

AMENDATORY SECTION (Amending Order 76-6, filed 3/1/76)

**WAC 296-24-29419 Safe operating practices.** Whenever any sling is used, the following practices shall be observed:

- (1) Slings that are damaged or defective shall not be used.
- (2) Slings shall not be shortened with knots or bolts or other makeshift devices.
- (3) Sling legs shall not be kinked.
- (4) ~~((Slings shall not be loaded in excess of their rated capacities.))~~ Employers must not load a sling in excess of its recommended safe working load as prescribed by the sling manufacturer on the identification markings permanently affixed to the sling.
- (5) Slings used in a basket hitch shall have the loads balanced to prevent slippage.
- (6) Slings shall be securely attached to their loads.
- (7) Slings shall be padded or protected from the sharp edges of their loads.
- (8) Suspended loads shall be kept clear of all obstructions.
- (9) All employees shall be kept clear of loads about to be lifted and of suspended loads.
- (10) Hands or fingers shall not be placed between the sling and its load while the sling is being tightened around the load.
- (11) Shock loading is prohibited.
- (12) A sling shall not be pulled from under a load when the load is resting on the sling.
- (13) Employers must not use slings without affixed and legible identification markings.

AMENDATORY SECTION (Amending Order 76-29, filed 9/30/76)

**WAC 296-24-29423 Alloy steel chain slings.** (1) Sling identification. Alloy steel chain slings shall have permanently affixed durable identification stating size, grade, rated capacity and reach.

- (2) Attachments.
  - (a) Hooks, rings, oblong links, pear shaped links, welded or mechanical coupling links or other attachments shall have a rated capacity at least equal to that of the alloy steel chain with which they are used or the sling shall not be used in excess of the rated capacity of the weakest component.
  - (b) Makeshift links or fasteners formed from bolts or rods, or other such attachments, shall not be used.

(3) Inspections.

(a) In addition to the inspection required by WAC 296-24-29421, a thorough periodic inspection of alloy steel chain slings in use shall be made on a regular basis, to be determined on the basis of:

- (i) Frequency of sling use;
- (ii) Severity of service conditions;
- (iii) Nature of lifts being made; and

(iv) Experience gained on the service life of slings used in similar circumstances. Such inspections shall in no event be at intervals greater than once every 12 months.

(b) The employer shall make and maintain a record of the most recent month in which each alloy steel chain sling was thoroughly inspected, and shall make such record available for examination.

(c) The thorough inspection of alloy steel chain slings shall be performed by a competent person designated by the employer, and shall include a thorough inspection for wear, defective welds, deformation and increase in length. Where such defects or deterioration are present, the sling shall be immediately removed from service.

(4) Proof testing. The employer shall ensure that before use, each new, repaired, or reconditioned alloy steel chain sling, including all welded components in the sling assembly, shall be proof tested by the sling manufacturer or equivalent entity, in accordance with paragraph 5.2 of the American Society of Testing and Materials Specification A391-65 (ANSI G61.1-1968). The employer shall retain a certificate of the proof test and shall make it available for examination.

~~(5) ((Sling use. Alloy steel chain slings shall not be used with loads in excess of the rated capacities prescribed in Table D-1. Slings not included in this table shall be used only in accordance with the manufacturer's recommendations.~~

~~(6) Safe operating temperatures. Alloy steel chain slings shall be permanently removed from service if they are heated above 1000°F. When exposed to service temperatures in excess of 600°F maximum working load limits permitted in Table D-1 shall be reduced in accordance with the chain or sling manufacturer's recommendations.~~

(7)) Safe operating temperatures. Employers must permanently remove an alloy steel-chain sling from service if it is heated above 1000°F. When exposed to service temperatures in excess of 600°F, employers must reduce the maximum working load limits permitted by the chain manufacturer in accordance with the chain or sling manufacturer's recommendations.

(6) Repairing and reconditioning alloy steel chain slings.

(a) Worn or damaged alloy steel chain slings or attachments shall not be used until repaired. When welding or heat testing is performed, slings shall not be used unless repaired, reconditioned and proof tested by the sling manufacturer or an equivalent entity.

(b) Mechanical coupling links or low carbon steel repair links shall not be used to repair broken lengths of chain.

~~((8))~~ (7) Effects of wear. If the chain size at any point of any links is less than that stated in Table ~~((D-2))~~ D-1, the

sling shall be removed from service.

~~((9))~~ (8) Deformed attachments.

(a) Alloy steel chain sling with cracked or deformed master links, coupling links or other components shall be removed from service.

(b) Slings shall be removed from service if hooks are cracked, have been opened more than 15 percent of the normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plane of the unbent hook.

AMENDATORY SECTION (Amending Order 79-9, filed 7/31/79)

**WAC 296-24-29425 Wire rope slings.** (1) Sling use. (~~Wire rope slings shall not be used with loads in excess of the rated capacities shown in Tables D-3 through D-14. Slings not included in these tables shall be used only in accordance with the manufacturer's recommendations.~~) Employers must use only wire rope slings that have permanently affixed and legible identification markings as prescribed by the manufacturer, and that indicate the recommended safe working load for the type(s) of hitch(es) used, the angle upon which it is based, and the number of legs if more than one.

(2) Minimum sling lengths.

(a) Cable laid and 6x19 and 6x37 slings shall have a minimum clear length of wire rope 10 times the component rope diameter between splices, sleeves or end fittings.

(b) Braided slings shall have a minimum clear length of wire rope 40 times the component rope diameter between the loops or end fittings.

(c) Cable laid grommets, strand laid grommets and endless slings shall have a minimum circumferential length of 96 times their body diameter.

(3) Safe operating temperatures. Fiber core wire rope slings of all grades shall be permanently removed from service if they are exposed to temperatures in excess of 200°F. When nonfiber core wire rope slings of any grade are used at temperatures above 400°F or below minus 60°F, recommendations of the sling manufacturer regarding use at that temperature shall be followed.

(4) End attachments.

(a) Welding of end attachments, except covers to thimbles, shall be performed prior to the assembly of the sling.

(b) All welded end attachments shall not be used unless proof tested by the manufacturer or equivalent entity at twice their rated capacity prior to initial use. The employer shall retain a certificate of the proof test, and make it available for examination.

(5) Removal from service. Wire rope slings shall be immediately removed from service if any of the following conditions are present:

(a) Ten randomly distributed broken wires in one rope lay, or five broken wires in one strand in one rope lay.

(b) Wear or scraping of one-third the original diameter of outside individual wires.

(c) Kinking, crushing, bird caging or any other damage resulting in distortion of the wire rope structure.

(d) Evidence of heat damage.

(e) End attachments that are cracked, deformed or worn.

(f) Hooks that have been opened more than 15 percent of the normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plane of the unbent hook.

(g) Corrosion of the rope or end attachments.

AMENDATORY SECTION (Amending Order 76-6, filed 3/1/76)

**WAC 296-24-29427 Metal mesh slings.** (1) Sling marking. Each metal mesh sling shall have permanently affixed to it a durable marking that states the rated capacity for vertical basket hitch and choker hitch loadings.

(2) Handles. Handles shall have a rated capacity at least equal to the metal fabric and exhibit no deformation after proof testing.

(3) Attachments of handles to fabric. The fabric and handles shall be joined so that:

(a) The rated capacity of the sling is not reduced.

(b) The load is evenly distributed across the width of the fabric.

(c) Sharp edges will not damage the fabric.

(4) Sling coatings. Coatings which diminish the rated capacity of a sling shall not be applied.

(5) Sling testing. All new and repaired metal mesh slings, including handles, shall not be used unless proof tested by the manufacturer or equivalent entity at a minimum of 1-1/2 times their rated capacity. Elastomer impregnated slings shall be proof tested before coating.

(6) ~~((Proper use of metal mesh slings. Metal mesh slings shall not be used to lift loads in excess of their rated capacities as prescribed in Table D-15. Slings not included in this table shall be used only in accordance with the manufacturer's recommendations.~~

(7)) Safe operating temperatures. Metal mesh slings which are not impregnated with elastomers may be used in a temperature range from minus 20°F to plus 550°F without decreasing the working load limit. Metal mesh slings impregnated with polyvinyl chloride or neoprene may be used only in a temperature range from zero degrees to plus 200°F. For operations outside these temperature ranges or for metal mesh slings impregnated with other materials, the sling manufacturer's recommendations shall be followed.

((8)) (7) Repairs.

(a) Metal mesh slings which are repaired shall not be used unless repaired by a metal mesh sling manufacturer or an equivalent entity.

(b) Once repaired, each sling shall be permanently marked or tagged, or a written record maintained, to indicate the date and nature of the repairs and the person or organization that performed the repairs. Records of repairs shall be made available for examination.

~~((9))~~ (8) Removal from service. Metal mesh slings shall be immediately removed from service if any of the following conditions are present:

(a) A broken weld or broken brazed joint along the sling edge.

(b) Reduction in wire diameter of 25 percent due to abrasion or 15 percent due to corrosion.

(c) Lack of flexibility due to distortion of the fabric.

(d) Distortion of the female handle so that the depth of the slot is increased more than 10 percent.

(e) Distortion of either handle so that the width of the eye is decreased more than 10 percent.

(f) A 15 percent reduction of the original cross sectional area of metal at any point around the handle eye.

(g) Distortion of either handle out of its plane.

AMENDATORY SECTION (Amending Order 76-6, filed 3/1/76)

**WAC 296-24-29429 Natural and synthetic fiber rope slings.**

(1) Sling use.

(a) ~~((Fiber rope slings made from conventional three strand construction fiber rope shall not be used with loads in excess of the rated capacities prescribed in Tables D-16 through D-19.))~~ Employers must use natural and synthetic fiber rope slings that have permanently affixed and legible identification markings stating the rated capacity for the type(s) of hitch(es) used and the angle upon which it is based, type of fiber material, and the number of legs if more than one.

(b) Fiber rope slings shall have a diameter of curvature meeting at least the minimums specified in Figs. D-4 and D-5.

(c) Slings not included in these tables shall be used only in accordance with the manufacturer's recommendations.

(2) Safe operating temperatures. Natural and synthetic fiber rope slings, except for wet frozen slings, may be used in a temperature range from minus 20°F to plus 180°F without decreasing the working load limit. For operations outside this temperature range and for wet frozen slings, the sling manufacturer's recommendations shall be followed.

(3) Splicing. Spliced fiber rope slings shall not be used unless they have been spliced in accordance with the following minimum requirements and in accordance with any additional recommendations of the manufacturer:

(a) In manila rope, eye splices shall consist of at least three full tucks, and short splices shall consist of at least six full tucks, three on each side of the splice center line.

(b) In synthetic fiber rope, eye splices shall consist of at least four full tucks, and short splices shall consist of at least eight full tucks, four on each side of the center line.

(c) Strand end tails shall not be trimmed flush with the surface of the rope immediately adjacent to the full tucks. This applies to all types of fiber rope and both eye and short splices. For fiber rope under one inch in diameter, the tail shall project at least six rope diameters beyond the last full tuck. For fiber rope one inch in diameter and larger, the tail shall project at least six inches beyond the last full tuck. Where a projecting tail interferes with the use of the sling, the tail shall be tapered and spliced into the body of the rope using at least two additional tucks (which will require a tail length of approximately six rope diameters beyond the last full tuck).

(d) Fiber rope slings shall have a minimum clear length of rope between eye splices equal to 10 times the rope diameter.

(e) Knots shall not be used in lieu of splices.

(f) Clamps not designed specifically for fiber ropes shall not be used for splicing.

(g) For all eye splices, the eye shall be of such size to provide an included angle of not greater than 60 degrees at the splice when the eye is placed over the load or support.

(4) End attachments. Fiber rope slings shall not be used if end attachments in contact with the rope have sharp edges or projections.

(5) Removal from service. Natural and synthetic fiber rope slings shall be immediately removed from service if any of the following conditions are present:

(a) Abnormal wear.

(b) Powdered fiber between strands.

(c) Broken or cut fibers.

(d) Variations in the size or roundness of strands.

(e) Discoloration or rotting.

(f) Distortion of hardware in the sling.

(6) Repairs. Only fiber rope slings made from new rope shall be used. Use of repaired or reconditioned fiber rope slings is prohibited.

AMENDATORY SECTION (Amending Order 76-6, filed 3/1/76)

**WAC 296-24-29431 Synthetic web slings.** (1) Sling identification. Each sling shall be marked or coded to show the rated capacities for each type of hitch and type of synthetic web material.

(2) Webbing. Synthetic webbing shall be of uniform thickness and width and selvage edges shall not be split from the webbing's

width.

(3) Fittings. Fittings shall be:

(a) Of a minimum breaking strength equal to that of the sling;  
and

(b) Free of all sharp edges that could in any way damage the webbing.

(4) Attachment of end fittings to webbing and formation of eyes. Stitching shall be the only method used to attach end fittings to webbing and to form eyes. The thread shall be in an even pattern and contain a sufficient number of stitches to develop the full breaking strength of the sling.

~~(5) ((Sling use. Synthetic web slings illustrated in Figure D-6 shall not be used with loads in excess of the rated capacities specified in Tables D-20 through D-22. Slings not included in these tables shall be used only in accordance with the manufacturer's recommendations.~~

~~(6))~~ Environmental conditions. When synthetic web slings are used, the following precautions shall be taken:

(a) Nylon web slings shall not be used where fumes, vapors, sprays, mists or liquids of acids or phenolics are present.

(b) Polyester and polypropylene web slings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present.

(c) Web slings with aluminum fittings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present.

~~((7))~~ (6) Safe operating temperatures. Synthetic web slings of polyester and nylon shall not be used at temperatures in excess of 180°F. Polypropylene web slings shall not be used at temperatures in excess of 200°F.

~~((8))~~ (7) Repairs.

(a) Synthetic web slings which are repaired shall not be used unless repaired by a sling manufacturer or an equivalent entity.

(b) Each repaired sling shall be proof tested by the manufacturer or equivalent entity to twice the rated capacity prior to its return to service. The employer shall retain a certificate of the proof test and make it available for examination.

(c) Slings, including webbing and fittings, which have been repaired in a temporary manner shall not be used.

~~((9))~~ (8) Removal from service. Synthetic web slings shall be immediately removed from service if any of the following conditions are present:

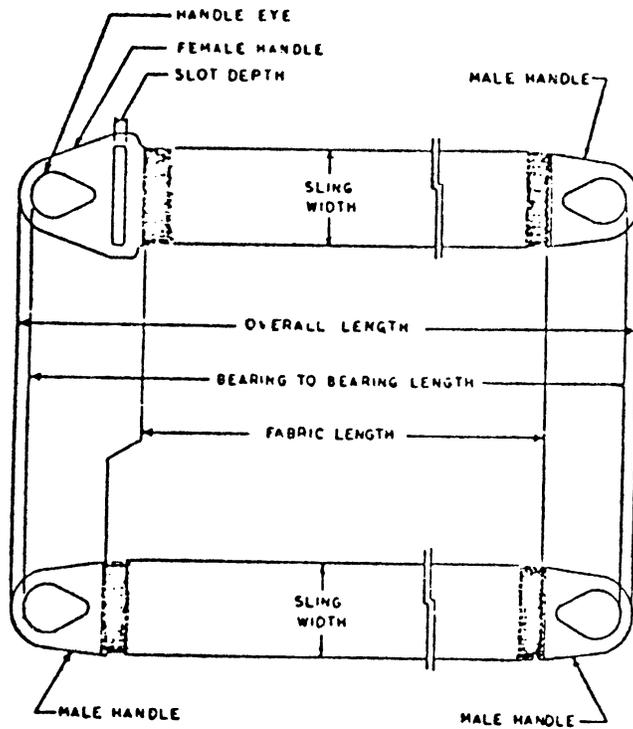
(a) Acid or caustic burns;

(b) Melting or charring of any part of the sling surface;

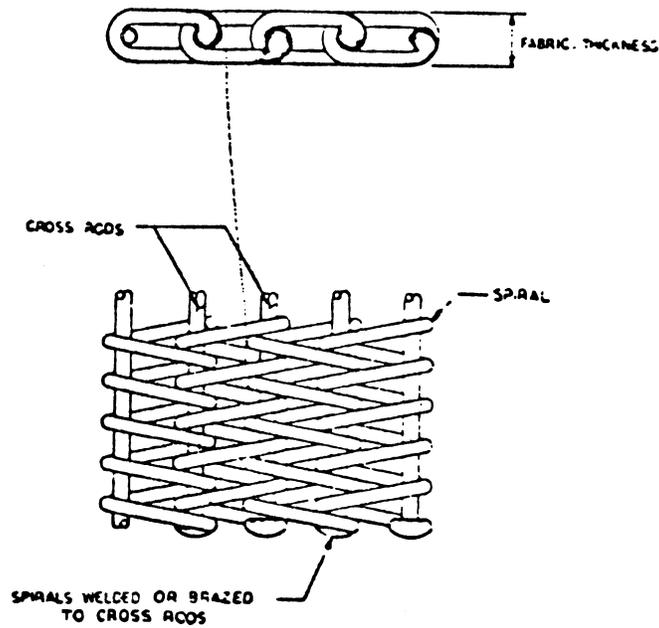
(c) Snags, punctures, tears or cuts;

(d) Broken or worn stitches; or

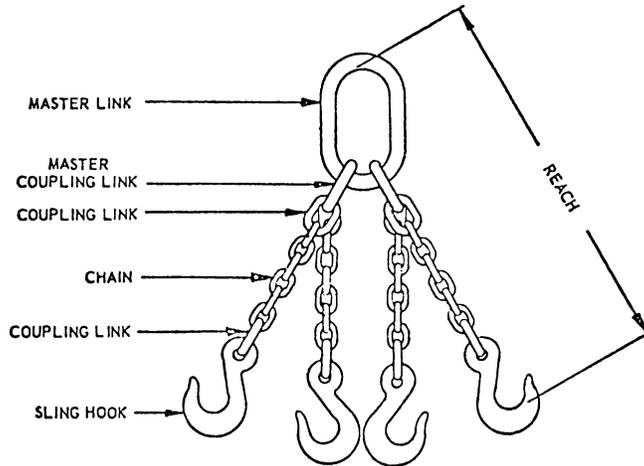
(e) Distortion of fittings.



