tankers, and fueling stations).

**Boom Liners**
Constructed of different materials and configurations, these usually offer only small containment possibilities. These units are most often used for inside containment situations (mainly offloads or spill control), but can be used for exterior applications on impervious surfaces.

Liners come in any configuration and shape. Most are tarpaulin form and are PVC, reinforced oil resistant PVC, polyethylene (MDPE), high density polyethylene (HDPE), rubber liners, Koroseal liners, Burke seal, urethanes, and other manufactured materials. All can be used as membranes for temporary secondary containment.

**Application**
Critical materials that exist on a site for more than 30 days must have secondary containment. Temporary secondary containment units shall meet all jurisdictional setbacks as required for permanent installations. The usual places of installation and
use are in conjunction with new facility construction that needs temporary storage; such as, truck, vessel, or train docking and fueling stations, and road construction projects. Most jurisdictions require engineering for system installations along with manufactured listings.

**Advantages**
- Cost effective in labor and installation costs.
- Ease of removing and installing compared to permanent placement.
- Leaks are easy to detect.
- Good for short-term placement.

**Disadvantages**
- Not a long-term solution.
- Tend to deteriorate over time and exposure to the elements.
- May encompass large areas with greater risk of potential exposure.

**Maintenance**
Due to the temporary nature of these units, they are often not installed with the same care and detail as a permanent containment structure. Therefore, daily inspection of these units is critical. Absorbents, as well as diking and cleanup materials should be on site and readily accessible.
BMP 15- Tank contained in subgrade vault.

PURPOSE:
To contain leaks from corroded or punctured tanks or transfer lines and to contain spills from tank overfilling. To provide for easy inspection of tanks and lines.

ADVANTAGES:
More than one tank can be placed in each vault. Size and type of tank can be changed relatively easily. Vaults will provide for containment of spills from overflows and leaking pipes as well as leaking tanks.

DISADVANTAGES:
High installation cost, especially if vault must be covered to support vehicular traffic. Uncovered vaults must be equipped with storm water removal facilities. Concrete vaults may require special coatings or liners to insure that they are impervious to the material stored.

APPLICATION:
Potentially useful in any situation requiring underground storage. Especially applicable for storage of corrosive materials where frequent tank inspection is desirable. May also be desirable where it is expected that the size or type of tank may be changed in the future. Since the nature of this type of installation demands that the volume of the vault be greater than the volume of the tank(s) it contains the primary criteria for determining the size of the vault should be the needed clearance for inspection and installation.
BMP 16- Catch and store Critical Materials spilled at loading docks.

CONTROL MEASURE:
Loading dock spill sump with stormwater release.

PURPOSE:

ADVANTAGES:
Simple installation. Relatively inexpensive.

DISADVANTAGES:
Provisions must be made for the release of stormwater. Auxiliary stormwater disposal system must be installed. If load size is variable, storage for large loads may be needed though infrequently used.

APPLICATION:
These systems are suitable for use in any area where stormwater runoff and spilled products will be funneled to the same disposal point.

DESIGN CRITERIA:

The total storage volume should be adequate to contain the largest volume that will be transferred at the site. If the sump is located in an enclosed, sunken loading area, the volume of the enclosed area may be included in the design. If manually operated stormwater release valves are used, their normal position should be the position which retains stormwater in the sump.
BMP 17- Covered loading areas.

CONTROL MEASURE:

PURPOSE:
Prevent the mixing of stormwater and spilled products. thus allowing simple spill sumps.

ADVANTAGES:
Makes the use of spill containment sumps without stormwater release possible. Provides better foul weather working conditions.

DISADVANTAGES:
More expensive than uncovered areas. Drainage must be diverted away from the loading area. Sumps can be pumped to remove products or accidentally discharged water.

APPLICATION:
The system can be used anywhere products are to be loaded or unloaded. It is most appropriate where there is little chance that stormwater or wash water will enter the system necessitating pumping the sump for a non-spill event.

