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7. Abstract <p>This document provides guidance to Tank Waste Remediation Systems personnel in determining what containment is appropriate for work activities, what containments area available, general applications of each, design criteria, and other information needed to make informed decisions concerning containment application.</p>		
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RADIOLOGICAL CONTAINMENT SELECTION, DESIGN, AND SPECIFICATION GUIDE

1.0 PURPOSE

This document is to provide guidance for Planners, Schedulers, Engineers, Managers, Health Physicists, and others who may need to determine the appropriate level of containment for controlling radioactive contamination at Tank Farms.

2.0 SCOPE

This document provides guidance on the selection and design of containment devices for use at Tank Farm facilities. Guidance topics other than selection and design can be found in WHC-SD-GN-RD-20002, Westinghouse Containment Program.

3.0 PROCESS

The general steps applied to the containment process are as follows:

- Define the job
- Determine level of containment needed
- Determine the type of containment needed.
- Develop criteria for the containment
- Designing Containment
- Obtain Containment
- Use containment.

4.0 DETERMINING CONTAINMENT NEED

The appropriate containment for a given task should be selected based on the fundamental concepts of contamination control and personnel safety. Table A-1, Recommended Containments for Specific Work Activities, provides a worksheet format applying the guidance contained in this section.

The level of containment is broken down into four "risk" categories: very low, low, moderate, and high. These categories are somewhat subjective in nature; because of this, the table is a guide from which to begin the planning and evaluation process and is not intended to be the sole means of determining what level of containment should be used. Other considerations should include impact of containment failure, area dose rates, waste minimization, ventilation, etc. When all factors are considered, the final determination may vary from the matrix.

Table 1. Recommended Containments for Specific Work Activities.

Removable Contamination Level	Contamination Stability	Operation	Containment Category
< 10 times Table 2-2 6	Very Stable 4	Simple material movement 5	Very Low Risk Total = 15-20
< 100 times Table 2-2 12	Moderately Stable 8	Vigorous material movement 10	Low Risk Total = 21-31
> 100 times Table 2-2 18	Low Stability 12	Use of power tools in area or manual cutting, shaping or abrading of material 15	Moderate Risk Total = 32-45
		Use of low velocity power tools to cut, shape or abrade material 20	High Risk Total > 45
		Use of high velocity power tools to cut, shape or abrade material 25	
—	+ —	+ —	= —

Instructions: Select the appropriate block from each of the first three columns. Add the numbers from the appropriate block in each column and select the appropriate containment class.

NOTES:

1. Removable contamination level refers to the DOE Radiological Control Manual Table 2-2.
2. Containment requirements may be revised up or down based on general area contamination levels, or dose rates, and personnel protection afforded (for example, respirators, ventilation, engineering controls).
3. When contamination levels cannot be verified, either by survey or historical data, the most limiting level for contamination should be used.
4. The values on the chart call for subjective analysis. The Radiological Control Organization is responsible for making the final determination of the level of containment. This should be done in consultation with the line organization.

4.1 Assessment Criteria

Three primary criteria are used to determine the appropriate level of containment. These criteria are: removable contamination levels, contamination stability, and the work activity to be performed.

Secondary criteria are also considered as a second check of the result to allow for common sense adjustments. These other considerations should include impact of containment failure, area dose rates, waste minimization, ventilation, etc. When all factors are considered, the final determination may vary from the matrix.

In essence the primary criteria are independent of the area the job takes place in, the secondary criteria customize the selection to the work area, ensuring the decision is appropriate.

4.1.1 Removable Contamination Levels

Removable contamination is defined as radioactive material that can be removed from surfaces by nondestructive means such as casual contact, wiping, brushing, or washing. The table breaks the criteria down into three distinct categories: 1), less than 10 times Table 2-2 ($< 10,000$ dpm $\beta\gamma$, 200 dpm α); 2) 10 to 100 times Table 2-2 (10,000 to 100,000 dpm $\beta\gamma$ or 200 to 2000 dpm α); or 3), greater than 100 times Table 2-2 ($> 100,000$ dpm $\beta\gamma$, 2000 dpm α).

NOTE: If the likely contamination levels cannot be obtained from survey or historical data, the most limiting category should be used.

4.1.2 Contamination Stability

As noted above, removable contamination is defined as radioactive material that can be removed from surfaces by casual contact. Stability is a qualitative assessment of how easily this transfer occurs and how easily the contamination may be transported from surface to surface or surface to air. Containment stability is broken into three categories, high, medium, and low. For example: contamination that, if disturbed, readily resuspends into the air would be categorized as low stability, while contamination suspended in liquid, or on a moist or oily surface would generally be considered high stability, other contaminated surfaces would generally fall between these criteria based on surface texture, weathering and a variety of other factors to be considered.

4.1.3 Work Activity

Work activities are those actions which will be performed in the contaminated portion of the work area. The containment selection process breaks work activities into five categories:

1. Simple material movement such as walking, lifting, carrying.
2. Vigorous material movement such as repackaging waste, HEPA filter manipulation, packing replacement, etc.
3. Using power tools in the area or manually cutting, abrading, or shaping the material.
4. Using low-velocity power tools (portable band saws, electric drills operated at low speeds, etc.) on the contaminated components.

5. Using high-velocity power tools (grinders, high-speed drills, etc.) on the contaminated components.

4.2 Containment Categories

4.2.1 Very Low Risk

For tasks involving a very small risk of contamination spread, no specific containment beyond the administrative controls of good work practices would apply. This does not preclude using containment; experience and training of the work force would be the basis for containment selection. In this category, containment might be a damp rag, sleeving, an air curtain, or even a plastic bag.