**Figure D-1**  
Metal Mesh Sling (Typical)



**Figure D-2**  
Metal Mesh Construction



**Figure D-3**  
Major Components of a Quadruple Sling

**(TABLE D-1)**  
RATED CAPACITY (WORKING LOAD LIMIT), FOR ALLOY STEEL  
CHAIN SLINGS\* RATED CAPACITY (WORKING LOAD LIMIT),  
POUNDS

**TABLE D-1: Part 1--Double Slings**

Chain Size, Inches	Single-Branch Sling - 90 degree Loading	30 degree	Double-Sling Vertical Angle <sup>†</sup> 45 degree	60 degree
		60 degree	Horizontal Angle <sup>‡</sup> 45 degree	30 degree
1/4	3,250	5,650	4,550	3,250
3/8	6,600	11,400	9,300	6,600
1/2	11,250	19,500	15,900	11,250
5/8	16,500	28,500	23,300	16,500
3/4	23,000	39,800	32,500	23,000
7/8	28,750	49,800	40,600	28,750
1	38,750	67,100	54,800	38,750
1-1/8	44,500	77,000	63,000	44,500
1-1/4	57,500	99,500	81,000	57,500
1-3/8	67,000	116,000	94,000	67,000
1-1/2	80,000	138,000	112,500	80,000
1-3/4	100,000	172,000	140,000	100,000

—<sup>†</sup>Rating of multileg slings adjusted for angle of loading measured as the included angle between the inclined leg and the vertical as shown in Figure D-5.

—<sup>‡</sup>Rating of multileg slings adjusted for angle of loading between the inclined leg and the horizontal plane of the load, as shown in Figure D-5.

—<sup>§</sup>Quadruple sling rating is same as triple sling because normal lifting practice may not distribute load uniformly to all 4 legs.

**TABLE D-1: Part 2--Triple and Quadruple Slings**

Chain Size, Inches	Single Branch Sling— 90 degree Loading	Triple and Quadruple Sling <sup>(*)</sup>		
		30 degree	Vertical Angle <sup>(†)</sup> 45 degree	60 degree
		60 degree	Horizontal Angle <sup>(‡)</sup> 45 degree	30 degree
1/4	3,250	8,400	6,800	4,900
3/8	6,600	17,000	14,000	9,900
1/2	11,250	29,000	24,000	17,000
5/8	16,500	43,000	35,000	24,500
3/4	23,000	59,500	48,500	34,500
7/8	28,750	74,500	61,000	43,000
1	38,750	101,000	82,000	58,000
1-1/8	44,500	115,500	94,500	66,500
1-1/4	57,500	149,000	121,500	86,000
1-3/8	67,000	174,000	141,000	100,500
1-1/2	80,000	207,000	169,000	119,500
1-3/4	100,000	258,000	210,000	150,000

<sup>(\*)</sup>Rating of multileg slings adjusted for angle of loading measured as the included angle between the inclined leg and the vertical as shown in Figure D-5.

<sup>(†)</sup>Rating of multileg slings adjusted for angle of loading between the inclined leg and the horizontal plane of the load, as shown in Figure D-5.

<sup>(‡)</sup>Quadruple sling rating is same as triple sling because normal lifting practice may not distribute load uniformly to all 4 legs.)

**TABLE ((D-2)) D-1**

MINIMUM ALLOWABLE CHAIN SIZE  
AT ANY POINT OF LINK

Chain Size, Inches	Minimum Allowable Chain Size, Inches
1/4	13/64
3/8	19/64
1/2	25/64
5/8	31/64
3/4	19/32
7/8	45/64
1	13/16
1- 1/8	29/32
1- 1/4	1
1- 3/8	1- 3/32
1- 1/2	1- 3/16
1- 3/4	1-13/32

**((TABLE D-3**

RATED CAPACITIES FOR SINGLE LEG SLINGS 6x19 AND 6x37  
CLASSIFICATION IMPROVED FLOW STEEL GRADE ROPE WITH  
FIBER CORE (FC)

Rope Dia. Constr. (Inches)	Rated Capacities, Tons (2,000 lb)								
	Vertical			Choker			Vertical Basket <sup>±</sup>		
	HT	MS	S	HT	MS	S	HT	MS	S
—1/4 6x19	0.49	0.51	0.55	0.37	0.38	0.41	0.99	1.0	1.1
—5/16 6x19	0.76	0.79	0.85	0.57	0.59	0.64	1.5	1.6	1.7
—3/8 6x19	1.1	1.1	1.2	0.80	0.85	0.91	2.1	2.2	2.4
—7/16 6x19	1.4	1.5	1.6	1.1	1.1	1.2	2.9	3.0	3.3
—1/2 6x19	1.8	2.0	2.1	1.4	1.5	1.6	3.7	3.9	4.3

Rope		Rated Capacities, Tons (2,000 lb)								
Dia. (Inches)	Constr.	Vertical			Choker			Vertical Basket <sup>±</sup>		
		HT	MS	S	HT	MS	S	HT	MS	S
<del>9/16</del>	<del>6x19</del>	<del>2.3</del>	<del>2.5</del>	<del>2.7</del>	<del>1.7</del>	<del>1.9</del>	<del>2.0</del>	<del>4.6</del>	<del>5.0</del>	<del>5.4</del>
<del>5/8</del>	<del>6x19</del>	<del>2.8</del>	<del>3.1</del>	<del>3.3</del>	<del>2.1</del>	<del>2.3</del>	<del>2.5</del>	<del>5.6</del>	<del>6.2</del>	<del>6.7</del>
<del>3/4</del>	<del>6x19</del>	<del>3.9</del>	<del>4.4</del>	<del>4.8</del>	<del>2.9</del>	<del>3.3</del>	<del>3.6</del>	<del>7.8</del>	<del>8.8</del>	<del>9.5</del>
<del>7/8</del>	<del>6x19</del>	<del>5.1</del>	<del>5.9</del>	<del>6.4</del>	<del>3.9</del>	<del>4.5</del>	<del>4.8</del>	<del>10.0</del>	<del>12.0</del>	<del>13.0</del>
<del>1</del>	<del>6x19</del>	<del>6.7</del>	<del>7.7</del>	<del>8.4</del>	<del>5.0</del>	<del>5.8</del>	<del>6.3</del>	<del>13.0</del>	<del>15.0</del>	<del>17.0</del>
<del>1-1/8</del>	<del>6x19</del>	<del>8.4</del>	<del>9.5</del>	<del>10.0</del>	<del>6.3</del>	<del>7.1</del>	<del>7.9</del>	<del>17.0</del>	<del>19.0</del>	<del>21.0</del>
<del>1-1/4</del>	<del>6x37</del>	<del>9.8</del>	<del>11.0</del>	<del>12.0</del>	<del>7.4</del>	<del>8.3</del>	<del>9.2</del>	<del>20.0</del>	<del>22.0</del>	<del>25.0</del>
<del>1-3/8</del>	<del>6x37</del>	<del>12.0</del>	<del>13.0</del>	<del>15.0</del>	<del>8.9</del>	<del>10.0</del>	<del>11.0</del>	<del>24.0</del>	<del>27.0</del>	<del>30.0</del>
<del>1-1/2</del>	<del>6x37</del>	<del>14.0</del>	<del>16.0</del>	<del>17.0</del>	<del>10.0</del>	<del>12.0</del>	<del>13.0</del>	<del>28.0</del>	<del>32.0</del>	<del>35.0</del>
<del>1-5/8</del>	<del>6x37</del>	<del>16.0</del>	<del>18.0</del>	<del>21.0</del>	<del>12.0</del>	<del>14.0</del>	<del>15.0</del>	<del>33.0</del>	<del>37.0</del>	<del>41.0</del>
<del>1-3/4</del>	<del>6x37</del>	<del>19.0</del>	<del>21.0</del>	<del>24.0</del>	<del>14.0</del>	<del>16.0</del>	<del>18.0</del>	<del>38.0</del>	<del>43.0</del>	<del>48.0</del>
<del>2</del>	<del>6x37</del>	<del>25.0</del>	<del>28.0</del>	<del>31.0</del>	<del>18.0</del>	<del>21.0</del>	<del>23.0</del>	<del>49.0</del>	<del>55.0</del>	<del>62.0</del>

HT = Hand tucked splice and hidden tuck splice  
 For hidden tuck splice (IWRC) use value in HT columns.  
 MS = Mechanical splice.  
 S = Swaged or zinc poured socket.  
 \* These values only apply when the D/d ratio for HT slings is 10 or greater, and for MS and S slings is 20 or greater where:  
 D = Diameter of curvature around which the body of the sling is bent.  
 d = Diameter of rope.

**TABLE D-4**  
 RATED CAPACITIES FOR SINGLE LEG SLINGS 6x19 AND 6x37  
 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE WITH  
 INDEPENDENT WIRE ROPE CORE (IWRC)

Rope		Rated Capacities, Tons (2,000 lb)								
Dia. (Inches)	Constr.	Vertical			Choker			Vertical Basket <sup>±</sup>		
		HT	MS	S	HT	MS	S	HT	MS	S
<del>1/4</del>	<del>6x19</del>	<del>0.53</del>	<del>0.56</del>	<del>0.59</del>	<del>0.40</del>	<del>0.42</del>	<del>0.44</del>	<del>1.0</del>	<del>1.1</del>	<del>1.2</del>
<del>5/16</del>	<del>6x19</del>	<del>0.81</del>	<del>0.87</del>	<del>0.92</del>	<del>0.61</del>	<del>0.65</del>	<del>0.69</del>	<del>1.6</del>	<del>1.7</del>	<del>1.8</del>
<del>3/8</del>	<del>6x19</del>	<del>1.1</del>	<del>1.2</del>	<del>1.3</del>	<del>0.86</del>	<del>0.93</del>	<del>0.98</del>	<del>2.3</del>	<del>2.5</del>	<del>2.6</del>
<del>7/16</del>	<del>6x19</del>	<del>1.5</del>	<del>1.7</del>	<del>1.8</del>	<del>1.2</del>	<del>1.3</del>	<del>1.3</del>	<del>3.1</del>	<del>3.4</del>	<del>3.5</del>
<del>1/2</del>	<del>6x19</del>	<del>2.0</del>	<del>2.2</del>	<del>2.3</del>	<del>1.5</del>	<del>1.6</del>	<del>1.7</del>	<del>3.9</del>	<del>4.4</del>	<del>4.6</del>
<del>9/16</del>	<del>6x19</del>	<del>2.5</del>	<del>2.7</del>	<del>2.9</del>	<del>1.8</del>	<del>2.1</del>	<del>2.2</del>	<del>4.9</del>	<del>5.5</del>	<del>5.8</del>
<del>5/8</del>	<del>6x19</del>	<del>3.0</del>	<del>3.4</del>	<del>3.6</del>	<del>2.2</del>	<del>2.5</del>	<del>2.7</del>	<del>6.0</del>	<del>6.8</del>	<del>7.2</del>
<del>3/4</del>	<del>6x19</del>	<del>4.2</del>	<del>4.9</del>	<del>5.1</del>	<del>3.1</del>	<del>3.6</del>	<del>3.8</del>	<del>8.4</del>	<del>9.7</del>	<del>10.0</del>
<del>7/8</del>	<del>6x19</del>	<del>5.5</del>	<del>6.6</del>	<del>6.9</del>	<del>4.1</del>	<del>4.9</del>	<del>5.2</del>	<del>11.0</del>	<del>13.0</del>	<del>14.0</del>
<del>1</del>	<del>6x19</del>	<del>7.2</del>	<del>8.5</del>	<del>9.0</del>	<del>5.4</del>	<del>6.4</del>	<del>6.7</del>	<del>14.0</del>	<del>17.0</del>	<del>18.0</del>
<del>1-1/8</del>	<del>6x19</del>	<del>9.0</del>	<del>10.0</del>	<del>11.0</del>	<del>6.8</del>	<del>7.8</del>	<del>8.5</del>	<del>18.0</del>	<del>21.0</del>	<del>23.0</del>
<del>1-1/4</del>	<del>6x37</del>	<del>10.0</del>	<del>12.0</del>	<del>13.0</del>	<del>7.9</del>	<del>9.2</del>	<del>9.9</del>	<del>21.0</del>	<del>24.0</del>	<del>26.0</del>
<del>1-3/8</del>	<del>6x37</del>	<del>13.0</del>	<del>15.0</del>	<del>16.0</del>	<del>9.6</del>	<del>11.0</del>	<del>12.0</del>	<del>25.0</del>	<del>29.0</del>	<del>32.0</del>
<del>1-1/2</del>	<del>6x37</del>	<del>15.0</del>	<del>17.0</del>	<del>19.0</del>	<del>11.0</del>	<del>13.0</del>	<del>14.0</del>	<del>30.0</del>	<del>35.0</del>	<del>38.0</del>
<del>1-5/8</del>	<del>6x37</del>	<del>18.0</del>	<del>20.0</del>	<del>22.0</del>	<del>13.0</del>	<del>15.0</del>	<del>17.0</del>	<del>35.0</del>	<del>41.0</del>	<del>44.0</del>
<del>1-3/4</del>	<del>6x37</del>	<del>20.0</del>	<del>24.0</del>	<del>26.0</del>	<del>15.0</del>	<del>18.0</del>	<del>19.0</del>	<del>41.0</del>	<del>47.0</del>	<del>51.0</del>
<del>2</del>	<del>6x37</del>	<del>26.0</del>	<del>30.0</del>	<del>33.0</del>	<del>20.0</del>	<del>23.0</del>	<del>25.0</del>	<del>53.0</del>	<del>61.0</del>	<del>66.0</del>

HT = Hand tucked splice.  
 For hidden tuck splice (IWRC) use Table I value in HT columns.  
 MS = Mechanical splice.  
 S = Swaged or zinc poured socket.  
 \* These values only apply when the D/d ratio for HT slings is 10 or greater, and for MS and S slings is 20 or greater where:  
 D = Diameter of curvature around which the body of the sling is bent.

d – Diameter of rope.

**TABLE D-5**

RATED CAPACITIES FOR SINGLE LEG SLINGS CABLE LAID ROPE  
 –MECHANICAL SPLICE ONLY 7x7x7 AND 7x7x19  
 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE 7x6x19  
 IWRC CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE

Rope		Rated Capacities, Tons (2,000 lb)		
Dia. (Inches)	Constr.	Vertical	Choker	Vertical Basket <sup>‡</sup>
1/4	7x7x7	0.50	0.38	1.0
3/8	7x7x7	1.1	0.81	2.0
1/2	7x7x7	1.8	1.4	3.7
5/8	7x7x7	2.8	2.1	5.5
3/4	7x7x7	3.8	2.9	7.6
5/8	7x7x19	2.9	2.2	5.8
3/4	7x7x19	4.1	3.0	8.1
7/8	7x7x19	5.4	4.0	11.0
1	7x7x19	6.9	5.1	14.0
1- 1/8	7x7x19	8.2	6.2	16.0
1- 1/4	7x7x19	9.9	7.4	20.0
3/4	7x6x19 IWRC	3.8	2.8	7.6
7/8	7x6x19 IWRC	5.0	3.8	10.0
1	7x6x19 IWRC	6.4	4.8	13.0
1- 1/8	7x6x19 IWRC	7.7	5.8	15.0
1- 1/4	7x6x19 IWRC	9.2	6.9	18.0
1- 5/16	7x6x19 IWRC	10.0	7.5	20.0
1- 3/8	7x6x19 IWRC	11.0	8.2	22.0
1- 1/2	7x6x19 IWRC	13.0	9.6	26.0

\* These values only apply when the D/d ratio is 10 or greater where:  
 D – Diameter of curvature around which the body of the sling is bent.  
 d – Diameter of rope.