DESIGN CRITERIA:
The covered area must extend beyond all paved surfaces which slope toward the sump inlet. The sump should be designed to contain the entire volume of the largest container likely to be handled at the loading dock.
BMP 18- Grated perimeter drain

PURPOSE:
Surround level workspace with a trap which will catch spills within the work area.

ADVANTAGES:
Can be used in open areas. Floor does not need to slope as would be required with a simple drain.

DISADVANTAGES:
High installation costs. The grating system must be carefully maintained in order to prevent blocking. The grating must be kept in place to reduce the likelihood of worker accidents.

APPLICATION:
This system is most appropriate for use in areas which contain equipment or storage containers holding critical liquids, and which experience considerable worker traffic. Also useful in areas which must be level.

DESIGN CRITERIA:
While slope is not necessary, if used, it should be away from the center of the area. The volume of the grated area should contain the total volume of all material stored within the grated perimeter or the system should drain to a storage tank of adequate volume.
BMP 19- Floor drain collection system.

PURPOSE:
To collect spilled material and retain for clean-up.

ADVANTAGES:
low cost installation using traditional plumbing materials.

DISADVANTAGES:
Suitable only for areas where small volumes of products are involved unless drains are piped to a large storage tank. Requires sloping floors to the drains.

APPLICATION:
Most useful in areas where spills are unlikely or only small volumes of products are used. Drains should not be connected to sewer system. This type of system is probably not suitable for areas where equipment requiring level floors is to be installed.

DESIGN CRITERIA:
The tank should be sized to hold the total volume of material contained in the equipment placed on the floor draining to the tank with a ten percent allowance to prevent overflow. Where floor drains are used in product storage areas, the amount of product stored should be determined by the available storage volume assuming the same ten percent safety factor. Due to the lack of outlets on these systems, they are probably not appropriate for locations where routine washing of floors or equipment is necessary. Drain tanks located under floors or outside should have easily accessible access ports to allow for cleaning and recovery of spilled material.

In installations having covered vaults both the tank and the vault must be vented. Uncovered vaults must be equipped with facilities to allow removal of storm water. These facilities must provide for the separation of any spilled or leaked products from the storm water.
stream before it is released into the environment. Devices listed under "Selective Flow Devices" may be used. The floor of all vaults should be sloped to a sump depression to allow for easy removal of spills or storm water. In cases where concrete or other material used to construct the vault is not impervious to the product being stored within the vault a suitable liner or coating impervious to the product must be applied to the inside of the vault. In any case, if cracks appear in the vault material they must be sealed with a material resistant to the products being stored.

Vault containment facilities may be backfilled with sand if desired to allow covering the vault with a typical pave surface. In this type of installation a liner must be installed prior to backfilling.

Since some infiltration through the paved surface will occur, a well for removal of storm water from the vault must be provided.
C-25
BMP 20- **Floor containment liner**.

**PURPOSE:** To contain spills or leaks which occur inside buildings having earth or gravel floors.

**ADVANTAGES:**
Relatively low cost. A properly installed synthetic liner will provide a more effective barrier than a concrete floor which has developed cracks.

**DISADVANTAGES:**
Careful installation is required to prevent puncturing the liner. Material spilled will accumulate in the soil above the liner. This may create health or fire hazards, unless contaminated soil is removed. Disposal of soil contaminated by spills may create a hazardous waste/dangerous waste problem.

**APPLICATION:**
Though required under floors where no other impervious liners exist, synthetic liners may be installed under any floor where extra protection is desired. As a general rule critical materials storage on earth floors should not be allowed.

**DESIGN CRITERIA:**
The material selected for the liner membrane must be resistant to the product being contained. The liner installation should include enough sidewall to contain complete loss of all material contained in the largest container stored inside the facility. The volume calculation must consider only the void space in the soil as being available for containing spills. A minimum of six inches of soil must cover the liner. The material placed immediately above and below the liner should be of such a nature that it will not puncture the liner.
BMP 21- Drain Pans

Catch small spills which occur when transferring liquids from storage tanks to small containers.

ADVANTAGES:
Low cost method for controlling small spills. May improve worker safety by keeping spilled material off of floors. May lower materials use by allowing the recovery of small spills.