No HPT certification or work package description of the containment is routinely required.

4.2.2 Low Risk

Tasks where the risk of contamination spread is low, but the containment device is specified. Examples of devices in this category are catch containments, drip pans, bull pens, sleeving, air curtains, etc.

No HPT certification of the containment is routinely required, but the work package describes the containment device/method.

4.2.3 Moderate Risk

Tasks where the risk of contamination spread is moderate and containment becomes total enclosure such as heavy sleeving, glove bags, or containment tents.

HPT certification of the containment device is required. The work package should contain a certification checklist for the appropriate style of containment.

4.2.4 High Risk

Tasks where the risk of contamination spread is high and containment should be accomplished by ventilated tents or glove bags, used independently or in conjunction with each other.

HPT certification of the containment device is required. The work package must contain a certification checklist for the appropriate style of containment.

FIGURE 1: DESIGN CHECKLIST, PART 1

JOB TITLE _____
WORK PROCEDURE _____
LOCATION _____

SUMMARY OF WORK _____

CONTAINMENT TYPE: ☐ Tent ☐ Glove Bag ☐ Other
CONTAINMENT STYLE: ☐ Standard - Type: _____ ☐ Custom

REQUESTING ORG: _____

USERS: _____

SOURCE:

- ☐ Procured
☐ On Site Manufacture (WO/PO # _____)
☐ Field Construction

SPECIAL INSTRUCTIONS/TEST REQUIREMENTS: _____

Preparer: _____

REVIEWERS:

User: _____

User: _____

Radiological Control: _____

ATTACHMENTS:

- ☐ Tent Design Worksheet
☐ Glove Bag Design Worksheet
☐ Other

FIGURE 2: DESIGN CHECKLIST, CONTAINMENT TENT ATTACHMENT

Work Package _____ Job Summary _____

Location _____

Notes _____

Prepared By _____

Reviewed By _____

Radiological Control _____

Craft _____

Operations _____

Other _____

(A) 3" x 6" service sleeve

(B) ____ x ____ Service Sleeve

(C) ____ x ____ Service Sleeve

(P) Passout Box

(W) Window ____ x ____

Door

Zipper
Velcro

FIGURE 3: DESIGN CHECKLIST, GLOVE BAG ATTACHMENT

Work Package _____ Job Summary _____
Location _____
Notes _____

SKETCH:

Recommended Source
() On Site Manufacture
() In Field Manufacture
() Off Site Procurement

Prepared By _____

Reviewed By _____

Radiological Control _____

Craft _____

Operations _____

Other _____

- A Glove Ports
- B 6" x 12" Service Sleeve
- C 3" x 6" Service Sleeve
- D _____ x _____" Service Sleeve
- E Passout Box

Zipper

Velcro

5.0 CONTAINMENT DESIGN GUIDELINES

5.1 Purpose

This section provides a uniform methodology for containment design and specification.

5.2 Process

A sample design checklist is included, (Figure 1, Design Checklist). The containment design checklist is a two-page document; page 1 collects needed information, and page 2 includes a sketch that can be used to show the layout of the containment. The attachment includes two versions of page 2: one for glove bags, and one for tents. Some information is repeated, so the two pages may be used independently.

5.3 Design Considerations

5.3.1 Containment Tents

5.3.1.1 Features

The following features should be considered when designing a containment tent:

- **External Frame** — Containments should use an external frame. If, for structural or other reasons, an external frame is not practical, every effort should be made to prevent framing materials from becoming contaminated. Two basic types of frames are used, the first is the standard tube lock, the second is schedule 40 pipe, cut to length. For all type I, II, and V tents (standard 10' x 15') the schedule 40 type is normally used, this is installed by operations. For most other applications tube lock is used because the dimensions of the tent vary so widely the pipe is far too complex to assemble.
- **Material** — Material should be a flexible, impermeable fabric of sufficient strength to meet the specific environmental conditions. Generally Pacifitex or Heruculite type materials are used, any material meeting the requirements of mil spec 43006G, Type 1 material will work. As a note, other materials can be used if needed, but any material used must fulfill the requirements of NFPA 701 A, Large Scale, for fire retardant capability.
- **Support** — For external applications, flexible supports are needed. All tents should have sufficient tie-offs (e.g., grommet tabs, molded tie-offs, or other such devices) to support the tent. This can be achieved in a variety of methods, however the basic fundamentals of securing a tent require that all external corners have a grommet strip or tie offs used to support the tent. This also applies to those corners on the ground, especially for out door applications. Figure 4 shows a routine pattern for tie offs on a tent, this pattern is also appropriate for grommet strips. Grommets should not be spaced more than 18" apart.
- **Service Sleeves** — Service sleeves are used to bring services such as power and air into a tent. As a rule, service sleeves should be a minimum of 3 in. in diameter.

- **Dump Sleeves** — Dump sleeves are generally located near exit doors as a receptacle for waste and used protective clothing. Dump sleeves may have collars attached that allow sleeves to be replaced or have long sleeves attached. The advantage of long sleeves is to allow waste to be collected in the sleeve and removed using a standard bag out method as is used with glove bags. Dump sleeves are not a mandatory item on tents and should not be installed unless they will be used.