**TABLE D-6**

RATED CAPACITIES FOR SINGLE LEG SLINGS 8-PART AND 6-PART BRAIDED ROPE 6x7 AND 6x19 CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE 7x7 CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE

Component Ropes		Rated Capacities, Tons (2,000 lb)					
Diameter (inches)	Constr.	Vertical		Choker		Basket Vertical to 30 degrees <sup>‡</sup>	
		8-Part	6-Part	8-Part	6-Part	8-Part	6-Part
3/32	6x7	0.42	0.32	0.32	0.24	0.74	0.55
1/8	6x7	0.76	0.57	0.57	0.42	1.3	0.98
3/16	6x7	1.7	1.3	1.3	0.94	2.9	2.2
3/32	7x7	0.51	0.39	0.38	0.29	0.89	0.67
1/8	7x7	0.95	0.71	0.71	0.53	1.6	1.2
3/16	7x7	2.1	1.5	1.5	1.2	3.6	2.7
3/16	6x19	1.7	1.3	1.3	0.98	3.0	2.2
1/4	6x19	3.1	2.3	2.3	1.7	5.3	4.0
5/16	6x19	4.8	3.6	3.6	2.7	8.3	6.2
3/8	6x19	6.8	5.1	5.1	3.8	12.0	8.9
7/16	6x19	9.3	6.9	6.9	5.2	16.0	12.0
1/2	6x19	12.0	9.0	9.0	6.7	21.0	15.0
9/16	6x19	15.0	11.0	11.0	8.5	26.0	20.0

5/8	6x19	19.0	14.0	14.0	10.0	32.0	24.0
3/4	6x19	27.0	20.0	20.0	15.0	46.0	35.0
7/8	6x19	36.0	27.0	27.0	20.0	62.0	47.0
1	6x19	47.0	35.0	35.0	26.0	81.0	61.0

\* These values only apply when the D/d ratio is 20 or greater where:  
D = Diameter of curvature around which the body of the sling is bent.  
d = Diameter of component rope.

**TABLE D-7**

RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS 6x19 AND 6x37 CLASSIFICATION IMPROVED PLOW-STEEL-GRADE ROPE WITH FIBER CORE (FC)

**TABLE D-7: Part 1-- 2-Leg Bridle Slings**

Rope		Rated Capacities, Tons (2,000 lb)					
		2-Leg Bridle Slings					
Dia. (Inches)	Constr.	Vert 30 degree		45 degree Angle		Vert 60 degree	
		Horz 60 degree		Angle		Horz 30 degree	
		HT	MS	HT	MS	HT	MS
1/4	6x19	0.85	0.88	0.70	0.72	0.49	0.51
5/16	6x19	1.3	1.4	1.1	1.1	0.76	0.79
3/8	6x19	1.8	1.9	1.5	1.6	1.1	1.1
7/16	6x19	2.5	2.6	2.0	2.2	1.4	1.5
1/2	6x19	3.2	3.4	2.6	2.8	1.8	2.0
9/16	6x19	4.0	4.3	3.2	3.5	2.3	2.5
5/8	6x19	4.8	5.3	4.0	4.4	2.8	3.1
3/4	6x19	6.8	7.6	5.5	6.2	3.9	4.4
7/8	6x19	8.9	10.0	7.3	8.4	5.1	5.9
1	6x19	11.0	13.0	9.4	11.0	6.7	7.7
1-1/8	6x19	14.0	16.0	12.0	13.0	8.4	9.5
1-1/4	6x37	17.0	19.0	14.0	16.0	9.8	11.0
1-3/8	6x37	20.0	23.0	17.0	19.0	12.0	13.0
1-1/2	6x37	24.0	27.0	20.0	22.0	14.0	16.0
1-5/8	6x37	28.0	32.0	23.0	26.0	16.0	18.0
1-3/4	6x37	33.0	37.0	27.0	30.0	19.0	21.0
2	6x37	43.0	48.0	35.0	39.0	25.0	28.0

HT = Hand tucked splice.  
MS = Mechanical splice.

**TABLE D-7: Part 2-- 3-Leg Bridle Slings**

Rope		Rated Capacities, Tons (2,000 lb)					
		3-Leg Bridle Slings					
Dia. (Inches)	Constr.	Vert 30 degree		45 degree Angle		Vert 60 degree	
		Horz 60 degree		Angle		Horz 30 degree	
		HT	MS	HT	MS	HT	MS
1/4	6x19	1.3	1.3	1.0	1.1	0.74	0.76
5/16	6x19	2.0	2.0	1.6	1.7	1.1	1.2
3/8	6x19	2.8	2.9	2.3	2.4	1.6	1.7
7/16	6x19	3.7	4.0	3.0	3.2	2.1	2.3
1/2	6x19	4.8	5.1	3.9	4.2	2.8	3.0
9/16	6x19	6.0	6.5	4.9	5.3	3.4	3.7
5/8	6x19	7.3	8.0	5.9	6.5	4.2	4.6
3/4	6x19	10.0	11.0	8.3	9.3	5.8	6.6
7/8	6x19	13.0	15.0	11.0	13.0	7.7	8.9
1	6x19	17.0	20.0	14.0	16.0	10.0	11.0
1-1/8	6x19	22.0	24.0	18.0	20.0	13.0	14.0

Rope		Rated Capacities, Tons (2,000 lb)					
		3-Leg Bridle Slings					
Dia. (Inches)	Constr.	Vert 30 degree		45 degree		Vert 60 degree	
		Horz 60 degree		Angle		Horz 30 degree	
		HT	MS	HT	MS	HT	MS
1-1/4	6x37	25.0	29.0	21.0	23.0	15.0	17.0
1-3/8	6x37	31.0	35.0	25.0	28.0	18.0	20.0
1-1/2	6x37	36.0	41.0	30.0	33.0	21.0	24.0
1-5/8	6x37	43.0	48.0	35.0	39.0	25.0	28.0
1-3/4	6x37	49.0	56.0	40.0	45.0	28.0	32.0
2	6x37	64.0	72.0	52.0	59.0	37.0	41.0

HT = Hand tucked splice.  
MS = Mechanical splice.

**TABLE D-8**

RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS 6x19 AND 6x37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE WITH INDEPENDENT WIRE ROPE CORE (IWRC)

**TABLE D-8. Part 1-- 2-Leg Bridle Sling**

Rope		Rated Capacities, Tons (2,000 lb)					
		2-Leg Bridle Slings					
Dia. (Inches)	Constr.	Vert 30 degree		45 degree		Vert 60 degree	
		Horz 60 degree		Angle		Horz 30 degree	
		HT	MS	HT	MS	HT	MS
1/4	6x19	0.92	0.97	0.75	0.79	0.53	0.56
5/16	6x19	1.4	1.5	1.1	1.2	0.81	0.87
3/8	6x19	2.0	2.1	1.6	1.8	1.1	1.2
7/16	6x19	2.7	2.9	2.2	2.4	1.5	1.7
1/2	6x19	3.4	3.8	2.8	3.1	2.0	2.2
9/16	6x19	4.3	4.8	3.5	3.9	2.5	2.7
5/8	6x19	5.2	5.9	4.2	4.8	3.0	3.4
3/4	6x19	7.3	8.4	5.9	6.9	4.2	4.9
7/8	6x19	9.6	11.0	7.8	9.3	5.5	6.6
1	6x19	12.0	15.0	10.0	12.0	7.2	8.5
1-1/8	6x19	16.0	18.0	13.0	15.0	9.0	10.0
1-1/4	6x37	18.0	21.0	15.0	17.0	10.0	12.0
1-3/8	6x37	22.0	25.0	18.0	21.0	13.0	15.0
1-1/2	6x37	26.0	30.0	21.0	25.0	15.0	17.0
1-5/8	6x37	31.0	35.0	25.0	29.0	18.0	20.0
1-3/4	6x37	35.0	41.0	29.0	33.0	20.0	24.0
2	6x37	46.0	53.0	37.0	43.0	26.0	30.0

HT = Hand tucked splice.  
MS = Mechanical splice.

**TABLE D-8. Part 2-- 3-Leg Bridle Slings**

Rope		Rated Capacities, Tons (2,000 lb)					
		2-Leg Bridle Sling					
Dia. (Inches)	Constr.	Vert 30 degree		45 degree		Vert 60 degree	
		Horz 60 degree		Angle		Horz 30 degree	
		HT	MS	HT	MS	HT	MS
1/4	6x19	1.4	1.4	1.1	1.2	0.79	0.84
5/16	6x19	2.1	2.3	1.7	1.8	1.2	1.3
3/8	6x19	3.0	3.2	2.4	2.6	1.7	1.9

Rope		Rated Capacities, Tons (2,000 lb)					
		2-Leg Bridle Sling					
Dia. (Inches)	Constr.	Vert 30 degree		45 degree		Vert 60 degree	
		Horz 60 degree		Angle		Horz 30 degree	
		HF	MS	HF	MS	HF	MS
<del>7/16</del>	<del>6x19</del>	<del>4.0</del>	<del>4.4</del>	<del>3.3</del>	<del>3.6</del>	<del>2.3</del>	<del>2.5</del>
<del>1/2</del>	<del>6x19</del>	<del>5.1</del>	<del>5.7</del>	<del>4.2</del>	<del>4.6</del>	<del>3.0</del>	<del>3.3</del>
<del>9/16</del>	<del>6x19</del>	<del>6.4</del>	<del>7.1</del>	<del>5.2</del>	<del>5.8</del>	<del>3.7</del>	<del>4.1</del>
<del>5/8</del>	<del>6x19</del>	<del>7.8</del>	<del>8.8</del>	<del>6.4</del>	<del>7.2</del>	<del>4.5</del>	<del>5.1</del>
<del>3/4</del>	<del>6x19</del>	<del>11.0</del>	<del>13.0</del>	<del>8.9</del>	<del>10.0</del>	<del>6.3</del>	<del>7.3</del>
<del>7/8</del>	<del>6x19</del>	<del>14.0</del>	<del>17.0</del>	<del>12.0</del>	<del>14.0</del>	<del>8.3</del>	<del>9.9</del>
<del>1</del>	<del>6x19</del>	<del>19.0</del>	<del>22.0</del>	<del>15.0</del>	<del>18.0</del>	<del>11.0</del>	<del>13.0</del>
<del>1-1/8</del>	<del>6x19</del>	<del>23.0</del>	<del>27.0</del>	<del>19.0</del>	<del>22.0</del>	<del>13.0</del>	<del>16.0</del>
<del>1-1/4</del>	<del>6x37</del>	<del>27.0</del>	<del>32.0</del>	<del>22.0</del>	<del>26.0</del>	<del>16.0</del>	<del>18.0</del>
<del>1-3/8</del>	<del>6x37</del>	<del>33.0</del>	<del>38.0</del>	<del>27.0</del>	<del>31.0</del>	<del>19.0</del>	<del>22.0</del>
<del>1-1/2</del>	<del>6x37</del>	<del>39.0</del>	<del>45.0</del>	<del>32.0</del>	<del>37.0</del>	<del>23.0</del>	<del>26.0</del>
<del>1-5/8</del>	<del>6x37</del>	<del>46.0</del>	<del>53.0</del>	<del>38.0</del>	<del>43.0</del>	<del>27.0</del>	<del>31.0</del>
<del>1-3/4</del>	<del>6x37</del>	<del>53.0</del>	<del>61.0</del>	<del>43.0</del>	<del>50.0</del>	<del>31.0</del>	<del>35.0</del>
<del>2</del>	<del>6x37</del>	<del>68.0</del>	<del>79.0</del>	<del>56.0</del>	<del>65.0</del>	<del>40.0</del>	<del>46.0</del>

— HT = Hand tucked splice.

— MS = Mechanical splice.

**TABLE D-9**

RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS  
 CABLE LAID ROPE - MECHANICAL SPLICE ONLY 7x7x7 AND  
 7x7x19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE  
 7x6x19 IWRC CONSTRUCTION IMPROVED PLOW  
 STEEL GRADE ROPE

**TABLE D-9: Part 1-- 2-Leg Bridle Slings**

Rope		Rated Capacities, Tons (2,000 lb)					
		2-Leg Bridle Sling					
Dia. (Inches)	Constr.	Vert 30 degree		45 degree		Vert 60 degree	
		Horz 60 degree		Angle		Horz 30 degree	
<del>1/4</del>	<del>7x7x7</del>	<del>0.87</del>	<del>0.71</del>	<del>0.50</del>			
<del>3/8</del>	<del>7x7x7</del>	<del>1.9</del>	<del>1.5</del>	<del>1.1</del>			
<del>1/2</del>	<del>7x7x7</del>	<del>3.2</del>	<del>2.6</del>	<del>1.8</del>			
<del>5/8</del>	<del>7x7x7</del>	<del>4.8</del>	<del>3.9</del>	<del>2.8</del>			
<del>3/4</del>	<del>7x7x7</del>	<del>6.6</del>	<del>5.4</del>	<del>3.8</del>			
<del>5/8</del>	<del>7x7x19</del>	<del>5.0</del>	<del>4.1</del>	<del>2.9</del>			
<del>3/4</del>	<del>7x7x19</del>	<del>7.0</del>	<del>5.7</del>	<del>4.1</del>			
<del>7/8</del>	<del>7x7x19</del>	<del>9.3</del>	<del>7.6</del>	<del>5.4</del>			
<del>1</del>	<del>7x7x19</del>	<del>12.0</del>	<del>9.7</del>	<del>6.9</del>			
<del>1-1/8</del>	<del>7x7x19</del>	<del>14.0</del>	<del>12.0</del>	<del>8.2</del>			
<del>1-1/4</del>	<del>7x7x19</del>	<del>17.0</del>	<del>14.0</del>	<del>9.9</del>			
<del>3/4</del>	<del>7x6x19 IWRC</del>	<del>6.6</del>	<del>5.4</del>	<del>3.8</del>			
<del>7/8</del>	<del>7x6x19 IWRC</del>	<del>8.7</del>	<del>7.1</del>	<del>5.0</del>			
<del>1</del>	<del>7x6x19 IWRC</del>	<del>11.0</del>	<del>9.0</del>	<del>6.4</del>			
<del>1-1/8</del>	<del>7x6x19 IWRC</del>	<del>13.0</del>	<del>11.0</del>	<del>7.7</del>			
<del>1-1/4</del>	<del>7x6x19 IWRC</del>	<del>16.0</del>	<del>13.0</del>	<del>9.2</del>			
<del>1-5/16</del>	<del>7x6x19 IWRC</del>	<del>17.0</del>	<del>14.0</del>	<del>10.0</del>			
<del>1-3/8</del>	<del>7x6x19 IWRC</del>	<del>19.0</del>	<del>15.0</del>	<del>11.0</del>			
<del>1-1/2</del>	<del>7x6x19 IWRC</del>	<del>22.0</del>	<del>18.0</del>	<del>13.0</del>			

**TABLE D-9: Part 2-- 3-Leg Bridle Slings**

Rope		Rated Capacities, Tons (2,000 lb)		
		3-Leg Bridle Slings		
Dia. (Inches)	Constr.	Vert 30 degree Horz 60 degree	45 degree Angle	Vert 60 degree Horz 30 degree
<del>1/4</del>	<del>7x7x7</del>	<del>1.3</del>	<del>1.1</del>	<del>0.75</del>
<del>3/8</del>	<del>7x7x7</del>	<del>2.8</del>	<del>2.3</del>	<del>1.6</del>
<del>1/2</del>	<del>7x7x7</del>	<del>4.8</del>	<del>3.9</del>	<del>2.8</del>
<del>5/8</del>	<del>7x7x7</del>	<del>7.2</del>	<del>5.9</del>	<del>4.2</del>
<del>3/4</del>	<del>7x7x7</del>	<del>9.9</del>	<del>8.1</del>	<del>5.7</del>
<del>5/8</del>	<del>7x7x19</del>	<del>7.5</del>	<del>6.1</del>	<del>4.3</del>
<del>3/4</del>	<del>7x7x19</del>	<del>10.0</del>	<del>8.6</del>	<del>6.1</del>
<del>7/8</del>	<del>7x7x19</del>	<del>14.0</del>	<del>11.0</del>	<del>8.1</del>
<del>†</del>	<del>7x7x19</del>	<del>18.0</del>	<del>14.0</del>	<del>10.0</del>
<del>1-1/8</del>	<del>7x7x19</del>	<del>21.0</del>	<del>17.0</del>	<del>12.0</del>
<del>1-1/4</del>	<del>7x7x19</del>	<del>26.0</del>	<del>21.0</del>	<del>15.0</del>
<del>3/4</del>	<del>7x6x19 IWRC</del>	<del>9.9</del>	<del>8.0</del>	<del>5.7</del>
<del>7/8</del>	<del>7x6x19 IWRC</del>	<del>13.0</del>	<del>11.0</del>	<del>7.5</del>
<del>†</del>	<del>7x6x19 IWRC</del>	<del>17.0</del>	<del>13.0</del>	<del>9.6</del>
<del>1-1/8</del>	<del>7x6x19 IWRC</del>	<del>20.0</del>	<del>16.0</del>	<del>11.0</del>
<del>1-1/4</del>	<del>7x6x19 IWRC</del>	<del>24.0</del>	<del>20.0</del>	<del>14.0</del>
<del>1-5/16</del>	<del>7x6x19 IWRC</del>	<del>26.0</del>	<del>21.0</del>	<del>15.0</del>
<del>1-3/8</del>	<del>7x6x19 IWRC</del>	<del>28.0</del>	<del>23.0</del>	<del>16.0</del>
<del>1-1/2</del>	<del>7x6x19 IWRC</del>	<del>33.0</del>	<del>27.0</del>	<del>19.0</del>