DISADVANTAGES:
The collection of small amounts of spilled materials may create new disposal problems.

APPLICATION:
This measure is useful only when small amounts of material are being transferred. It should be used only in situations where the filling operation will be attended at all times.

DESIGN CRITERIA:
The drip pan should be located under the filling spout so any drips or overflows are collected. Drip pans should be sized to contain the entire volume of the largest container that is normally filled. While the drip pan should be attached to the floor to prevent accidentally moving the pan away from the desired location, it should be easily removable to allow easy spill recovery or disposal. Due to the limitation on pan size, presented by ease of handling and worker safety (the pan should not protrude into work areas), the pan volume should be a maximum of five gallons.
BMP 22- Containers, Cabinets

Secondary containment of smaller containers is just as important as larger containers, such as tanks. In the example photo at the right, the potential for spilling of these materials is very high. This could pose a hazard to the aquifer without proper containment.

Although this is an obvious concern, the storage of most critical materials is often taken for granted.

The use of simple containers, such as buckets, can serve as a secondary containment of critical materials.

Secondary containment cabinets can be used for storage of larger capacities of critical materials. These cabinets are designed with shelving and a base that will contain spills and leaks of a container.
BMP 23- Concrete Coatings

Coatings for concrete secondary containment areas are recommended. The main function of the coating is to seal the concrete barrier, which might be unable to prevent seepage of small to large amounts. Coatings also protect the concrete from product breakdown that can occur when liquids come into contact with the concrete.

While coatings can enhance the containment of liquids and prolong the life of the concrete, it is important that new concrete structures be designed with the proper mix/ingredients for the area and product being stored, have proper reinforcement, and have appropriate joint details. This will reduce the potential for cracking or joint separation and help ensure the integrity of the containment.

There is a vast variety of coating materials that are categorized in a number of ways. Some of the more common materials mentioned for coatings are liners (usually polymers), paints, resins, epoxies, acrylics, polyesters, polyurethanes, bitumens, and lastomers. Trade organizations that deal with the type of materials a facility handles should be able to direct the facility to coating vendors that can provide coatings that are satisfactory for the stored materials.

Selection Factors
Factors to consider when choosing a coating material should include:

- Ability to bond to the substrate.
- Durability (to impacts, heavy equipment used in the containment area, reaction to spilled materials, photo degeneration, etc.).
- Resistance to microbial action (stains, odors, scaling, etc.).
- Flexibility (ability to stretch and shrink instead of crack).
- Product compatibility with the product being stored.
- Projected life of the product.
- Cost.
- Ease of application.
- Reaction to expected weather conditions.

Application Factors
Factors to consider when applying coatings include:

- Safety of the applicators (slipping or presence of volatiles).
- Preparation of the substrate prior to coating application (must usually be very clean).
APPENDIX D
Sample Inspection Checklists
Weekly Facility Inspection Checklist

Inspection Location: ____________________________________________.
Inspection for the week of: ______________________________________.

Accumulation

_____ Are all appropriate containers marked with a hazardous waste label?
_____ Are all and containers marked with a risk label, if appropriate?
_____ Are all containers closed?
_____ Are all container labels visible and readable?
_____ Are all containers in good condition?
_____ Is there 30 inches of aisle space between rows of containers?
_____ Are any containers or cabinets leaking?

Sumps

_____ Are sumps clean and free of contamination, spills, leaks, and standing water?

Safety Equipment

_____ Are fire extinguishers charged?
_____ Are spill kits stocked?
_____ Is the first aid cabinet stocked?
_____ Is the emergency shower and eye wash station functioning properly?
_____ Are the emergency communication devices operating properly?
_____ Is the emergency response information posted near all communication devices?
_____ Is the Material Safety Data Sheet (MSDS) manual readily available?

Secondary Containment

_____ Is the secondary containment free of cracks or other failures?
_____ Does the secondary containment contain any product?