Figure 4: Typical Tie Off Locations

- **Color** — Tents used at Tank Farms should be white and labeled to indicate its radiological status.
- **Windows** — Windows should be clear and of sufficient number to allow use of external lighting. For outdoor applications, covers should be considered that allow sun side windows to be covered. This will help keep temperatures in the tent ALARA.
- **Make up air** — When ventilation is used on a tent, the tent must have a means of taking in make-up air. Acceptable methods of taking in make-up air include, but are not limited to, inlet breather filters or one-way louvers. Figure 5 shows typical breather filters.
- **Doors** — Doors should be designed to be opened and closed easily. If high radiation area controls are required, consideration should be given to using doors that can be locked. Doors should have a clear viewing panel in the upper half and have posting pouches capable of holding standard size signs on the lower half. For tents to be used for extended periods of time or under harsh conditions, spare or backup doors may be included in the tent.
- **Ante Rooms** - Ante rooms provide additional contamination control by providing directional air flow and barriers against the spread of contamination, as well as a location to remove contaminated clothing.
- **Open Roofs** - Crane operations often require roofs to be openable on a containment tent. The best method of doing this is to have the roof in the form of a semi-detachable flap that is firmly attached on one side, and attached with velcro on the other three sides. The velcro on the tent should be 8" wide, and the velcro on the roof flaps, 4" wide. The roof flap should have a loop every 5' to allow a support to be installed that prevents sagging. For larger tents, two overlapping flaps may be needed.

5.3.1.2 Ventilation of Containment Tents

If it is determined that a containment should be ventilated, the ventilation should be planned as part of the containment. Ventilation for containment tents usually is operated at 0.01-0.3 in. of water and 4-20 air changes per hour. Where possible, ventilation should be localized using flexible ducting directly to the source of the contamination. This is a far more efficient method of ventilation and may preclude the use of respiratory protection. Vacuum cleaners can also provide an effective source of localized ventilation. See Figure 6 for examples of good and bad ventilation arrangements.

5.3.1.3 Outdoor Considerations

When containments are to be used out of doors, key factors must be considered such as wind, rain, snow, lack of support facilities and temperature. Some of the essential features of indoor and outdoor containments are provided for comparison below.

- Indoor containments

Lower gauge (10-14 mil) fabric (nylon reinforced plastic)

UV resistance and plastic stabilizer requirements are not critical

Structural members will not be required to withstand wind gusts of up to 50 mph

- Outdoor containments

Higher gauge (14-18 mil) fabric (nylon reinforced plastic)

UV resistant material should be used

Structural members will be required to withstand wind gusts of up to 50 mph

Figure 5: Breather Filter Assemblies.

Flexible supports needed to connect tent to frame

5.3.1.3.1 Wind

Wind considerations will often mandate that an engineering assessment of outdoor containments be performed. For containment tents, material meeting Mil-C-43006G, Type 1 material requirements, attached with 2.5-in. molded plastic tie offs will generally endure winds > 50 mph if the tie-offs are connected to the frame with flexible cord and the frame is adequately anchored.

Operating considerations for specific applications should include wind speeds at which containment tents are no longer considered stable. When this wind speed is expected, provisions for collapsing tents in place and securing them to frames should be considered.

5.1.3.1.2 Rain

Rain is only a problem to containments if it is allowed to pool or penetrate unsecured openings. All containment structures used out of doors should include a slope either built into the tent or a secondary cover added externally that allows the containment to shed rain water. Note that the slope should not direct rain water toward a door. If a flat topped containment is needed, drain fittings, such as could normally be used in a catch containment, can be installed in the roof and liquids routed outside the tent. Alternative methods of removing water from the roofs of containment should be considered.

5.3.1.3.3 Snow

Snow accumulation should be removed as quickly as is reasonable. No reasonably obtainable roof slope will shed all snow. A good method of dealing with snow is to install a secondary cover on the containment that can be put at a much steeper pitch than the roof of the containment and that is external to the frame.

5.3.1.3.4 Temperature

At colder temperatures many plastics become stiff; this can make many simple operations very difficult. For example it is very difficult change a pass out sleeve or tape up a service lead in cold

Figure 6: Ventilation Arrangements

weather. For tents, little can be done unless the tent can be heated. For glove bags, polyurethane is a viable alternative as it maintains flexibility in extreme cold.

5.3.1.3.5 Miscellaneous Considerations

Containment tents used outdoors have a tendency to begin deteriorating around doors and windows. The constant motion caused by wind action can cause door zippers to wear out very quickly. A proven method of resolving this is to have both Velcro and zipper door closures. Another method is to have spare doors actually installed in the containment but not placed in service until needed.

5.3.2 Glove Bags

Design consideration for glove bags should consider the following:

- Support — External framing may be needed for support depending on application and ventilation requirements. Molded tie-offs, grommet tabs, or other tie-off devices should be included in the design of the glove bag. Elastic cord is preferable for connecting glove bags to an external frame.
- Service Sleeves — Service sleeves are used to bring needed services into a glove bag and to provide an outlet for air exhaust or liquid drains.
- Color — Glove bags should be clear and/or yellow. Accessories need not be specially colored if they are appropriately labeled.
- Ventilation — All glove bags should contain a 2-cfm or larger HEPA filter located in the upper half of the glove bag. Glove bags having negative ventilation should contain HEPA filters of sufficient flow capacity to prevent the glove bag from collapsing. If air tools are used, the exhaust should be directed out of the glove bag, unless adequate exhaust ventilation is provided.
- Temperature — Glove bags that will be in contact with piping or components where temperatures may exceed 150 °F should be protected by heat insulating material.
- Liquid Collection — Where liquid is expected or likely to collect in the glove bag, the glove bag should be verified liquid tight. A drain assembly or pump suction should be included in the design. Many acids will dissolve seams that have been glued.