**TABLE D-10**

RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS 8-PART AND 6-PART BRAIDED ROPE 6x7 AND 6x19 CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE 7x7 CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE

**TABLE D-10: Part 1-- 2-Leg Bridle Slings**

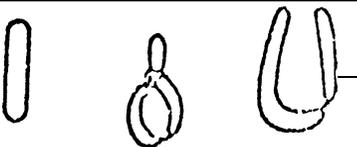
Component		Rated Capacities, Tons (2,000 lb)					
		2-Leg Bridle Slings					
Dia. (Inches)	Constr.	Vert 30 degree		45 degree		Vert 60 degree	
		Horz 60 degree		Angle		Horz 30 degree	
		8-Part	6-Part	8-Part	6-Part	8-Part	6-Part
<del>3/32</del>	<del>6x7</del>	<del>0.74</del>	<del>0.55</del>	<del>0.60</del>	<del>0.45</del>	<del>0.42</del>	<del>0.32</del>
<del>1/8</del>	<del>6x7</del>	<del>1.3</del>	<del>0.98</del>	<del>1.1</del>	<del>0.80</del>	<del>0.76</del>	<del>0.57</del>
<del>3/16</del>	<del>6x7</del>	<del>2.9</del>	<del>2.2</del>	<del>2.4</del>	<del>1.8</del>	<del>1.7</del>	<del>1.3</del>
<del>3/32</del>	<del>7x7</del>	<del>0.89</del>	<del>0.67</del>	<del>0.72</del>	<del>0.55</del>	<del>0.51</del>	<del>0.39</del>
<del>1/8</del>	<del>7x7</del>	<del>1.6</del>	<del>1.2</del>	<del>1.3</del>	<del>1.0</del>	<del>0.95</del>	<del>0.71</del>
<del>3/16</del>	<del>7x7</del>	<del>3.6</del>	<del>2.7</del>	<del>2.9</del>	<del>2.2</del>	<del>2.1</del>	<del>1.5</del>
<del>3/16</del>	<del>6x19</del>	<del>3.0</del>	<del>2.2</del>	<del>2.4</del>	<del>1.8</del>	<del>1.7</del>	<del>1.3</del>
<del>1/4</del>	<del>6x19</del>	<del>5.3</del>	<del>4.0</del>	<del>4.3</del>	<del>3.2</del>	<del>3.1</del>	<del>2.3</del>
<del>5/16</del>	<del>6x19</del>	<del>8.3</del>	<del>6.2</del>	<del>6.7</del>	<del>5.0</del>	<del>4.8</del>	<del>3.6</del>
<del>3/8</del>	<del>6x19</del>	<del>12.0</del>	<del>8.9</del>	<del>9.7</del>	<del>7.2</del>	<del>6.8</del>	<del>5.1</del>
<del>7/16</del>	<del>6x19</del>	<del>16.0</del>	<del>12.0</del>	<del>13.0</del>	<del>9.8</del>	<del>9.3</del>	<del>6.9</del>
<del>1/2</del>	<del>6x19</del>	<del>21.0</del>	<del>15.0</del>	<del>17.0</del>	<del>13.0</del>	<del>12.0</del>	<del>9.0</del>
<del>9/16</del>	<del>6x19</del>	<del>26.0</del>	<del>20.0</del>	<del>21.0</del>	<del>16.0</del>	<del>15.0</del>	<del>11.0</del>
<del>5/8</del>	<del>6x19</del>	<del>32.0</del>	<del>24.0</del>	<del>26.0</del>	<del>20.0</del>	<del>19.0</del>	<del>14.0</del>
<del>3/4</del>	<del>6x19</del>	<del>46.0</del>	<del>35.0</del>	<del>38.0</del>	<del>28.0</del>	<del>27.0</del>	<del>20.0</del>
<del>7/8</del>	<del>6x19</del>	<del>62.0</del>	<del>47.0</del>	<del>51.0</del>	<del>38.0</del>	<del>36.0</del>	<del>27.0</del>
<del>†</del>	<del>6x19</del>	<del>81.0</del>	<del>61.0</del>	<del>66.0</del>	<del>50.0</del>	<del>47.0</del>	<del>35.0</del>

**TABLE D-10: Part 2-- 3-Leg Bridle Slings**

Component		Rated Capacities, Tons (2,000 lb)					
Rope		3-Leg Bridle Slings					
—Dia. (Inches)	Constr.	Vert 30 degree		45 degree		Vert 60 degree	
		Horz 60 degree		Angle		Horz 30 degree	
		8-Part	6-Part	8-Part	6-Part	8-Part	6-Part
<del>3/32</del>	<del>6x7</del>	<del>1.1</del>	<del>0.83</del>	<del>0.90</del>	<del>0.68</del>	<del>0.64</del>	<del>0.48</del>
<del>1/8</del>	<del>6x7</del>	<del>2.0</del>	<del>1.5</del>	<del>1.6</del>	<del>1.2</del>	<del>1.1</del>	<del>0.85</del>
<del>3/16</del>	<del>6x7</del>	<del>4.4</del>	<del>3.3</del>	<del>3.6</del>	<del>2.7</del>	<del>2.5</del>	<del>1.9</del>
<del>3/32</del>	<del>7x7</del>	<del>1.3</del>	<del>1.0</del>	<del>1.1</del>	<del>0.82</del>	<del>0.77</del>	<del>0.58</del>
<del>1/8</del>	<del>7x7</del>	<del>2.5</del>	<del>1.8</del>	<del>2.0</del>	<del>1.5</del>	<del>1.4</del>	<del>1.1</del>
<del>3/16</del>	<del>7x7</del>	<del>5.4</del>	<del>4.0</del>	<del>4.4</del>	<del>3.3</del>	<del>3.1</del>	<del>2.3</del>
<del>3/16</del>	<del>6x19</del>	<del>4.5</del>	<del>3.4</del>	<del>3.7</del>	<del>2.8</del>	<del>2.6</del>	<del>1.9</del>
<del>1/4</del>	<del>6x19</del>	<del>8.0</del>	<del>6.0</del>	<del>6.5</del>	<del>4.9</del>	<del>4.6</del>	<del>3.4</del>
<del>5/16</del>	<del>6x19</del>	<del>12.0</del>	<del>9.3</del>	<del>10.0</del>	<del>7.6</del>	<del>7.1</del>	<del>5.4</del>
<del>3/8</del>	<del>6x19</del>	<del>18.0</del>	<del>13.0</del>	<del>14.0</del>	<del>11.0</del>	<del>10.0</del>	<del>7.7</del>
<del>7/16</del>	<del>6x19</del>	<del>24.0</del>	<del>18.0</del>	<del>20.0</del>	<del>15.0</del>	<del>14.0</del>	<del>10.0</del>
<del>1/2</del>	<del>6x19</del>	<del>31.0</del>	<del>23.0</del>	<del>25.0</del>	<del>19.0</del>	<del>18.0</del>	<del>13.0</del>
<del>9/16</del>	<del>6x19</del>	<del>39.0</del>	<del>29.0</del>	<del>32.0</del>	<del>24.0</del>	<del>23.0</del>	<del>17.0</del>
<del>5/8</del>	<del>6x19</del>	<del>48.0</del>	<del>36.0</del>	<del>40.0</del>	<del>30.0</del>	<del>28.0</del>	<del>21.0</del>
<del>3/4</del>	<del>6x19</del>	<del>69.0</del>	<del>52.0</del>	<del>56.0</del>	<del>42.0</del>	<del>40.0</del>	<del>30.0</del>
<del>7/8</del>	<del>6x19</del>	<del>94.0</del>	<del>70.0</del>	<del>76.0</del>	<del>57.0</del>	<del>54.0</del>	<del>40.0</del>
<del>†</del>	<del>6x19</del>	<del>122.0</del>	<del>91.0</del>	<del>99.0</del>	<del>74.0</del>	<del>70.0</del>	<del>53.0</del>

**TABLE D-11**

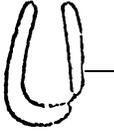
**RATED CAPACITIES FOR STRAND LAID  
GROMMET - HAND TUCKED IMPROVED  
PLOW STEEL GRADE ROPE**

ROPE BODY		RATED CAPACITIES, TONS (2,000 lb)		
—Dia. (Inches)	Constr.			
		Vertical	Choker	Vertical Basket*
<del>1/4</del>	<del>7x19</del>	<del>0.85</del>	<del>0.64</del>	<del>1.7</del>
<del>5/16</del>	<del>7x19</del>	<del>1.3</del>	<del>1.0</del>	<del>2.6</del>
<del>3/8</del>	<del>7x19</del>	<del>1.9</del>	<del>1.4</del>	<del>3.8</del>
<del>7/16</del>	<del>7x19</del>	<del>2.6</del>	<del>1.9</del>	<del>5.2</del>
<del>1/2</del>	<del>7x19</del>	<del>3.3</del>	<del>2.5</del>	<del>6.7</del>
<del>9/16</del>	<del>7x19</del>	<del>4.2</del>	<del>3.1</del>	<del>8.4</del>
<del>5/8</del>	<del>7x19</del>	<del>5.2</del>	<del>3.9</del>	<del>10.00</del>
<del>3/4</del>	<del>7x19</del>	<del>7.4</del>	<del>5.6</del>	<del>15.0</del>
<del>7/8</del>	<del>7x19</del>	<del>10.0</del>	<del>7.5</del>	<del>20.0</del>
<del>†</del>	<del>7x19</del>	<del>13.0</del>	<del>9.7</del>	<del>26.0</del>
<del>†-1/8</del>	<del>7x19</del>	<del>16.0</del>	<del>12.0</del>	<del>32.0</del>
<del>†-1/4</del>	<del>7x37</del>	<del>18.0</del>	<del>14.0</del>	<del>37.0</del>
<del>†-3/8</del>	<del>7x37</del>	<del>22.0</del>	<del>16.0</del>	<del>44.0</del>
<del>†-1/2</del>	<del>7x37</del>	<del>26.0</del>	<del>19.0</del>	<del>52.0</del>

\* These values only apply when the D/d ratio is 5 or greater where:  
 — D = Diameter of curvature around which rope is bent.  
 — d = Diameter of rope body.

**TABLE D-12**

RATED CAPACITIES FOR CABLE LAID GROMMET--HAND TUCKED 7x6x7 AND 7x6x19 CONSTRUCTIONS IMPROVED FLOW STEEL-GRADE ROPE 7x7x7 CONSTRUCTION GALVANIZED AIRCRAFT-GRADE ROPE

CABLE BODY		RATED CAPACITIES, TONS (2,000 lb)		
—Dia. (Inches)	—Constr.			
		Vertical	Choker	Vertical Basket*
—3/8	—7x6x7	—1.3	—0.95	—2.5
—9/16	—7x6x7	—2.8	—2.1	—5.6
—5/8	—7x6x7	—3.8	—2.8	—7.6
—3/8	—7x7x7	—1.6	—1.2	—3.2
—9/16	—7x7x7	—3.5	—2.6	—6.9
—5/8	—7x7x7	—4.5	—3.4	—9.0
—5/8	7x6x19	—3.9	—3.0	—7.9
—3/4	7x6x19	—5.1	—3.8	—10.0
—15/16	7x6x19	—7.9	—5.9	—16.0
1-1/8	7x6x19	—11.0	—8.4	—22.0
1-5/16	7x6x19	—15.0	—11.0	—30.0
1-1/2	7x6x19	—19.0	—14.0	—39.0
1-11/16	7x6x19	—24.0	—18.0	—49.0
1-7/8	7x6x19	—30.0	—22.0	—60.0
2-1/4	7x6x19	—42.0	—31.0	—84.0
2-5/8	7x6x19	—56.0	—42.0	—112.0

\*— These values only apply when the D/d ratio is 5 or greater where:  
 D— Diameter of curvature around which cable body is bent,  
 d — Diameter of cable body.

**TABLE D-13**

RATED CAPACITIES FOR STRAND LAID ENDLESS SLINGS--MECHANICAL JOINT IMPROVED FLOW STEEL-GRADE ROPE

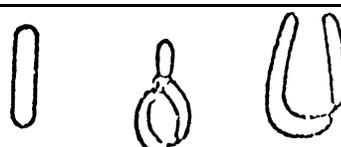
ROPE BODY		RATED CAPACITIES, TONS (2,000 lb)		
—Dia. (Inches)	Constr.			
		Vertical	Choker	Vertical Basket*
—1/4	6x19-IWRC	—0.92	—0.69	—1.8
—3/8	6x19-IWRC	—2.0	—1.5	—4.1
—1/2	6x19-IWRC	—3.6	—2.7	—7.2
—5/8	6x19-IWRC	—5.6	—4.2	—11.0
—3/4	6x19-IWRC	—8.0	—6.0	—16.0
—7/8	6x19-IWRC	—11.0	—8.1	—21.0
1	6x19-IWRC	—14.0	—10.0	—28.0

1-1/8	6x19 IWRC	—18.0	—13.0	—35.0
1-1/4	6x37 IWRC	—21.0	—15.0	—41.0
1-3/8	6x37 IWRC	—25.0	—19.0	—50.0
1-1/2	6x37 IWRC	—29.0	—22.0	—59.0

\* These values only apply when the D/d ratio is 5 or greater where:  
D = Diameter of curvature around which rope is bent,  
d = Diameter of rope body.

**TABLE D-14**

RATED CAPACITIES FOR CABLE LAID ENDLESS SLINGS -  
MECHANICAL JOINT 7x7x7 AND 7x7x19 CONSTRUCTIONS -  
GALVANIZED AIRCRAFT GRADE ROPE 7x6x19 IWRC  
CONSTRUCTION IMPROVED FLOW STEEL GRADE ROPE

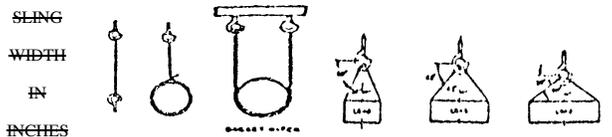
CABLE BODY		RATED CAPACITIES, TONS (2,000 lb)		
Dia. (Inches)	Constr.			
		Vertical	Choker	Vertical Basket*
1/4	7x7x7	—0.83	—0.62	—1.6
3/8	7x7x7	—1.8	—1.3	—3.5
1/2	7x7x7	—3.0	—2.3	—6.1
5/8	7x7x7	—4.5	—3.4	—9.1
3/4	7x7x7	—6.3	—4.7	—12.0
5/8	7x7x19	—4.7	—3.5	—9.5
3/4	7x7x19	—6.7	—5.0	—13.0
7/8	7x7x19	—8.9	—6.6	—18.0
1	7x7x19	—11.0	—8.5	—22.0
1-1/8	7x7x19	—14.0	—10.0	—28.0
1-1/4	7x7x19	—17.0	—12.0	—33.0
3/4	7x6x19 IWRC	—6.2	—4.7	—12.0
7/8	7x6x19 IWRC	—8.3	—6.2	—16.0
1	7x6x19 IWRC	—10.0	—7.9	—21.0
1-1/8	7x6x19 IWRC	—13.0	—9.7	—26.0
1-1/4	7x6x19 IWRC	—16.0	—12.0	—31.0
1-3/8	7x6x19 IWRC	—18.0	—14.0	—37.0
1-1/2	7x6x19 IWRC	—22.0	—16.0	—43.0

\* These values only apply when the D/d value is 5 or greater where:  
D = Diameter of curvature around which cable body is bent,  
d = Diameter of cable body.