Comments:

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<th>Date of Action</th>
<th>Describe the actions that you took to correct the deficiencies noted above</th>
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Printed Name: ____________________________________________
Signature: ____________________________________________
Date: ____________________________________________
Time: ____________________________________________
Recommended Weekly Facility Inspection Checklist for Small Business

Inspection for the week of: ________________________________
Inspector Printed Name: ________________________________
Inspector Signature: ___________________________________
Date of Inspection: __________________________ Time: ______________________

Legend: Y=Yes; N=No; C=Comment, below

Inventory of Raw Material (Product)
___ Are all drums and containers marked with appropriate labels?
___ Are all drum labels visible and readable?
___ Are all drums and containers in good condition?
___ Are all containers closed?
___ Are any drums leaking?
___ Is the secondary containment free of cracks or other failures?

Accumulation of Waste
___ Are all drums and containers marked with hazardous waste labels?
___ Are all drum labels visible and readable?
___ Are all drums and containers in good condition?
___ Are all containers closed?
___ Are any drums leaking?
___ Is there 30 inches of aisle space between rows of containers?
___ Are all drums marked with the proper waste code(s)?
___ Are there any drums that are near or have exceeded the timeframe?
___ Are all drums and containers marked with a risk label, if appropriate?
___ Is the secondary containment free of cracks or other failures?

Safety Equipment
___ Are fire extinguishers charged?
___ Are spill kits stocked?
___ Is the first aid cabinet stocked?
___ Is the emergency shower and eye wash station functioning properly?
___ Are the emergency communication devices operating properly?
___ Is the emergency response information posted near all communication devices?

Comments: ______________________________________
____________________________________________________
____________________________________________________

Date of Action: ___________ Describe the actions that you took to correct the deficiencies noted above (continued on Back)

____________________________________________________
____________________________________________________
____________________________________________________

Printed Name: __________________________________________
Signature: ______________________________________________
Date: __________________________________________________
Time: _______________
### Recommended Daily Facility Inspection Checklist for Companies with Outside Storage Areas

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<th>Inspector: ____________________________</th>
<th>Date: ____________________________</th>
<th>Time: ______________</th>
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**Legend:**
- X = Satisfactory
- NA = Not Applicable
- O = Repair or adjustment required
- C = See Comment on back

#### Drainage
- Any noticeable oil sheen on runoff.
- Containment area drainage valves are closed and locked.
- Oil/water separator systems working properly.
- Effluent from oil/water separator inspected.
- No visible oil sheen in containment area.
- No standing water in containment area.

#### Above ground Storage Tanks (ASTs)
- Tank surfaces checked for signs of leakage.
- Tank condition good (no rusting, corrosion, pitting).
- Bolts, rivets, or seams are not damaged.
- Tank foundation intact.
- Level gauges and alarms working properly.
- Vents are not obstructed.
- Valves, flanges, and gaskets are free from leaks.
- Containment walls are intact.

#### Pipelines
- No signs of corrosion damage to pipelines or supports.
- Buried pipelines are not exposed.
- Out-of-service pipes capped.
- Signs/barriers for vehicle protection in place.
- No leaks at valves, flanges, or other fittings.
- Are sumps clean and free of contamination, spills, leaks, and standing water?

#### Truck Loading/Unloading Area
- No standing water in rack area.
- Warning signs posted.
- No leaks in hoses.
- Drip pans not overflowing.
- Catch basins free of contamination.
- Containment curbing or trenches intact.
- Connections are capped or blank-flanged.

#### Storage Areas
- Is the secondary containment free of cracks or failures?
- Are all containers marked with appropriate labels?
- Are all container labels visible and readable?
- Are all containers in good condition?
- Are all containers closed?
- Are any containers leaking?

#### Security
- Fence and gates intact.
- Gates have locks.
- ASTs locked when not in use.
- Starter controls for pumps locked when not in use.
- Lighting is working properly.

**Comments:**

__________________________

__________________________

__________________________

Date of Action: _________ Describe the actions that you took to correct the deficiencies noted on front of form.

__________________________

__________________________

__________________________

Printed Name: ____________________________

Signature: ____________________________

Date: ____________________________

Time: ____________________________