5.3.3 Poly Bottle Installations

Design considerations for poly bottle installations should include the following:

- Volume — Estimated volumes of liquid expected should be planned for as part of poly bottle installations; staging of spare poly bottles should be considered. Poly bottles should never be filled more than 3/4 full.
- Location — Where possible, poly bottles should not be located in walkways or other locations where the bottle, hose, or attachments could easily become damaged, disconnected, or spilled.

- **Sizing** — Poly bottles generally come in two sizes, 5 and 15 gal. Where movement of a full or partially full bottle is difficult (i.e., stairwells, ladders), the smaller bottle should be used.
- **Inspections** — Since poly bottles are not routinely certified, consideration must be given to an inspection frequency during the design phase of the process. Considerations should include area traffic, contamination levels, radiation levels, and the expected flow rate into the bottle.
- **Spillage** — Poly bottles should be supported or tied off to a sturdy point to prevent tip over.
- **Criticality** — The use of poly bottles should be evaluated by qualified personnel when used with fissile isotopes.

Figure 7: Standard Poly Bottle Installation

- **Freezing** — Where poly bottles are exposed to freezing conditions, freeze protection should be included in the design.
- **Liquid Temperature** — Liquids greater than 150 °F should be collected in bottles designed for high-temperature liquids. Poly bottles should not be used unless sufficient liquid is included in the bottle as a heat sink.
- **Change out** — The organization responsible of changing and/or emptying full poly bottles should be identified.
- **Liquid Level** — Poly bottles should have dye (red or blue food coloring) added to color the liquid when installed. This allows the liquid level to be observed without tipping the bottle. A generic application of a poly bottle to a catch containment is shown in Figure 7.

6.0 SPECIFICATIONS AND APPLICATION GUIDES

Standard specifications are a very useful method of simplifying the use of containment. In essence, standard specifications establish ground rules, within which many different versions of a containment can be obtained. No standard specification will address all needs.

This section contains abridged sketches and specifications for readily available tank farm containments. All of the containment devices shown in this section are available from spare parts or can be ordered using the specifications and sketches provided. The specifications are consistent with the published tank farm specifications, however if further detail is needed the reference section contains a list of approved tank farm specifications for containment.

6.1 Quality Assurance

While most containments do not require stringent quality assurance programs, the following may have quality assurance verification:

- Bolts or fasteners used in framing
- Verification of any required tests (i.e., air tests)
- Material verification.

6.2 Abridged Specifications for Glove Bags

6.2.1 Type I Glove Bag: The "FIC Glove Bag"

A. Specifications

The glove bag shall have the following features:

Armsleeves must be 18" in length, tapering from 9" in diameter at the shoulder to 5 1/2" in diameter at the wrist. They must be made of polyurethane, 12 mil thick, yellow in color.

The bottom of the glove bag must be flexible polyurethane, at least 12 mil thick, yellow in color.

The sides and top of the glove bag must be flexible polyurethane, at least 12 mil thick, clear in color.

The pass-out boxes shall have an inner opening and an outer opening that can be secured by a velcro or zippered seal. The inner opening shall have a 1" x 2" tab that can be pulled from the inside to access the opening. The box will be located on the outside of the containment and must be 6" x 6" x 8".

The glove bag shall be constructed as follows.

All seals in the main body have a minimum of 1/2" overlap, transfer & access sleeves minimum of 1/4" overlap.

Tie-offs attached by heat sealing and in sufficient quantity to provide adequate support.

Double stitching and a minimum of 12 mil polyurethane is required on all stitched seams.

Packaging and labeling

The glove bags shall be individually labeled as "Type I Glove Bag", on both the outer package and the glove bag. The label on the bag shall be attached to the glove bag by either a tag, or a heat sealed tab, not less than 1" by 2" or larger than 3" by 6".

B. Application Guidance

This type of glove bag is primarily made for use on FICs. Key features to support this activity are the rear port for attaching to the FIC and a larger passout box. The larger passout box will hold the new FIC reel assembly for installation.

FIGURE 8, TYPE I: FIC GLOVE BAG

6.2.2 Type II Glove Bag "Standard 4" Riser Glove Bag"

A. Specification

The glove bag shall have the following features:

Armsleeves must be 18" in length, tapering from 9" in diameter at the shoulder to 5 1/2" in diameter at the wrist. They must be made of polyurethane, 12 mil thick, yellow in color.

The bottom of the glove bag must be flexible polyurethane, at least 12 mil thick, yellow in color.

The sides and top of the glove bag must be flexible polyurethane, at least 12 mil thick, clear in color.

The pass-out boxes shall have an inner opening and an outer opening that can be secured by a velcro or zippered seal. Both the inner and outer opening shall have a 1" x 2" tab that can be pulled to access the opening. The box will be located on the outside of the containment and be at least 4" x 4" x 4" and not larger than 6" x 6" x 6". Passout boxes may be round using an 8" diameter and 4" to 6" depth.

The glove bag shall be constructed as follows.

All seals in the main body have a minimum of 1/2" overlap, transfer & access sleeves minimum of 1/4" overlap.

Tie-offs attached by heat sealing and in sufficient quantity to provide adequate support.

Double stitching and a minimum of 12 mil polyurethane is required on all stitched seams.

Packaging and Labeling

The glove bags shall be individually labeled as "Type II Glove Bag", on both the outer package and the glove bag. The label on the bag shall be attached to the glove bag by either a tag, or a heat sealed tab, not less than 1" by 2" or larger than 3" by 6".

B. Applications

Type II Glove Bags are used to access 4" and 12" risers.