**TABLE D-15**

RATED CAPACITIES  
CARBON STEEL AND STAINLESS STEEL  
METAL MESH SLINGS

EFFECT OF ANGLE ON RATED  
CAPACITIES IN BASKET HITCH



SLING WIDTH IN INCHES	VERTICAL EYE OR CHOKER	VERTICAL EYE BASKET	30 deg Vertical 60 deg Horizontal	45 deg Vertical 45 deg Horizontal	60 deg Vertical 30 deg Horizontal
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<b>Heavy Duty-10 Ga 35 Spirals/Ft of sling width</b>					
2	1,500	3,000	2,600	2,100	1,500
3	2,700	5,400	4,700	3,800	2,700
4	4,000	8,000	6,900	5,600	4,000
6	6,000	12,000	10,400	8,400	6,000
8	8,000	16,000	13,800	11,300	8,000
10	10,000	20,000	17,000	14,100	10,000
12	12,000	24,000	20,700	16,900	12,000
14	14,000	28,000	24,200	19,700	14,000
16	16,000	32,000	27,700	22,600	16,000
18	18,000	36,000	31,100	25,400	18,000
20	20,000	40,000	34,600	28,200	20,000
<b>Medium Duty-12 Ga 43 Spirals/Ft of sling width</b>					
2	1,350	2,700	2,300	1,900	1,400
3	2,000	4,000	3,500	2,800	2,000
4	2,700	5,400	4,700	3,800	2,700
6	4,500	9,000	7,800	6,400	4,500
8	6,000	12,000	10,400	8,500	6,000
10	7,500	15,000	13,000	10,600	7,500
12	9,000	18,000	15,600	12,700	9,000
14	10,500	21,000	18,200	14,800	10,500
16	12,000	24,000	20,800	17,000	12,000
18	13,500	27,000	23,400	19,100	13,500
20	15,000	30,000	26,000	21,200	15,000
<b>Light Duty-14 Ga 59 Spirals/Ft of sling width</b>					
2	900	1,800	1,600	1,300	900
3	1,400	2,800	2,400	2,000	1,400
4	2,000	4,000	3,500	2,800	2,000
6	3,000	6,000	5,200	4,200	3,000
8	4,000	8,000	6,900	5,700	4,000
10	5,000	10,000	8,600	7,100	5,000
12	6,000	12,000	10,400	8,500	6,000
14	7,000	14,000	12,100	9,900	7,000
16	8,000	16,000	13,900	11,300	8,000
18	9,000	18,000	15,600	12,700	9,000
20	10,000	20,000	17,300	14,100	10,000

**TABLE D-16**

**MANILA ROPE SLINGS**

**TABLE D-16: Part 1--Eye and Eye Sling**

	<b>EYE &amp; EYE SLING</b>				
	<b>BASKET Hitch</b>				
Rope Diameter					

Nominal in Inches	Nominal Weight per 100 ft. in Pounds	Ver- tical Hitch	Chok- er Hitch	Angle of Rope to Horizontal			
				90°	60°	45°	30°
				Angle of Rope to Vertical			
				0°	30°	45°	60°
1/2	7.5	480	240	960	830	680	480
9/16	10.4	620	310	1,240	1,070	875	620
5/8	13.3	790	395	1,580	1,370	1,120	790
3/4	16.7	970	485	1,940	1,680	1,370	970
13/16	19.5	1,170	585	2,340	2,030	1,650	1,170
7/8	22.5	1,390	695	2,780	2,410	1,970	1,390
1"	27.0	1,620	810	3,240	2,810	2,290	1,620
1 1/16	31.3	1,890	945	3,780	3,270	2,670	1,890
1 1/8	36.0	2,160	1,080	4,320	3,740	3,050	2,160
1 1/4	41.7	2,430	1,220	4,860	4,210	3,440	2,430
1 5/16	47.9	2,700	1,350	5,400	4,680	3,820	2,700
1 1/2	59.9	3,330	1,670	6,660	5,770	4,710	3,330
1 5/8	74.6	4,050	2,030	8,100	7,010	5,730	4,050
1 3/4	89.3	4,770	2,390	9,540	8,260	6,740	4,770
2"	107.5	5,580	2,790	11,200	9,660	7,890	5,580
2 1/8	125.0	6,480	3,240	13,000	11,200	9,160	6,480
2 1/4	146.0	7,380	3,690	14,800	12,800	10,400	7,380
2 1/2	166.7	8,370	4,190	16,700	14,500	11,800	8,370
2 5/8	190.8	9,360	4,680	18,700	16,200	13,200	9,360

See Figures D-4 and D-5 for sling configuration description.

**TABLE D-16: Part 2-Endless Sling**

ENDLESS SLING							
Rope Dia- meter	Nominal Weight per 100 ft. in Pounds	Ver- tical Hitch	Chok- er Hitch	BASKET HITCH			
				Angle of Rope to Horizontal			
				90°	60°	45°	30°
				Angle of Rope to Vertical			
				0°	30°	45°	60°
1/2	7.5	865	430	1,730	1,500	1,220	865
9/16	10.4	1,120	560	2,230	1,930	1,580	1,120
5/8	13.3	1,420	710	2,840	2,460	2,010	1,420
3/4	16.7	1,750	875	3,490	3,020	2,470	1,750
13/16	19.5	2,110	1,050	4,210	3,650	2,980	2,110
7/8	22.5	2,500	1,250	5,000	4,330	3,540	2,500
1"	27.0	2,920	1,460	5,830	5,050	4,120	2,920
1 1/16	31.3	3,400	1,700	6,800	5,890	4,810	3,400
1 1/8	36.0	3,890	1,940	7,780	6,730	5,500	3,890
1 1/4	41.7	4,370	2,190	8,750	7,580	6,190	4,370
1 5/16	47.9	4,860	2,430	9,720	8,420	6,870	4,860
1 1/2	59.9	5,990	3,000	12,000	10,400	8,480	5,990
1 5/8	74.6	7,290	3,650	14,600	12,600	10,300	7,290
1 3/4	89.3	8,590	4,290	17,200	14,900	12,100	8,590
2"	107.5	10,000	5,020	20,100	17,400	14,200	10,000
2 1/8	125.0	11,700	5,830	23,300	20,200	16,500	11,700
2 1/4	146.0	13,300	6,640	26,600	23,000	18,800	13,300

2-1/2	166.7	15,100	7,530	30,100	26,100	21,300	15,100
2-5/8	190.8	16,800	8,420	33,700	29,200	23,800	16,800

See Figures D-4 and D-5 for sling configuration description.

**TABLE D-17**

**NYLON ROPE SLINGS**

**TABLE D-17: Part 1--Eye and Eye Sling**

EYE & EYE SLING							
Rope Diameter	Nominal Weight per 100 ft. in Pounds	Vertical Hitch	Choker Hitch	BASKET HITCH			
				Angle of Rope to Horizontal			
				90°	60°	45°	30°
Nominal in Inches	per 100 ft. in Pounds	Vertical Hitch	Choker Hitch	Angle of Rope to Vertical			
				0°	30°	45°	60°
1/2	6.5	635	320	1,270	1,100	900	635
9/16	8.3	790	395	1,580	1,370	1,120	790
5/8	10.5	1,030	515	2,060	1,780	1,460	1,030
3/4	14.5	1,410	705	2,820	2,440	1,990	1,410
13/16	17.0	1,680	840	3,360	2,910	2,380	1,680
7/8	20.0	1,980	990	3,960	3,430	2,800	1,980
1"	26.0	2,480	1,240	4,960	4,300	3,510	2,480
1-1/16	29.0	2,850	1,430	5,700	4,940	4,030	2,850
1-1/8	34.0	3,270	1,640	6,540	5,660	4,620	3,270
1-1/4	40.0	3,710	1,860	7,420	6,430	5,250	3,710
1-5/16	45.0	4,260	2,130	8,520	7,380	6,020	4,260
1-1/2	55.0	5,250	2,630	10,500	9,090	7,420	5,250
1-5/8	68.0	6,440	3,220	12,900	11,200	9,110	6,440
1-3/4	83.0	7,720	3,860	15,400	13,400	10,900	7,720
2"	95.0	9,110	4,560	18,200	15,800	12,900	9,110
2-1/8	109.0	10,500	5,250	21,000	18,200	14,800	10,500
2-1/4	129.0	12,400	6,200	24,800	21,500	17,500	12,400
2-1/2	149.0	13,900	6,950	27,800	24,100	19,700	13,900
2-5/8	168.0	16,000	8,000	32,000	27,700	22,600	16,000

See Figures D-4 and D-5 for sling configuration description.

**TABLE D-17: Part 2--Endless Sling**

ENDLESS SLING							
Rope Diameter	Nominal Weight per 100 ft. in Pounds	Vertical Hitch	Choker Hitch	BASKET HITCH			
				Angle of Rope to Horizontal			
				90°	60°	45°	30°
Nominal in Inches	per 100 ft. in Pounds	Vertical Hitch	Choker Hitch	Angle of Rope to Vertical			
				0°	30°	45°	60°
1/2	6.5	1,140	570	2,290	1,980	1,620	1,140
9/16	8.3	1,420	710	2,840	2,460	2,010	1,420
5/8	10.5	1,850	925	3,710	3,210	2,620	1,850
3/4	14.5	2,540	1,270	5,080	4,400	3,590	2,540
13/16	17.0	3,020	1,510	6,050	5,240	4,280	3,020
7/8	20.0	3,560	1,780	7,130	6,170	5,040	3,560
1"	26.0	4,460	2,230	8,930	7,730	6,310	4,460

1-1/16	—29.0	5,130	2,570	10,300	8,890	7,260	5,130
1-1/8	—34.0	5,890	2,940	11,800	10,200	8,330	5,890
1-1/4	—40.0	6,680	3,340	13,400	11,600	9,450	6,680
1-5/16	—45.0	7,670	3,830	15,300	13,300	10,800	7,670
1-1/2	—55.0	9,450	4,730	18,900	16,400	13,400	9,450
1-5/8	—68.0	11,600	5,800	23,200	20,100	16,400	11,600
1-3/4	—83.0	13,900	6,950	27,800	24,100	19,700	13,900
2"	—95.0	16,400	8,200	32,800	28,400	23,200	16,400
2-1/8	—109.0	18,900	9,450	37,800	32,700	26,700	18,900
2-1/4	—129.0	22,300	11,200	44,600	38,700	31,600	22,300
2-1/2	—149.0	25,000	12,500	50,000	43,300	35,400	25,000
2-5/8	—168.0	28,800	14,400	57,600	49,900	40,700	28,800

See Figures D-4 and D-5 for sling configuration description.

**TABLE D-18**

**POLYESTER ROPE SLINGS**

**TABLE D-18: Part 1--Eye and Eye Sling**

Rope Diameter		EYE & EYE SLING					
		Nominal Weight per 100 ft. in Pounds		Vertical Hitch		BASKET HITCH	
						Angle of Rope to Horizontal	
Nominal in Inches	per 100 ft. in Pounds	Ver-tical Hitch	Chok-er Hitch	Angle of Rope to Vertical			
				90°	60°	45°	30°
				0°	30°	45°	60°
1/2	—8.0	635	320	1,270	1,100	900	635
9/16	—10.2	790	395	1,580	1,370	1,120	790
5/8	—13.0	990	495	1,980	1,710	1,400	990
3/4	—17.5	1,240	620	2,480	2,150	1,750	1,240
13/16	—21.0	1,540	770	3,080	2,670	2,180	1,540
7/8	—25.0	1,780	890	3,560	3,080	2,520	1,780
1"	—30.5	2,180	1,090	4,360	3,780	3,080	2,180
1-1/16	—34.5	2,530	1,270	5,060	4,380	3,580	2,530
1-1/8	—40.0	2,920	1,460	5,840	5,060	4,130	2,920
1-1/4	—46.3	3,290	1,650	6,580	5,700	4,650	3,290
1-5/16	—52.5	3,710	1,860	7,420	6,430	5,250	3,710
1-1/2	—66.8	4,630	2,320	9,260	8,020	6,550	4,630
1-5/8	—82.0	5,640	2,820	11,300	9,770	7,980	5,640
1-3/4	—98.0	6,710	3,360	13,400	11,600	9,490	6,710
2"	—118.0	7,920	3,960	15,800	13,700	11,200	7,920
2-1/8	—135.0	9,110	4,460	18,200	15,800	12,900	9,110
2-1/4	—157.0	10,600	5,300	21,200	18,400	15,000	10,600
2-1/2	—181.0	12,100	6,050	24,200	21,000	17,100	12,100
2-5/8	—205.0	13,600	6,800	27,200	23,600	19,200	13,600

See Figures D-4 and D-5 for sling configuration description.

**TABLE D-18: Part 2--Endless Sling**

Rope Diameter		ENDLESS SLING			
		Vertical Hitch		BASKET HITCH	
				Angle of Rope to Horizontal	
Nominal in Inches	per 100 ft. in Pounds	Ver-tical Hitch	Chok-er Hitch	90°	60°
				45°	30°

Nominal in Inches	Nominal Weight per 100 ft. in Pounds	Ver- tical in Hitch	Chok- er Hitch	Angle of Rope to Vertical			
				90°	60°	45°	30°
				0°	30°	45°	60°
<del>1/2</del>	<del>8.0</del>	<del>1,140</del>	<del>570</del>	<del>2,290</del>	<del>1,980</del>	<del>1,620</del>	<del>1,140</del>
<del>9/16</del>	<del>10.2</del>	<del>1,420</del>	<del>710</del>	<del>2,840</del>	<del>2,460</del>	<del>2,010</del>	<del>1,420</del>
<del>5/8</del>	<del>13.0</del>	<del>1,780</del>	<del>890</del>	<del>3,570</del>	<del>3,090</del>	<del>2,520</del>	<del>1,780</del>
<del>3/4</del>	<del>17.5</del>	<del>2,230</del>	<del>1,120</del>	<del>4,470</del>	<del>3,870</del>	<del>3,160</del>	<del>2,230</del>
<del>13/16</del>	<del>21.0</del>	<del>2,770</del>	<del>1,390</del>	<del>5,540</del>	<del>4,800</del>	<del>3,920</del>	<del>2,770</del>
<del>7/8</del>	<del>25.0</del>	<del>3,200</del>	<del>1,600</del>	<del>6,410</del>	<del>5,550</del>	<del>4,530</del>	<del>3,200</del>
<del>1"</del>	<del>30.5</del>	<del>3,920</del>	<del>1,960</del>	<del>7,850</del>	<del>6,800</del>	<del>5,550</del>	<del>3,920</del>
<del>1-1/16</del>	<del>34.5</del>	<del>4,550</del>	<del>2,280</del>	<del>9,110</del>	<del>7,990</del>	<del>6,440</del>	<del>4,550</del>
<del>1-1/8</del>	<del>40.0</del>	<del>5,260</del>	<del>2,630</del>	<del>10,500</del>	<del>9,100</del>	<del>7,440</del>	<del>5,260</del>
<del>1-1/4</del>	<del>46.3</del>	<del>5,920</del>	<del>2,960</del>	<del>11,800</del>	<del>10,300</del>	<del>8,380</del>	<del>5,920</del>
<del>1-5/16</del>	<del>52.5</del>	<del>6,680</del>	<del>3,340</del>	<del>13,400</del>	<del>11,600</del>	<del>9,450</del>	<del>6,680</del>
<del>1-1/2</del>	<del>66.8</del>	<del>8,330</del>	<del>4,170</del>	<del>16,700</del>	<del>14,400</del>	<del>11,800</del>	<del>8,330</del>
<del>1-5/8</del>	<del>82.0</del>	<del>10,200</del>	<del>5,080</del>	<del>20,300</del>	<del>17,600</del>	<del>14,400</del>	<del>10,200</del>
<del>1-3/4</del>	<del>98.0</del>	<del>12,100</del>	<del>6,040</del>	<del>24,200</del>	<del>20,900</del>	<del>17,100</del>	<del>12,100</del>
<del>2"</del>	<del>118.0</del>	<del>14,300</del>	<del>7,130</del>	<del>28,500</del>	<del>24,700</del>	<del>20,200</del>	<del>14,300</del>
<del>2-1/8</del>	<del>135.0</del>	<del>16,400</del>	<del>8,200</del>	<del>32,800</del>	<del>28,400</del>	<del>23,200</del>	<del>16,400</del>
<del>2-1/4</del>	<del>157.0</del>	<del>19,100</del>	<del>9,540</del>	<del>38,200</del>	<del>33,100</del>	<del>27,000</del>	<del>19,100</del>
<del>2-1/2</del>	<del>181.0</del>	<del>21,800</del>	<del>10,900</del>	<del>43,600</del>	<del>37,700</del>	<del>30,800</del>	<del>21,800</del>
<del>2-5/8</del>	<del>205.0</del>	<del>24,500</del>	<del>12,200</del>	<del>49,000</del>	<del>42,400</del>	<del>34,600</del>	<del>24,500</del>

See Figures D-4 and D-5 for sling configuration description.