FIGURE 9, TYPE II: 4" RISER GLOVE BAG

6.2.4 Type IV Glove Bag: The "Greenway Glove Bag"

A. Specification

The glove bag shall have the following features:

Armsleeves must be 18" in length, tapering from 9" in diameter at the shoulder to 5 1/2" in diameter at the wrist. They must be made of polyurethane, 12 mil thick, yellow in color.

The bottom of the glove bag must be flexible polyurethane, at least 12 mil thick, yellow in color.

The sides and top of the glove bag must be flexible polyurethane, at least 12 mil thick, clear in color.

The pass-out boxes shall have an inner opening and an outer opening that can be secured by a velcro or zippered seal. Both the inner and outer opening shall have a 1" x 2" tab that can be pulled to access the opening. The box will be located on the outside of the containment and be at least 4" x 4" x 4" and not larger than 6" x 6" x 6". Passout boxes may be round using an 8" diameter and 4" to 6" depth.

The glove bag shall be constructed as follows.

All seals in the main body have a minimum of 1/2" overlap, transfer & access sleeves minimum of 1/4" overlap.

Tie-offs attached by heat sealing and in sufficient quantity to provide adequate support.

Double stitching and a minimum of 12 mil polyurethane is required on all stitched seams.

Packaging and Labeling

The glove bags shall be individually labeled as "Type IV Glove Bag", on both the outer package and the glove bag. The label on the bag shall be attached to the glove bag by either a tag, or a heat sealed tab, not less than 1" by 2" or larger than 3" by 6".

B. Applications

Type IV Glove Bags are similar to the Type II except that the bottom sleeve is a cone. This is to allow the glove bag to be installed on various sized risers, it will fit any riser with a surface diameter of less than a 24".

FIGURE 10, TYPE IV: GREENWAY GLOVE BAG

Exploded View

Side View

- A Glove Sleeve
- B 12" x 60" Service Sleeve
- C 3" x 6" Service Sleeve
- D 24" Service Sleeve, tapered to 11" at bottom, 36" long
- E Passout Box
- F 7" x 60" Service Sleeve
- G 24" x 48" Service Sleeve
- 2" Velcro (Flap is 6" x 18")

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6.2.5 Type V Glove Bag

A. Specifications

The glove bag shall have the following features:

Armsleeves must be 18" in length, tapering from 9" in diameter at the shoulder to 5 1/2" in diameter at the wrist. They must be made of polyurethane, 12 mil thick, yellow in color.

The bottom of the glove bag must be flexible polyurethane, at least 12 mil thick, yellow in color.

The sides and top of the glove bag must be flexible polyurethane, at least 12 mil thick, clear in color.

The pass-out boxes shall have an inner opening and an outer opening that can be secured by a velcro or zippered seal. Both the inner and outer opening shall have a 1" x 2" tab that can be pulled to access the opening. The box will be located on the outside of the containment and be at least 4" x 4" x 4" and not larger than 6" x 6" x 6". Passout boxes may be round using an 8" diameter and 4" to 6" depth.

The glove bag shall be constructed as follows.

All seals in the main body have a minimum of 1/2" overlap, transfer & access sleeves minimum of 1/4" overlap.

Tie-offs attached by heat sealing and in sufficient quantity to provide adequate support.

Double stitching is required on all stitched seams. Double stitching and a minimum of 12 mil polyurethane is required on all stitched seams.

Packaging and Labeling

The glove bags shall be individually labeled as "Type V Glove Bag", on both the outer package and the glove bag. The label on the bag shall be attached to the glove bag by either a tag, or a heat sealed tab, not less than 1" by 2" or larger than 3" by 6".

B. Applications

Type V glove bags are often referred to as dog house containments and are used to repair, decontaminate, or otherwise handle contaminated components that can be put inside of the glove bag. The bag is not generally designed to connect to external components.

FIGURE 11, TYPE V: DOG HOUSE CONTAINMENT

- A Glove Ports
- B 7" x 60" Service Sleeve
- C 3" x 6" Service Sleeve
- D 18" x 60" Service Sleeve
- E Passout Box 8" x 8" x 6" with 1" Velcro Seam on inner and outer flaps.
- 2" Velcro Seam

6.2.6 Type VI Glove Bag "Rulon"

A. Specifications

The glove bag shall have the following features:

Armsleeves must be 18" in length, tapering from 9" in diameter at the shoulder to 5 1/2" in diameter at the wrist. They must be made of polyurethane, 12 mil thick, yellow in color.

The bottom of the glove bag must be flexible polyurethane, at least 12 mil thick, yellow in color.

The sides and top of the glove bag must be flexible polyurethane, at least 12 mil thick, clear in color. The pass-out boxes shall have an inner opening and an outer opening that can be secured by a velcro or zippered seal. Both the inner and outer opening shall have a 1" x 2" tab that can be pulled to access the opening. The box will be located on the outside of the containment and be at least 4" x 4" x 4" and not larger than 6" x 6" x 6". Passout boxes may be round using an 8" diameter and 4" to 6" depth.

The glove bag shall be constructed as follows.

All seals in the main body have a minimum of 1/2" overlap, transfer & access sleeves minimum of 1/4" overlap.

Tie-offs attached by heat sealing and in sufficient quantity to provide adequate support.

Double stitching is required on all stitched seams. Double stitching and a minimum of 12 mil polyurethane is required on all stitched seams.

Packaging and Labeling

The glove bags shall be individually labeled as "Type VI Glove Bag", on both the outer package and the glove bag. The label on the bag shall be attached to the glove bag by either a tag, or a heat sealed tab, not less than 1" by 2" or larger than 3" by 6".

B. Applications

Type VI Glove bags are the only glove bag that can be wrapped around a pipe. Because of this they are useful for piping system work. One limitation on this glove bag is that it should never be used where liquids are expected, unless additional means are used to collect the liquids.

FIGURE 12, TYPE VI: RULON GLOVE BAG

Side View

Top View

Bottom View

- A Glove Ports
- B 6" x 12" Service Sleeve
- C 3" x 6" Service Sleeve
- D 8" x 24" Service Sleeve
- E Passout Box
- 2" velcro seam.

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6.4.7 Type VIII Glove Bags: The "Butch Hall"

A. Specifications

The glove bag shall have the following features:

Armsleeves must be 18" in length, tapering from 9" in diameter at the shoulder to 5 1/2" in diameter at the wrist. They must be made of polyurethane, 12 mil thick, yellow in color.

The bottom of the glove bag must be flexible polyurethane, at least 12 mil thick, yellow in color.

The sides and top of the glove bag must be flexible polyurethane, at least 12 mil thick, clear in color.

The pass-out boxes shall have an inner opening and an outer opening that can be secured by a velcro or zippered seal. Both the inner and outer opening shall have a 1" x 2" tab that can be pulled to access the opening. The box will be located on the outside of the containment and be at least 4" x 4" x 4" and not larger than 6" x 6" x 6". Passout boxes may be round using an 8" diameter and 4" to 6" depth.

The glove bag shall be constructed as follows.

All seals in the main body have a minimum of 1/2" overlap, transfer & access sleeves minimum of 1/4" overlap.

Tie-offs attached by heat sealing and in sufficient quantity to provide adequate support.

Double stitching and a minimum of 12 mil polyurethane is required on all stitched seams.

Packaging and Labeling

The glove bags shall be individually labeled as "Type VIII Glove Bag", on both the outer package and the glove bag. The label on the bag shall be attached to the glove bag by either a tag, or a heat sealed tab, not less than 1" by 2" or larger than 3" by 6".

B. Applications

The type VIII glove bag is an extremely versatile glove bag. It is designed for work by core sampling, the bag was designed by Butch Hall to allow almost any access to a riser he could envision. Technically this glove bag could be used instead of any other glove bag, included the Type V. As a note the glove bag is also large enough to hold a HEPA filtered vacuum and a filter change could conceivably be done in this glove bag.

FIGURE 12, TYPE VIII: BUTCH HALL GLOVE BAG

Side Views

- A Glove Ports
- B 7" x 72" Service Sleeve
- C 3" x 6" Service Sleeve
- D 24" x 36" Service Sleeve
- E Passout Box
- 2" velcro access port (leave membrane intact)

Top View

6.4.8 Type X Glove Bag: The "Wilder Glove Bag"

A. Specification

The glove bag shall have the following features:

Armsleeves must be 18" in length, tapering from 9" in diameter at the shoulder to 5 1/2" in diameter at the wrist. They must be made of polyurethane, 12 mil thick, yellow in color.

The bottom of the glove bag must be flexible polyurethane, at least 12 mil thick, yellow in color.

The sides and top of the glove bag must be flexible polyurethane, at least 12 mil thick, clear in color.

The pass-out boxes shall have an inner opening and an outer opening that can be secured by a velcro or zippered seal. Both the inner and outer opening shall have a 1" x 2" tab that can be pulled to access the opening. The box will be located on the outside of the containment and be at least 4" x 4" x 4" and not larger than 6" x 6" x 6". Passout boxes may be round using an 8" diameter and 4" to 6" depth.

The glove bag shall be constructed as follows.

All seals in the main body have a minimum of 1/2" overlap, transfer & access sleeves minimum of 1/4" overlap.

Tie-offs attached by heat sealing and in sufficient quantity to provide adequate support.

Double stitching and a minimum of 12 mil polyurethane is required on all stitched seams.

Packaging and Labeling

The glove bags shall be individually labeled as "Type X Glove Bag", on both the outer package and the glove bag. The label on the bag shall be attached to the glove bag by either a tag, or a heat sealed tab, not less than 1" by 2" or larger than 3" by 6".

B. Applications

Type X Glove Bags are designed to fit over the top of a 55 gallon drum.

FIGURE 13, TYPE X: WILDER GLOVE BAG

6.2.9 Type A Glove Bag Frame

A. Specifications

Note that this specification is a recommendation, no published specifications are available.
Frame Structure

The frame may be fabricated from 3/4 or 1-inch schedule 40 galvanized steel, PVC, or aluminum pipe. Connectors shall be fabricated from malleable iron castings meeting the requirements of ASTM A 47, Grade 32510 with case-hardened set screws, sized to fit the appropriate schedule 40 pipe. Pins with either threaded or hinged fittings that penetrate the piping may be used in lieu of set screws, provided holes are drilled in the pipe and fittings to accommodate the pins without additional drilling.

6.2.10 Type B Containment Frame

Frame Structure

A. Specifications

Note that this specification is a recommendation, no published specifications are available.
Frame Structure

The frame may be fabricated from 3/4 or 1-inch schedule 40 galvanized steel, PVC, or aluminum pipe. Connectors shall be fabricated from malleable iron castings meeting the requirements of ASTM A 47, Grade 32510 with case-hardened set screws, sized to fit the appropriate schedule 40 pipe. Pins with either threaded or hinged fittings that penetrate the piping may be used in lieu of set screws, provided holes are drilled in the pipe and fittings to accommodate the pins without additional drilling.

Pan

The pan shall be water-tight and manufactured of 16 gauge stainless steel with a minimum 2B finish on both sides or 12 gauge aluminum. For simplified manufacturing the round pan may be square to accommodate less expensive manufacturing.