**TABLE D-19**  
POLYPROPYLENE ROPE SLINGS  
**TABLE D-19: Part 1--Eye and Eye Sling**

Rope Dia- meter	EYE & EYE SLING							
	Nominal Weight per 100 ft. in Pounds	Ver- tical in Hitch	Chok- er Hitch	BASKET HITCH				
				Angle of Rope to Horizontal				
Nomi- nal in Inches	90°	60°	45°	30°	90°	60°	45°	30°
<del>1/2</del>	<del>4.7</del>	<del>645</del>	<del>325</del>	<del>1,290</del>	<del>1,120</del>	<del>910</del>	<del>645</del>	<del>645</del>
<del>9/16</del>	<del>6.1</del>	<del>780</del>	<del>390</del>	<del>1,560</del>	<del>1,350</del>	<del>1,100</del>	<del>780</del>	<del>780</del>
<del>5/8</del>	<del>7.5</del>	<del>950</del>	<del>475</del>	<del>1,900</del>	<del>1,650</del>	<del>1,340</del>	<del>950</del>	<del>950</del>
<del>3/4</del>	<del>10.7</del>	<del>1,300</del>	<del>650</del>	<del>2,600</del>	<del>2,250</del>	<del>1,840</del>	<del>1,300</del>	<del>1,300</del>
<del>13/16</del>	<del>12.7</del>	<del>1,520</del>	<del>760</del>	<del>3,040</del>	<del>2,630</del>	<del>2,150</del>	<del>1,520</del>	<del>1,520</del>
<del>7/8</del>	<del>15.0</del>	<del>1,760</del>	<del>880</del>	<del>3,520</del>	<del>3,050</del>	<del>2,490</del>	<del>1,760</del>	<del>1,760</del>
<del>1"</del>	<del>18.0</del>	<del>2,140</del>	<del>1,070</del>	<del>4,280</del>	<del>3,700</del>	<del>3,030</del>	<del>2,140</del>	<del>2,140</del>
<del>1-1/16</del>	<del>20.4</del>	<del>2,450</del>	<del>1,230</del>	<del>4,900</del>	<del>4,240</del>	<del>3,460</del>	<del>2,450</del>	<del>2,450</del>
<del>1-1/8</del>	<del>23.7</del>	<del>2,800</del>	<del>1,400</del>	<del>5,600</del>	<del>4,850</del>	<del>3,960</del>	<del>2,800</del>	<del>2,800</del>
<del>1-1/4</del>	<del>27.0</del>	<del>3,210</del>	<del>1,610</del>	<del>6,420</del>	<del>5,560</del>	<del>4,540</del>	<del>3,210</del>	<del>3,210</del>
<del>1-5/16</del>	<del>30.5</del>	<del>3,600</del>	<del>1,800</del>	<del>7,200</del>	<del>6,240</del>	<del>5,090</del>	<del>3,600</del>	<del>3,600</del>
<del>1-1/2</del>	<del>38.5</del>	<del>4,540</del>	<del>2,270</del>	<del>9,080</del>	<del>7,860</del>	<del>6,420</del>	<del>4,540</del>	<del>4,540</del>
<del>1-5/8</del>	<del>47.5</del>	<del>5,510</del>	<del>2,760</del>	<del>11,000</del>	<del>9,540</del>	<del>7,790</del>	<del>5,510</del>	<del>5,510</del>
<del>1-3/4</del>	<del>57.0</del>	<del>6,580</del>	<del>3,290</del>	<del>13,200</del>	<del>11,400</del>	<del>9,300</del>	<del>6,580</del>	<del>6,580</del>
<del>2"</del>	<del>69.0</del>	<del>7,960</del>	<del>3,980</del>	<del>15,900</del>	<del>13,800</del>	<del>11,300</del>	<del>7,960</del>	<del>7,960</del>
<del>2-1/8</del>	<del>80.0</del>	<del>9,330</del>	<del>4,670</del>	<del>18,700</del>	<del>16,200</del>	<del>13,200</del>	<del>9,330</del>	<del>9,330</del>

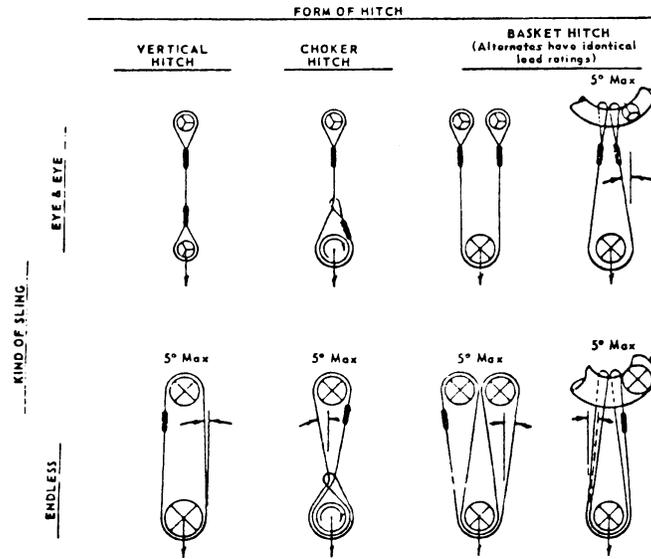
<del>2-1/4</del>	<del>—92.0</del>	<del>10,600</del>	<del>5,300</del>	<del>21,200</del>	<del>18,400</del>	<del>15,000</del>	<del>10,600</del>
<del>2-1/2</del>	<del>—107.0</del>	<del>12,200</del>	<del>6,100</del>	<del>24,400</del>	<del>21,100</del>	<del>17,300</del>	<del>12,200</del>
<del>2-5/8</del>	<del>—120.0</del>	<del>13,800</del>	<del>6,900</del>	<del>27,600</del>	<del>23,900</del>	<del>19,600</del>	<del>13,800</del>

See Figures D-4 and D-5 for sling configuration description.

**TABLE D-19: Part 2—Endless Sling**

Rope Diameter	ENDLESS SLING						
	Nominal Weight per 100 ft. in Pounds	Vertical Hitch	Choker Hitch	BASKET HITCH			
				Angle of Rope to Horizontal			
				90°	60°	45°	30°
Nominal in Inches	Vertical Hitch	Choker Hitch	Angle of Rope to Vertical				
			0°	30°	45°	60°	
<del>1/2</del>	<del>—4.7</del>	<del>1,160</del>	<del>580</del>	<del>2,320</del>	<del>2,010</del>	<del>1,640</del>	<del>1,160</del>
<del>9/16</del>	<del>—6.1</del>	<del>1,400</del>	<del>700</del>	<del>2,810</del>	<del>2,430</del>	<del>1,990</del>	<del>1,400</del>
<del>5/8</del>	<del>—7.5</del>	<del>1,710</del>	<del>855</del>	<del>3,420</del>	<del>2,960</del>	<del>2,420</del>	<del>1,710</del>
<del>3/4</del>	<del>—10.7</del>	<del>2,340</del>	<del>1,170</del>	<del>4,680</del>	<del>4,050</del>	<del>3,310</del>	<del>2,340</del>
<del>13/16</del>	<del>—12.7</del>	<del>2,740</del>	<del>1,370</del>	<del>5,470</del>	<del>4,740</del>	<del>3,870</del>	<del>2,740</del>
<del>7/8</del>	<del>—15.0</del>	<del>3,170</del>	<del>1,580</del>	<del>6,340</del>	<del>5,490</del>	<del>4,480</del>	<del>3,170</del>
<del>1"</del>	<del>—18.0</del>	<del>3,850</del>	<del>1,930</del>	<del>7,700</del>	<del>6,670</del>	<del>5,450</del>	<del>3,860</del>
<del>1-1/16</del>	<del>—20.4</del>	<del>4,410</del>	<del>2,210</del>	<del>8,820</del>	<del>7,640</del>	<del>6,240</del>	<del>4,410</del>
<del>1-1/8</del>	<del>—23.7</del>	<del>5,040</del>	<del>2,520</del>	<del>10,100</del>	<del>8,730</del>	<del>7,130</del>	<del>5,040</del>
<del>1-1/4</del>	<del>—27.0</del>	<del>5,780</del>	<del>2,890</del>	<del>11,600</del>	<del>10,000</del>	<del>8,170</del>	<del>5,780</del>
<del>1-5/16</del>	<del>—30.5</del>	<del>6,480</del>	<del>3,240</del>	<del>13,000</del>	<del>11,200</del>	<del>9,170</del>	<del>6,480</del>
<del>1-1/2</del>	<del>—38.5</del>	<del>8,170</del>	<del>4,090</del>	<del>16,300</del>	<del>14,200</del>	<del>11,600</del>	<del>8,170</del>
<del>1-5/8</del>	<del>—47.5</del>	<del>9,920</del>	<del>4,960</del>	<del>19,800</del>	<del>17,200</del>	<del>14,000</del>	<del>9,920</del>
<del>1-3/4</del>	<del>—57.0</del>	<del>11,800</del>	<del>5,920</del>	<del>23,700</del>	<del>20,500</del>	<del>16,800</del>	<del>11,800</del>
<del>2"</del>	<del>—69.0</del>	<del>14,300</del>	<del>7,160</del>	<del>28,700</del>	<del>24,800</del>	<del>20,300</del>	<del>14,300</del>
<del>2-1/8</del>	<del>—80.0</del>	<del>16,800</del>	<del>8,400</del>	<del>33,600</del>	<del>29,100</del>	<del>23,800</del>	<del>16,800</del>
<del>2-1/4</del>	<del>—92.0</del>	<del>19,100</del>	<del>9,540</del>	<del>38,200</del>	<del>33,100</del>	<del>27,000</del>	<del>19,100</del>
<del>2-1/2</del>	<del>—107.0</del>	<del>22,000</del>	<del>11,000</del>	<del>43,900</del>	<del>38,000</del>	<del>31,100</del>	<del>22,000</del>
<del>2-5/8</del>	<del>—120.0</del>	<del>24,800</del>	<del>12,400</del>	<del>49,700</del>	<del>43,000</del>	<del>35,100</del>	<del>24,800</del>

See Figures D-4 and D-5 for sling configuration description.)



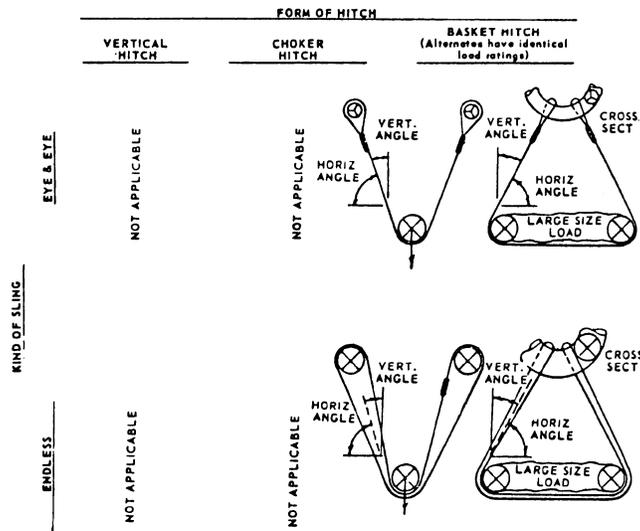
Notes: Angles of 5° or less from the vertical may be considered vertical angles.  
 For slings with legs more than 5° off vertical, the actual angle as shown in Figure D-5 must be considered.

EXPLANATION OF SYMBOLS: Minimum diameter of curvature

- Represents a contact surface which shall have a diameter of curvature at least double the diameter of the rope.
- Represents a contact surface which shall have a diameter of curvature at least 8 times the diameter of the rope.
- Represents a load in a choker hitch and illustration the rotary force on the load and/or the slippage of the rope in contact with the load. Diameter of curvature of load surface shall be at least double the diameter of the rope.

**Figure D-4**

Basic Sling Configurations with Vertical Legs



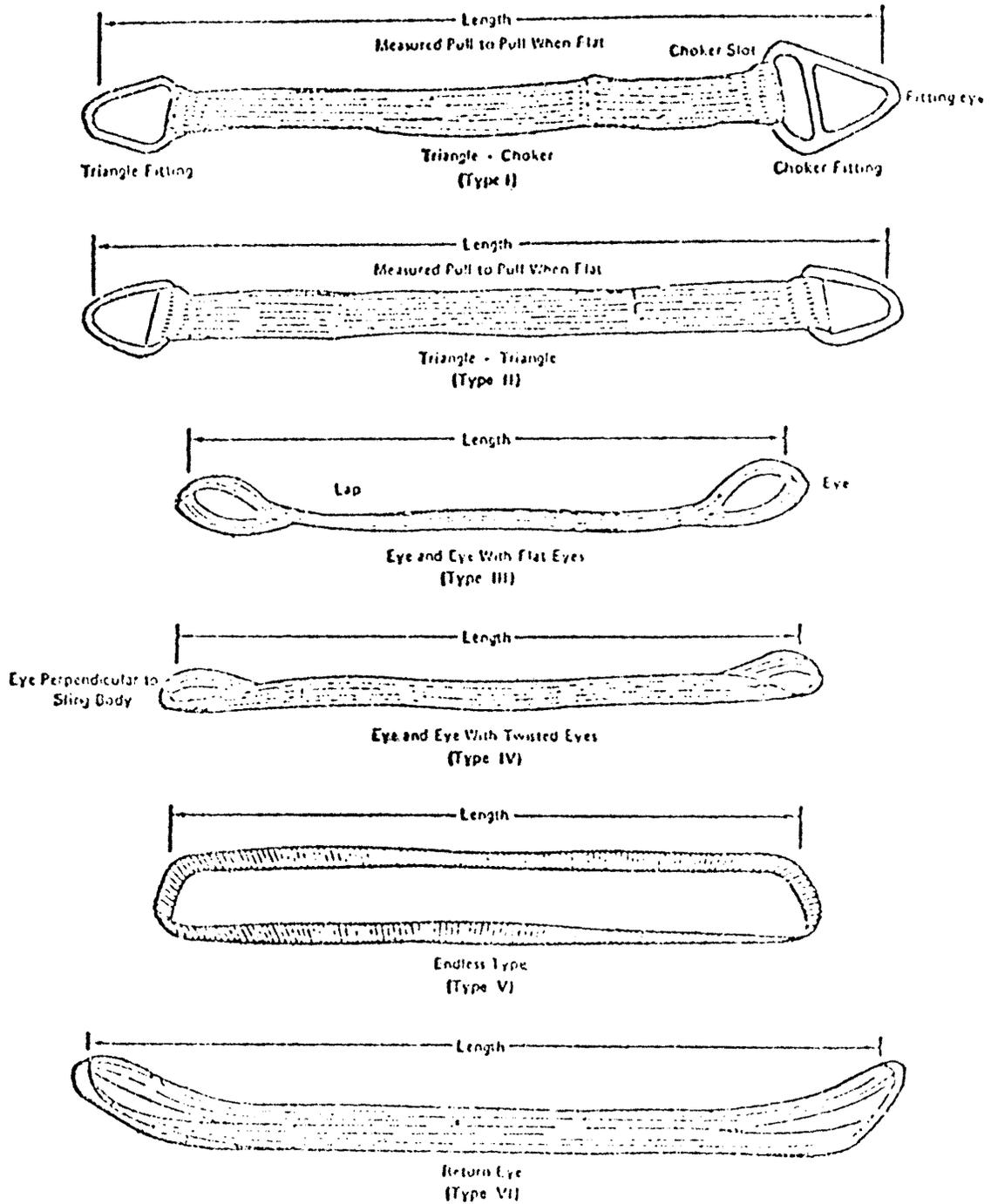
Notes: For vertical angles of 5° or less, refer to Figure D-4 "basic sling configuration with vertical legs."

See Figure D-4 for explanation of symbols.

### Figure D-5

#### Sling Configurations with Angled Legs

##### Basic Synthetic Web Sling Constructions



**Figure D-6**

Basic Synthetic Web Sling Constructions

**(TABLE D-20**

RATED CAPACITY IN POUNDS SYNTHETIC WEB SLINGS 1,000  
LBS. PER INCH OF WIDTH SINGLE PLY

**(TABLE D-20: Part 1--Types I, H, HH, and IV)**

Sling Body Width, Inches	Triangle - Choker Slings, Type I Triangle - Triangle Slings, Type H Eye & Eye with Flat Eye Slings, Type III Eye & Eye with Twisted Eye Slings, Type IV					
	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	1,000	750	2,000	1,700	1,400	1,000
2	2,000	1,500	4,000	3,500	2,800	2,000
3	3,000	2,200	6,000	5,200	4,200	3,000
4	4,000	3,000	8,000	6,900	5,700	4,000
5	5,000	3,700	10,000	8,700	7,100	5,000
6	6,000	4,500	12,000	10,400	8,500	6,000

Notes: 1. All angles shown are measured from the vertical.  
2. Capacities for intermediate widths not shown may be obtained by interpolation.

**(TABLE D-20: Part 2--Type V)**

Sling Body Width, Inches	Endless Slings, Type V					
	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	1,600	1,300	3,200	2,800	2,300	1,600
2	3,200	2,600	6,400	5,500	4,500	3,200
3	4,800	3,800	9,600	8,300	6,800	4,800
4	6,400	5,100	12,800	11,100	9,000	6,400
5	8,000	6,400	16,000	13,900	11,300	8,000
6	9,600	7,700	19,200	16,600	13,600	9,600

Notes: 1. All angles shown are measured from the vertical.  
2. Capacities for intermediate widths not shown may be obtained by interpolation.

**(TABLE D-20: Part 3--Type VI)**

Sling Body Width, Inches	Return Eye Slings, Type VI					
	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	800	650	1,600	1,400	1,150	800
2	1,600	1,300	3,200	2,800	2,300	1,600
3	2,400	1,950	4,800	4,150	3,400	2,400

Sling Body Width; Inches	Return Eye Slings, Type VI					
	Vert.	Choker	Vert.	30°	45°	60°
			Basket	Basket	Basket	Basket
4	3,200	2,600	6,400	5,500	4,500	3,200
5	4,000	3,250	8,000	6,900	5,650	4,000
6	4,800	3,800	9,600	8,300	6,800	4,800

Notes: 1. All angles shown are measured from the vertical.  
2. Capacities for intermediate widths not shown may be obtained by interpolation.