FIGURE 14, TYPE A GLOVE BAG FRAME

FIGURE 15, TYPE B GLOVE BAG FRAME

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6.3 Abridged Specifications for Containment Tents and Tent Framing

Containment tents are held up by two basic types of framing, schedule 40 pipe, and tube lock. For type I and type II containment tents schedule 40 frame is recommended it can easily and simply assemble by the Operators and when the job is done, left assembled in the area for future use. For containment tents manufactured by PFP, or large tents that are complex in nature, the tube lock is a preferable framing material.

6.3.1 Type I/II Containment Tent Frame

Frame Structure

The tent frame shall be fabricated from 1-inch schedule 40 galvanized pipe. Connectors shall be fabricated from malleable iron castings meeting the requirements of ASTM A 47, Grade 32510 with case-hardened set screws, sized to fit 1-inch schedule 40 galvanized pipe. Pins with either threaded or hinged fittings that penetrate the piping may be used in lieu of set screws.

In addition to set screws, all 8 corners will be re-enforced by with 1/4 inch bolts using nylon lock washers, the holes will be 5/16" in diameter and located such that the tent frame may be assembled without additional drilling of holes.

FIGURE 16, TYPE I/II CONTAINMENT TENT FRAME

Part	Amount	Name
A	4	7'6" Tall Side Rod
B	4	6' Short Side Rod
C	2	6'8" End Rod
D	4	15" Side Rail
E	2	10" End Bottom Rail
F	4	10'2" Top Rail
G	3	4' Corner Brace

6.4.2 Type I/II Containment Tents

The containment tent shall include the following:

Doors - The tent shall have two doors, the doors shall be a minimum of 30 inches wide by 66 inches high with a clear window measuring 18 inches by 18 inches located in the upper half of the door. On Type II tents, the door shall also contain a breather filter, located below the posting pouches. The tent shall include a means to support the door while open.

Pass-out Boxes - The tent shall be fabricated with pass-out boxes located within each section. Unless otherwise specified in the purchase order, the pass-out box shall be 4 inches high by 4 inches wide by 4 inches deep. The pass-out boxes shall utilize either velcro or zippers for the inner and outer seal closures. Round passout boxes of approximate volume and configuration may be used.

Posting Pouches - Two clear pouches (two pouches together) capable of holding a sign measuring 10 inches by 13 inches, shall be located on the outer surface of both doors and immediately adjacent to the doors, such that persons entering the tent can see the posting if the door is open.

Adequate Support - The tie offs used to support the tent shall be of sufficient quantity and strength to support the tent with a negative pressure of 1" of water.

Walls, Floors and Ceilings - The walls, floors, and ceilings shall be fabricated from material meeting Military Specification (Mil-Spec) MIL-C-40036G; Type 1 material is required. The color of the material shall be yellow except where windows are installed. The floor section of the work area shall be fabricated separately and affixed with a 4" velcro seam as shown in attached figures.

Windows - Window material shall be fabricated from 20 gauge polyurethane meeting Federal Specification L-P-375C. The material shall be transparent, double polished, and fire retardant.

Service/Waste Sleeves - Service and waste sleeves shall be fabricated from 0.012 inch thick translucent yellow fire retardant polyurethane meeting Federal Specification L-P-375C or MIL-C-43006G.

Tie-Offs - Tie-offs shall be 2.5" diameter heavy duty injection molded polyurethane and be attached to the body of the containment at intervals consistent with the external frame, not to exceed 18" intervals, corners shall have a separate row of tie-offs on each surface. Tie-offs that support the weight of the tent shall be affixed to the tent fabric, and not to windows.

Door Zippers - Door zippers shall be YKK Vision # 10 extra heavy duty or approved equivalent, with double pull sliders and an overlapping velcro flap. Either the zipper or the velcro must be able to seal the door independently as well as operate at the same time.

Breather Filter - Varies as shown for tent type:

For Type I tents a canister filter capable of 40 cfm shall be located in each wall of the work area, the filter shall be tested and found to be at least 99.97% efficient for particles of .3 microns or greater.

For Type II tents with a ventilated exhaust, a 1/2" flat foam filter in a zippered pouch with either minimum 1" wide velcro, or zipper closed flaps on both the inside and outside walls is required. The location is the same as for Type I tents, except the filter in walls containing doors, should be in the doors.

The tent shall be constructed using the following methods:

All seams on the walls and floors of the containment shall be double sealed.

All window seals shall exhibit a minimum 1/2 inch overlap; transfer and access sleeves shall exhibit a minimum 1/4 inch overlap.

Tie-offs shall be attached by heat sealing and shall be located in sufficient quantity to provide adequate support.

Double stitching is required on all door zippers.

Velcro shall be placed to allow holding the doors in the open position.

Quality Assurance Requirements

The supplier shall be responsible for the performance of all tests and inspections required prior to submission to the buyer of any items for acceptance. Except as otherwise specified, the supplier may use either his own or any commercial laboratory acceptable to the buyer. Records of all tests shall be kept complete and available to the buyer.

The tent components shall be shipped in appropriately labeled containers constructed in a manner that will ensure damage-free delivery.

Each containment tent shall be legibly and conspicuously marked with the purchase order number, specification number, name of supplier, name of component, and weight (gross and net).

FIGURE 17, TYPE I CONTAINMENT TENT

FIGURE 18, TYPE II CONTAINMENT TENT

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6.3.3 Type V Containment Tent

The Type V Containment Tent is a modified version of the Type I and II containments. It is manufactured by the Plutonium Finishing Plant (PFP) plastic shop. The containment tent the PFP version of the Type I/II containment tents.