**TABLE D-21**

RATED CAPACITY IN POUNDS SYNTHETIC WEB SLINGS 1,200  
LBS. PER INCH OF WIDTH SINGLE PLY

(TABLE D-21: Part 1--Types I, H, III, and IV)

Sling Body Width; Inches	Triangle - Choker Slings, Type I Triangle - Triangle Slings, Type II Eye & Eye with Flat Eye Slings, Type III Eye & Eye with Twisted Eye Slings, Type IV					
	Vert.	Choker	Vert.	30°	45°	60°
			Basket	Basket	Basket	Basket
1	1,200	900	2,400	2,100	1,700	1,200
2	2,400	1,800	4,800	4,200	3,400	2,400
3	3,600	2,700	7,200	6,200	5,100	3,600
4	4,800	3,600	9,600	8,300	6,800	4,800
5	6,000	4,500	12,000	10,400	8,500	6,000
6	7,200	5,400	14,400	12,500	10,200	7,200

Notes: 1. All angles shown are measured from the vertical.  
2. Capacities for intermediate widths not shown may be obtained by interpolation.

(TABLE D-21: Part 2--Type V)

Sling Body Width; Inches	Endless Slings, Type V					
	Vert.	Choker	Vert.	30°	45°	60°
			Basket	Basket	Basket	Basket
1	1,900	1,500	3,800	3,300	2,700	1,900
2	3,800	3,000	7,600	6,600	5,400	3,800
3	5,800	4,600	11,600	10,000	8,200	5,800
4	7,700	6,200	15,400	13,300	10,900	7,700
5	9,600	7,700	19,200	16,600	13,600	9,600
6	11,500	9,200	23,000	19,900	16,300	11,500

Notes: 1. All angles shown are measured from the vertical.  
2. Capacities for intermediate widths not shown may be obtained by interpolation.

(TABLE D-21: Part 3--Type VI)

Sling Body Width, Inches	Return Eye Slings, Type VI					
	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	950	750	1,900	1,650	1,350	950
2	1,900	1,500	3,800	3,300	2,700	1,900
3	2,850	2,250	5,700	4,950	4,050	2,850
4	3,800	3,000	7,600	6,600	5,400	3,800
5	4,750	3,750	9,500	8,250	6,750	4,750
6	5,800	4,600	11,600	10,000	8,200	5,800

Notes: 1. All angles shown are measured from the vertical.  
 2. Capacities for intermediate widths not shown may be obtained by interpolation.

**TABLE D-22**

RATED CAPACITY IN POUNDS SYNTHETIC WEB SLINGS 1,600  
 LBS. PER INCH OF WIDTH SINGLE PLY

(TABLE D-22: Part 1--Types I, H, HI, and IV)

Sling Body Width, Inches	Triangle - Choker Slings, Type I Triangle - Triangle Slings, Type H Eye & Eye with Flat Eye Slings, Type III Eye & Eye with Twisted Eye Slings, Type IV					
	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	1,600	1,200	3,200	2,800	2,300	1,600
2	3,200	2,400	6,400	5,500	4,500	3,200
3	4,800	3,600	9,600	8,300	6,800	4,800
4	6,400	4,800	12,800	11,100	9,000	6,400
5	8,000	6,000	16,000	13,800	11,300	8,000
6	9,600	7,200	19,200	16,600	13,600	9,600

Notes: 1. All angles shown are measured from the vertical.  
 2. Capacities for intermediate widths not shown may be obtained by interpolation.

Sling Body Width, Inches	Endless Slings, Type V					
	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	2,600	2,100	5,200	4,500	3,700	2,600
2	5,100	4,100	10,200	8,800	7,200	5,100
3	7,700	6,200	15,400	13,300	10,900	7,700
4	10,100	8,200	20,400	17,700	14,400	10,200
5	12,800	10,200	25,600	22,200	18,100	12,800
6	15,400	12,300	30,800	26,700	21,800	15,400

Notes: 1. All angles shown are measured from the vertical.  
 2. Capacities for intermediate widths not shown may be obtained by interpolation.

(TABLE D-22: Part 3--Type VI)

Sling Body Width, Inches	Return Eye Slings, Type VI					
	Vert.	Choker	Vert. Basket	30° Basket	45° Basket	60° Basket
1	1,050	1,050	2,600	2,250	1,850	1,300
2	2,600	2,100	5,200	4,500	3,700	2,600
3	3,900	3,150	7,800	6,750	5,500	3,900
4	5,100	4,100	10,200	8,800	7,200	5,100
5	6,400	5,150	12,800	11,050	9,050	6,400
6	7,700	6,200	15,400	13,300	10,900	7,700

Notes: 1. All angles shown are measured from the vertical.  
2. Capacities for intermediate widths not shown may be obtained by interpolation.)

AMENDATORY SECTION (Amending WSR 08-05-012, filed 2/8/08, effective 4/1/08)

**WAC 296-37-575 Recordkeeping requirements.** (1) Recording and reporting.

(a) The employer shall comply with the requirements of chapters 296-27, 296-800, and 296-900 WAC.

(b) The employer shall record the occurrence of any diving-related injury or illness which requires any dive team member to be hospitalized, specifying the circumstances of the incident and the extent of any injuries or illnesses.

(2) Availability of records.

(a) Upon the request of the director of the department of labor and industries or his duly authorized designees, the employer shall make available for inspection and copying any record or document required by this standard.

(b) Records and documents required by this standard shall be provided upon request to employees, designated representatives, and the assistant director in accordance with chapter 296-802 WAC. Safe practices manuals (WAC 296-37-530), depth-time profiles (WAC 296-37-540), recording of dives (WAC 296-37-545), decompression procedure assessment evaluations (WAC 296-37-545), and records of hospitalizations (WAC 296-37-575) shall be provided in the same manner as employee exposure records or analyses using exposure or medical records. Equipment inspections and testing records which pertain to employees (WAC 296-37-570) shall also be provided upon request to employees and their designated representatives.

(c) Records and documents required by this standard shall be retained by the employer for the following period:

(i) Dive team member medical records (physician's reports) (WAC 296-37-525) - Five years;

(ii) Safe practices manual (WAC 296-37-530) - Current document only;

(iii) Depth-time profile (WAC 296-37-540) - Until completion of the recording of dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness;

(iv) Recording dive (WAC 296-37-545) one year, except five years where there has been an incident of decompression sickness;

(v) Decompression procedure assessment evaluations (WAC 296-37-545) - Five years;

(vi) Equipment inspections and testing records (WAC 296-37-570) - Current entry or tag, or until equipment is withdrawn from service;

(vii) Records of hospitalizations (WAC 296-37-575) - Five years.

(d) After the expiration of the retention period of any record required to be kept for five years, the employer shall forward such

records to the National Institute for Occupational Safety and Health, Department of Health and Human Services. The employer shall also comply with any additional requirements set forth in chapter 296-802 WAC.

~~((e) In the event the employer ceases to do business:~~

~~(i) The successor employer shall receive and retain all dive and employee medical records required by this standard; or~~

~~(ii) If there is no successor employer, dive and employee medical records shall be forwarded to the National Institute for Occupational Safety and Health, Department of Health and Human Services.))~~

AMENDATORY SECTION (Amending WSR 05-03-093, filed 1/18/05, effective 3/1/05)

**WAC 296-56-60005 Definitions.** "Apron" means that open portion of a marine terminal immediately adjacent to a vessel berth and used in the direct transfer of cargo between the terminal and vessel.

"Assistant director for the division of WISHA services" means the assistant director of WISHA services, department of labor and industries or his/her authorized representative.

"Authorized," in reference to an employee's assignment, means selected by the employer for that purpose.

"Cargo door" (transit shed door) means a door designed to permit transfer of cargo to and from a marine terminal structure.

"Cargo packaging" means any method of containment for shipment, including cases, cartons, crates and sacks, but excluding large units such as intermodal containers, vans or similar devices.

"Confined space" means a space that:

- Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry); and
- Is not designed for continuous employee occupancy.

"Conveyor" means a device designed exclusively for transporting bulk materials, packages or objects in a predetermined path and having fixed or selective points of loading or discharge.

"Danger zone" means any place in or about a machine or piece of equipment where an employee may be struck by or caught between moving parts, caught between moving and stationary objects or parts of the machine, caught between the material and a moving part of the machine, burned by hot surfaces or exposed to electric shock. Examples of danger zones are nip and shear points, shear lines, drive mechanisms, and areas beneath counterweights.

"Designated person" means a person who possesses specialized abilities in a specific area and is assigned by the employer to perform a specific task in that area.

"Dock" means a wharf or pier forming all or part of a waterfront facility, including marginal or quayside berthing facilities; not to be confused with "loading dock" as at a transit shed or container freight station, or with the body of water between piers or wharves.

"Dock facilities" includes all piers, wharves, sheds, aprons, dolphins, cranes, or other gear or equipment owned or controlled by the dock or facility owner, where cargo or materials are loaded, moved or handled to or from a vessel.

"Dockboards" (car and bridge plates) mean devices for spanning short distances between rail cars or highway vehicles and loading

platforms that do not expose employees to falls greater than 4 feet (1.22 m).

"Enclosed space" means an indoor space, other than a confined space, that may contain or accumulate a hazardous atmosphere due to inadequate natural ventilation. Examples of enclosed spaces are trailers, railcars, and storage rooms.

"Examination," as applied to material handling devices required to be certified by this chapter, means a comprehensive survey consisting of the criteria outlined in WAC 296-56-60093 through 296-56-60097. The examination is supplemented by a unit proof test in the case of annual survey.

"Flammable atmosphere" means an atmosphere containing more than ten percent of the lower flammable limit (LEL) of a flammable or combustible vapor or dust mixed with air. Such atmospheres are usually toxic as well as flammable.

"Front-end attachments."

- As applied to power-operated industrial trucks, means the various devices, such as roll clamps, rotating and sideshifting carriages, magnets, rams, crane arms or booms, load stabilizers, scoops, buckets, and dumping bins, attached to the load end for handling lifts as single or multiple units.

- As applied to cranes, means various attachments applied to the basic machine for the performance of functions such as lifting, clamshell or magnet services.

"Fumigant" is a substance or mixture of substances, used to kill pests or prevent infestation, which is a gas or is rapidly or progressively transformed to the gaseous state even though some nongaseous or particulate matter may remain and be dispersed in the treatment space.

"Hazardous cargo, material, substance or atmosphere" means:

- Any substance listed in chapters 296-62 and 296-841 WAC;
- Any material in the hazardous materials table and hazardous materials communications regulations of the Department of Transportation, 49 CFR Part 172;

- Any article not properly described by a name in the hazardous materials table and hazardous materials communications regulations of the Department of Transportation, 49 CFR Part 172, but which is properly classified under the definition of those categories of dangerous articles given in 49 CFR Part 173;

- Atmospheres having concentrations of airborne chemicals in excess of permissible exposure limits as defined in chapter 296-62 WAC; or

- Any atmosphere with an oxygen content of less than nineteen and one-half percent by volume.

"House falls" means spans and supporting members, winches, blocks, and standing and running rigging forming part of a marine terminal and used with a vessel's cargo gear to load or unload by means of married falls.

"Inspection," as applied to material handling devices required to be certified by this chapter, includes a complete visual examination of all visible parts of the device.

"Intermodal container" means a reusable cargo container of rigid construction and rectangular configuration intended to

contain one or more articles of cargo or bulk commodities for transportation by water and one or more other transport modes without intermediate cargo handling. The term includes completely enclosed units, open top units, fractional height units, units incorporating liquid or gas tanks and other variations fitting into the container system, demountable or with attached wheels. It does not include cylinders, drums, crates, cases, cartons, packages, sacks, unitized loads or any other form of packaging.

"Loose gear" means removable or replaceable components of equipment or devices which may be used with or as a part of assembled material handling units for purposes such as making connections, changing line direction and multiplying mechanical advantage. Examples include shackles and snatch blocks.

"Marina" means a small harbor or boat basin providing dockage, supplies, and services for small craft.

"Marine terminal" means wharves, bulkheads, quays, piers, docks and other berthing locations and adjacent storage or contiguous areas and structures associated with the primary movement of cargo or materials from vessel to shore or shore to vessel. It includes structures which are devoted to receiving, handling, holding, consolidation, loading or delivery of waterborne shipments and passengers, and areas devoted to the maintenance of the terminal or equipment. The term does not include production or manufacturing areas having their own docking facilities and located at a marine terminal nor storage facilities directly associated with those production or manufacturing areas.

"Permit-required confined space (permit space)" means a confined space that has one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere;
- Contains a material that has the potential for engulfing an entrant;
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
- Contains any other recognized serious safety or health hazard.

"Ramps" mean other flat-surface devices for passage between levels and across openings not covered under "dockboards."

"Ship's stores" means materials that are aboard a vessel for the upkeep, maintenance, safety, operation, or navigation of the vessel, or for the safety or comfort of the vessel's passengers or crew.

**WAC 296-56-60229 Sanitation.** (1) Washing and toilet facilities.

(a) The employer shall provide accessible washing and toilet facilities sufficient for the sanitary requirements of employees. The facilities shall have:

(i) Running water, including hot and cold or tepid water (when cargo handling is conducted at locations without permanent facilities, containers of potable water may be provided in lieu of running water);

(ii) Soap;

(iii) Individual hand towels, clean individual sections of continuous toweling or ((warm)) air blowers; and

(iv) Fixed or portable toilets in separate compartments with latch-equipped doors.

(b) Separate toilet facilities shall be provided for male and female employees except when toilet rooms are occupied by only one person at a time. A means of locking shall be provided.

(c) Washing and toilet facilities shall be regularly cleaned and maintained in good order.

(2) Drinking water.

(a) Potable drinking water shall be accessible to employees at all times.

(b) Potable drinking water containers shall be clean, containing only water and ice, and shall be fitted with covers.

(c) Common drinking cups are prohibited.

(3) Prohibited eating areas. Consumption of food or beverages in areas where hazardous materials are being stored or handled shall be prohibited.

(4) Garbage and overboard discharges. Work shall not be conducted in the immediate vicinity of uncovered garbage or in the area of overboard discharges from the vessel's sanitary lines unless employees are protected from the garbage or discharge by a baffle or splash boards.

AMENDATORY SECTION (Amending WSR 09-15-145, filed 7/21/09, effective 9/1/09)

**WAC 296-62-07306 Requirements for areas containing carcinogens listed in WAC 296-62-07302.** (1) A regulated area shall be established by an employer where listed carcinogens are manufactured, processed, used, repackaged, released, handled or stored.

(2) All such areas shall be controlled in accordance with the requirements for the following category or categories describing the operation involved:

(a) Isolated systems. Employees working with carcinogens within an isolated system such as a "glove box" shall wash their hands and arms upon completion of the assigned task and before engaging in other activities not associated with the isolated system.

(b) Closed system operation. Within regulated areas where carcinogens are stored in sealed containers, or contained in a closed system including piping systems with any sample ports or openings closed while carcinogens are contained within:

(i) Access shall be restricted to authorized employees only;

(ii) Employees shall be required to wash hands, forearms, face and neck upon each exit from the regulated areas, close to the point of exit and before engaging in other activities.

(c) Open vessel system operations. Open vessel system operations as defined in WAC 296-62-07304(12) are prohibited.

(d) Transfer from a closed system. Charging or discharging point operations, or otherwise opening a closed system. In operations involving "laboratory-type hoods," or in locations where a carcinogen is contained in an otherwise "closed system," but is transferred, charged, or discharged into other normally closed containers, the provisions of this section shall apply.

(i) Access shall be restricted to authorized employees only;

(ii) Each operation shall be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated. Clean makeup air shall be introduced in sufficient volume to maintain the correct operation of the local exhaust system.

(iii) Employees shall be provided with, and required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area.

(iv) Each employee engaged in handling operations involving the following carcinogens must be provided with and required to wear and use a (~~full-face, supplied-air respirator, of the~~

~~continuous flow or pressure-demand type as required in chapter 296-842 WAC:))~~ NIOSH-certified self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any supplied air respirator that has a full facepiece and is operated in a pressure-demand or other positive pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus as required in chapter 296-842 WAC. A respirator affording higher levels of protection than this respirator may be substituted.

- Methyl Chloromethyl Ether;
- bis-Chloromethyl Ether;
- Ethylenimine;
- beta-Propiolactone;
- 4-Amino Diphenyl.

(v) Each employee((s)) engaged in handling operations involving((t)) the following carcinogens must be provided with, and required to wear and use, NIOSH-certified air-purifying, half-mask respirator with particulate filters as required in chapter 296-842 WAC. A respirator affording higher levels of protection than this respirator may be substituted.