The containment tent includes the following:

Anteroom - The tent shall have an anteroom measuring at least five feet by ten feet. Doors shall be a minimum of 30 inches wide by 66 inches high with a clear window measuring 18 inches by 18 inches located in the upper half of the door.

Work Area - The work area shall contain sleeves in the approximate locations shown on Figure 1.

Posting Pouches - Two clear pouches capable of holding a sign measuring 10 inches by 13 inches, shall be located both, on the outer surface of the doors and immediately adjacent to the doors, such that persons entering the tent can see the posting if the door is open.

Walls, Floors and Ceilings - The walls, floors, and ceilings shall be fabricated from material meeting Military Specification (Mil-Spec) MIL-C-43006G; Type 1 material is required. The color of the material shall be white except where windows are installed or other colors are specified on the work order.

Windows - Window material shall be fabricated from 0.012 inch thick plastic meeting Federal Specification L-P-375C. The material shall be transparent, double polished, and fire retardant to NFPA 701 A, small scale.

Service/Waste Sleeves - Service and waste sleeves shall be fabricated from 0.012 inch thick translucent yellow fire retardant PVC meeting Federal Specification L-P-375C or MIL-C-43006G.

Tie-Offs - Tie-offs shall be fabricated from heavy duty injection molded PVC or using grommets installed in strips of fabric affixed to or included in the containment tent. Tie-offs shall be located on all outside corners, vertical and horizontal, and on the bottom edge of the tent. Additional grommet strips or rows of tie-offs shall be located every 5', or centered in if less than 8', all external walls and on the roof, parallel to the 15' length of the tent. See figure 2 for an example of routine application of tie offs.

Door Closure - Doors shall be closed by an overlapping velcro flap. The velcro must be heat sealed or sewn to the containment.

FIGURE 19, TYPE V CONTAINMENT TENT

6.4 Spare Parts Inventory of Containment Material

The following table contains a listing of the spare parts inventory number for the containments shown in this document as well as the needed support equipment.

Tank Farm Containments/Material in WHC Stores

Stock No.	UOI	Description	Unit Price
6175-1610-0590	EA	Poly Bottle, 5 gallon, with second closure plug	\$ 39.95
6175-1610-0924	EA	Cone Shaped Catch Containment, 12" Dia	\$ 11.50
6175-1610-0925	EA	Containment, Flat Bottomed, 18" Diameter	\$ 11.50
6175-1610-0927	EA	Containment for 5 gallon Poly Bottle	\$ 29.50
6175-1610-0928	EA	Containment Tent, Type I (for non-ventilated operations)	\$1625.00
6175-1610-0929	EA	Containment Tent, Type II (for ventilated applications)	\$1625.00
6175-1610-0930	EA	Containment Tent Floor for Type I and II Tents	\$ 159.00
6175-1610-0936	EA	Bungee Cord, 1/4 " Dia x 500 feet	\$ 45.00
6175-1610-1260	EA	Containment Drain Assembly, 1/2"	\$ 4.50
6175-1610-1720	EA	Poly Bottle Fill and Vent Assembly, 5 gallon	\$ 12.50
6175-1610-1722	EA	Filter, Canister, 30 CFM	\$ 89.00
6175-1610-1724	EA	Filter, Glove Bag, 2 CFM	\$ 6.35
6175-1610-1726	EA	Filter, Type II Containment tent inlet, 18"x 18" x 1/2"	\$ 9.75
6175-1610-1930	EA	Frame, for Doghouse Glove Bag	\$ 200.00
6175-1610-1932	EA	Frame, Type I/II Containment Tent, 1" sch 40 galvanized pipe	\$ 535.00
6175-1610-1934	EA	Frame, Type B (Type II, III, IV, & VI glove bag)	\$ 355.80
6175-1610-2230	PR	Glove, 18" rolled cuff, size 11 (for glove bag)	\$ 1.95
6175-1610-2238	EA	Doghouse Containment	\$ 110.00
6175-1610-2240	EA	Glovebag, Type I (FIC)	\$ 110.00
6175-1610-2241	EA	Glovebag, Type II (for 4" Riser)	\$ 110.00
6175-1610-2242	EA	Glovebag, Type IV (Greenway)	\$ 110.00
6175-1610-2243	EA	Glovebag, Type VI (Rulon)	\$ 120.00
6175-1610-2244	EA	Glovebag, Type VIII (Butch Hall)	\$ 120.00
6175-1610-2245	EA	Glovebag, Type X (Wilder)	\$ 21.50
6175-1610-5656	EA	Pump, Hand Siphon	\$ 15.95

6175-1610-6200	EA	Ring, Glove, 5 1/2" Inside Diameter	\$ 3.75
6175-1610-6914	RL	Sleeving, 8" diameter x 100', 12 mil, translucent yellow, clear or white	\$ 21.50
6175-1610-6916	RL	Sleeving, 12" diameter x 50', 12 mil, translucent yellow, clear or white	\$ 21.50
6175-1610-6918	RL	Sleeving, 24" diameter x 50', 12 mil, translucent yellow, clear or white	\$ 21.50
6175-1610-6920	PK	Sleeving, 6" diameter x 100', 8 mil,	\$ 21.50
6175-1610-7440	EA	Tape, G-Flexx Tape, 3"x 20 yards	\$ 13.95
6175-1610-7442	EA	Tape, G-Flexx Tape, 6"x 20 yards	\$ 29.50
6175-1610-7760	EA	Tube, Transfer, 6" diameter Rigid PVC	\$ 6.75

7.0 REFERENCES

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