- 4-Nitrobiphenyl;
- alpha-Naphthylamine;
- 4-4'Methylene bis(2-Chloroaniline);
- 3-3'Dichlorobenzidine (and its salts);
- beta-Naphthylamine;
- Benzidine;
- 2-acetylamino fluorene;
- ((4-dimethylaminobenzene))  
4-imethylaminoazobenzene;
- n-nitrosodimethylamine.

must be provided with, and required to wear and use, a half-face, filter-type respirator certified for solid or liquid particulates with minimum efficiency rating of 95% as required in chapter 296-842 WAC. A respirator affording higher levels of protection than this respirator may be substituted.

(vi) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under WAC 296-62-07310 (2), (3) and (4).

(vii) Employees shall be required to wash hands, forearms, face and neck on each exit from the regulated area, close to the point of exit, and before engaging in other activities.

(viii) Employees shall be required to shower after the last exit of the day.

(ix) Drinking fountains are prohibited in the regulated area.

(e) Maintenance and decontamination activities. In clean up

of leaks or spills, maintenance or repair operations on contaminated systems or equipment, or any operations involving work in an area where direct contact with carcinogens could result, each authorized employee entering the area shall:

(i) Be provided with and required to wear, clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with WAC 296-800-160, and respiratory protective equipment required by this chapter 296-842 WAC;

(ii) Be decontaminated before removing the protective garments and hood;

(iii) Be required to shower upon removing the protective garments and hood.

(f) Laboratory activities. The requirements of this subdivision shall apply to research and quality control activities involving the use of carcinogens listed in WAC 296-62-07302.

(i) Mechanical pipetting aids shall be used for all pipetting procedures.

(ii) Experiments, procedures and equipment which could produce aerosols shall be confined to laboratory-type hoods or glove boxes.

(iii) Surfaces on which carcinogens are handled shall be protected from contamination.

(iv) Contaminated wastes and animal carcasses shall be collected in impervious containers which are closed and decontaminated prior to removal from the work area. Such wastes and carcasses shall be incinerated in such a manner that no carcinogenic products are released.

(v) All other forms of listed carcinogens shall be inactivated prior to disposal.

(vi) Laboratory vacuum systems shall be protected with high efficiency scrubbers or with disposable absolute filters.

(vii) Employees engaged in animal support activities shall be:

(A) Provided with, and required to wear, a complete protective clothing change, clean each day, including coveralls or pants and shirt, foot covers, head covers, gloves, and appropriate respiratory protective equipment or devices; and

(B) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified as required under WAC 296-62-07310 (2), (3) and (4).

(C) Required to wash hands, forearms, face and neck upon each exit from the regulated area close to the point of exit, and before engaging in other activities; and

(D) Required to shower after the last exit of the day.

(viii) Employees, other than those engaged only in animal support activities, each day shall be:

(A) Provided with and required to wear a clean change of appropriate laboratory clothing, such as a solid front gown, surgical scrub suit, or fully buttoned laboratory coat.

(B) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment

at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified as required under WAC 296-62-07310 (2), (3) and (4).

(C) Required to wash hands, forearms, face and neck upon each exit from the regulated area close to the point of exit, and before engaging in other activities.

(ix) Air pressure in laboratory areas and animal rooms where carcinogens are handled and bioassay studies are performed shall be negative in relation to the pressure in surrounding areas. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated.

(x) There shall be no connection between regulated areas and any other areas through the ventilation system.

(xi) A current inventory of the carcinogens shall be maintained.

(xii) Ventilated apparatus such as laboratory-type hoods, shall be tested at least semi-annually or immediately after ventilation modification or maintenance operations, by personnel fully qualified to certify correct containment and operation.

AMENDATORY SECTION (Amending WSR 04-10-026, filed 4/27/04, effective 8/1/04)

**WAC 296-62-07314 Medical surveillance.** (1) At no cost to the employee, a program of medical surveillance must be established and implemented for employees considered for assignment to enter regulated areas, and for authorized employees.

(2) Examinations.

(a) Before an employee is assigned to enter a regulated area, a preassignment physical examination by a physician must be provided and must include a personal history of the employee and/or his/her family and occupational background, including genetic and environmental factors.

(i) Taking of employees' medical history and background history must be considered to be a routine part of standard medical practice.

(ii) This provision does not require "genetic testing" of any employee.

(iii) This provision does not require the exclusion of otherwise qualified employees from jobs on the basis of genetic factors.

(b) Authorized employees must be provided periodic physical examination, not less often than annually, following the preassignment examination.

(c) In all physical examinations, the examining physician must be requested to consider whether there exist conditions of increased risk, including reduced immunological competence,

pregnancy, cigarette smoking, and those undergoing treatment with steroids or cytotoxic agents.

(3) Records.

(a) Employers of employees examined pursuant to this subdivision must maintain complete and accurate records of all such medical examinations. Records must be maintained for the duration of the employee's employment. (~~Upon termination of the employee's employment, including retirement or death, or in the event that the employer ceases business without a successor, records, or notarized true copies thereof, must be forwarded by registered mail to the director.~~) The employer shall ensure that medical records are maintained and made available in accordance with chapter 296-802 WAC, Employee medical and exposure records.

(b) Records required by this section must be provided upon request to employees, designated representatives, and the director in accordance with chapter 296-802 WAC.

(c) Any employer who requests a physical examination of an employee or prospective employee as required by this section must obtain from the physician a statement of the employee's suitability for employment in the specific exposure.

AMENDATORY SECTION (Amending WSR 09-15-145, filed 7/21/09, effective 9/1/09)

**WAC 296-62-07329 Vinyl chloride.** (1) Scope and application.

(a) This section includes requirements for the control of employee exposure to vinyl chloride (chloroethene), Chemical Abstracts Service Registry No. 75014.

(b) This section applies to the manufacture, reaction, packaging, repackaging, storage, handling or use of vinyl chloride or polyvinyl chloride, but does not apply to the handling or use of fabricated products made of polyvinyl chloride.

(c) This section applies to the transportation of vinyl chloride or polyvinyl chloride except to the extent that the department of transportation may regulate the hazards covered by this section.

(2) Definitions.

(a) "Action level" means a concentration of vinyl chloride of 0.5 ppm averaged over an eight-hour work day.

(b) "Authorized person" means any person specifically authorized by the employer whose duties require him/her to enter a regulated area or any person entering such an area as a designated representative of employees for the purpose of exercising an opportunity to observe monitoring and measuring procedures.

(c) "Director" means the director of department of labor and industries or his/her designated representative.

(d) "Emergency" means any occurrence such as, but not limited to, equipment failure, or operation of a relief device which is likely to, or does, result in massive release of vinyl chloride.

(e) "Fabricated product" means a product made wholly or partly from polyvinyl chloride, and which does not require further processing at temperatures, and for times, sufficient to cause mass melting of the polyvinyl chloride resulting in the release of vinyl chloride.

(f) "Hazardous operation" means any operation, procedure, or activity where a release of either vinyl chloride liquid or gas might be expected as a consequence of the operation or because of an accident in the operation, which would result in an employee exposure in excess of the permissible exposure limit.

(g) "Polyvinyl chloride" means polyvinyl chloride homopolymer or copolymer before such is converted to a fabricated product.

(h) "Vinyl chloride" means vinyl chloride monomer.

(3) Permissible exposure limit.

(a) No employee may be exposed to vinyl chloride at concentrations greater than 1 ppm averaged over any 8-hour period, and

(b) No employee may be exposed to vinyl chloride at concentrations greater than 5 ppm averaged over any period not exceeding 15 minutes.

(c) No employee may be exposed to vinyl chloride by direct contact with liquid vinyl chloride.

(4) Monitoring.

(a) A program of initial monitoring and measurement shall be undertaken in each establishment to determine if there is any employee exposed, without regard to the use of respirators, in excess of the action level.

(b) Where a determination conducted under subdivision (a) of this subsection shows any employee exposures without regard to the use of respirators, in excess of the action level, a program for determining exposures for each such employee shall be established. Such a program:

(i) Shall be repeated at least monthly where any employee is exposed, without regard to the use of respirators, in excess of the permissible exposure limit.

(ii) Shall be repeated not less than quarterly where any employee is exposed, without regard to the use of respirators, in excess of the action level.

(iii) May be discontinued for any employee only when at least two consecutive monitoring determinations, made not less than five working days apart, show exposures for that employee at or below the action level.

(c) Whenever there has been a production, process or control change which may result in an increase in the release of vinyl chloride, or the employer has any other reason to suspect that any employee may be exposed in excess of the action level, a determination of employee exposure under subdivision (a) of this subsection shall be performed.

(d) The method of monitoring and measurement shall have an accuracy (with a confidence level of 95 percent) of not less than plus or minus fifty percent from 0.25 through 0.5 ppm, plus or minus thirty-five percent from over 0.5 ppm through 1.0 ppm, plus or minus twenty-five percent over 1.0 ppm, (methods meeting these

accuracy requirements are available from the director).

(e) Employees or their designated representatives shall be afforded reasonable opportunity to observe the monitoring and measuring required by this subsection.

(5) Regulated area.

(a) A regulated area shall be established where:

(i) Vinyl chloride or polyvinyl chloride is manufactured, reacted, repackaged, stored, handled or used; and

(ii) Vinyl chloride concentrations are in excess of the permissible exposure limit.

(b) Access to regulated areas shall be limited to authorized persons.

(6) Methods of compliance. Employee exposures to vinyl chloride shall be controlled to at or below the permissible exposure limit provided in subsection (3) of this section by engineering, work practice, and personal protective controls as follows:

(a) Feasible engineering and work practice controls shall immediately be used to reduce exposures to at or below the permissible exposure limit.

(b) Wherever feasible engineering and work practice controls which can be instituted immediately are not sufficient to reduce exposures to at or below the permissible exposure limit, they shall nonetheless be used to reduce exposures to the lowest practicable level, and shall be supplemented by respiratory protection in accordance with subsection (7) of this section. A program shall be established and implemented to reduce exposures to at or below the permissible exposure limit, or to the greatest extent feasible, solely by means of engineering and work practice controls, as soon as feasible.

(c) Written plans for such a program shall be developed and furnished upon request for examination and copying to the director. Such plans shall be updated at least every six months.

(7) Respiratory protection.

(a) General. For employees who use respirators required by this section, the employer must provide each employee an appropriate respirator that complies with the requirements of this section.

(b) Respirator program. The employer must develop, implement, and maintain a respiratory protection program as required in chapter 296-842 WAC, Respirators, which covers each employee required by this chapter to use a respirator. Exception: The requirements in WAC 296-842-13005 that address change out of vapor or gas respirator cartridges or canisters.

(c) Respirator selection. The employer must:

(i) Select and provide to employees appropriate respirators as specified in this section and WAC 296-842-13005 in the respirator rule.

(ii) Provide organic vapor cartridges that have a service life of at least one hour when employees use air-purifying respirators in vinyl chloride concentrations up to 10 parts per million (ppm).

(iii) Make sure the following respirators, when selected, are equipped with a canister with a service life of at least four hours

when used in vinyl chloride concentrations up to 25 ppm:

(A) Helmet, hood, or full-facepiece PAPRs

OR

(B) Gas masks with a front- or back-mounted canister.

(d) Where air-purifying respirators are used:

(i) Air-purifying canisters or cartridges must be replaced prior to the expiration of their service life or the end of the shift in which they are first used, whichever occurs first, and

(ii) A continuous monitoring and alarm system must be provided when concentrations of vinyl chloride could reasonably exceed the allowable concentrations for the devices in use. Such system shall be used to alert employees when vinyl chloride concentrations exceed the allowable concentrations for the devices in use, and

(iii) Respirators specified for higher concentrations may be used for lower concentration.

(8) Hazardous operations.

(a) Employees engaged in hazardous operations, including entry of vessels to clean polyvinyl chloride residue from vessel walls, shall be provided and required to wear and use;

(i) Respiratory protection in accordance with subsections (3) and (7) of this section; and

(ii) Protective garments to prevent skin contact with liquid vinyl chloride or with polyvinyl chloride residue from vessel walls. The protective garments shall be selected for the operation and its possible exposure conditions.

(b) Protective garments shall be provided clean and dry for each use.

(c) Emergency situations. A written operational plan for emergency situations shall be developed for each facility storing, handling, or otherwise using vinyl chloride as a liquid or compressed gas. Appropriate portions of the plan shall be implemented in the event of an emergency. The plan shall specifically provide that:

(i) Employees engaged in hazardous operations or correcting situations of existing hazardous releases shall be equipped as required in subdivisions (a) and (b) of this subsection;

(ii) Other employees not so equipped shall evacuate the area and not return until conditions are controlled by the methods required in subsection (6) of this section and the emergency is abated.

(9) Training. Each employee engaged in vinyl chloride or polyvinyl chloride operations shall be provided training in a program relating to the hazards of vinyl chloride and precautions for its safe use.

(a) The program shall include:

(i) The nature of the health hazard from chronic exposure to vinyl chloride including specifically the carcinogenic hazard;

(ii) The specific nature of operations which could result in exposure to vinyl chloride in excess of the permissible limit and necessary protective steps;

(iii) The purpose for, proper use, and limitations of respiratory protective devices;

(iv) The fire hazard and acute toxicity of vinyl chloride, and

the necessary protective steps;

(v) The purpose for and a description of the monitoring program;

(vi) The purpose for and a description of, the medical surveillance program;

(vii) Emergency procedures:

(A) Specific information to aid the employee in recognition of conditions which may result in the release of vinyl chloride; and

(B) A review of this standard at the employee's first training and indoctrination program, and annually thereafter.

(b) All materials relating to the program shall be provided upon request to the director.

(10) Medical surveillance. A program of medical surveillance shall be instituted for each employee exposed, without regard to the use of respirators, to vinyl chloride in excess of the action level. The program shall provide each such employee with an opportunity for examinations and tests in accordance with this subsection. All medical examinations and procedures shall be performed by or under the supervision of a licensed physician and shall be provided without cost to the employee.

(a) At the time of initial assignment, or upon institution of medical surveillance;

(i) A general physical examination shall be performed with specific attention to detecting enlargement of liver, spleen or kidneys, or dysfunction in these organs, and for abnormalities in skin, connective tissues and the pulmonary system (see Appendix A).

(ii) A medical history shall be taken, including the following topics:

(A) Alcohol intake,

(B) Past history of hepatitis,

(C) Work history and past exposure to potential hepatotoxic agents, including drugs and chemicals,

(D) Past history of blood transfusions, and

(E) Past history of hospitalizations.

(iii) A serum specimen shall be obtained and determinations made of:

(A) Total bilirubin,

(B) Alkaline phosphatase,

(C) Serum glutamic oxalacetic transaminase (SGOT),

(D) Serum glutamic pyruvic transaminase (SGPT), and

(E) Gamma glutamyl transpeptidase.

(b) Examinations provided in accordance with this subdivision shall be performed at least:

(i) Every six months for each employee who has been employed in vinyl chloride or polyvinyl chloride manufacturing for ten years or longer; and

(ii) Annually for all other employees.

(c) Each employee exposed to an emergency shall be afforded appropriate medical surveillance.

(d) A statement of each employee's suitability for continued exposure to vinyl chloride including use of protective equipment and respirators, shall be obtained from the examining physician promptly after any examination. A copy of the physician's

statement shall be provided each employee.

(e) If any employee's health would be materially impaired by continued exposure, such employee shall be withdrawn from possible contact with vinyl chloride.

(f) Laboratory analyses for all biological specimens included in medical examinations shall be performed in laboratories licensed under 42 CFR Part 74.

(g) If the examining physician determines that alternative medical examinations to those required by subdivision (a) of this subsection will provide at least equal assurance of detecting medical conditions pertinent to the exposure to vinyl chloride, the employer may accept such alternative examinations as meeting the requirements of subdivision (a) of this subsection, if the employer obtains a statement from the examining physician setting forth the alternative examinations and the rationale for substitution. This statement shall be available upon request for examination and copying to authorized representatives of the director.

(11) Signs and labels.

(a) Entrances to regulated areas shall be posted with legible signs bearing the legend:

CANCER-SUSPECT AGENT AREA AUTHORIZED PERSONNEL ONLY

(b) Areas containing hazardous operations or where an emergency currently exists shall be posted with legible signs bearing the legend:

CANCER-SUSPECT AGENT IN THIS AREA PROTECTIVE EQUIPMENT REQUIRED AUTHORIZED PERSONNEL ONLY

(c) Containers of polyvinyl chloride resin waste from reactors or other waste contaminated with vinyl chloride shall be legibly labeled:

CONTAMINATED WITH VINYL CHLORIDE CANCER-SUSPECT AGENT

(d) Containers of polyvinyl chloride shall be legibly labeled:

POLYVINYL CHLORIDE (OR TRADE NAME) CONTAINS VINYL CHLORIDE VINYL CHLORIDE IS A CANCER-SUSPECT AGENT

(e) Containers of vinyl chloride shall be legibly labeled either:

VINYL CHLORIDE EXTREMELY FLAMMABLE GAS UNDER PRESSURE CANCER-SUSPECT AGENT

(or) (f) In accordance with 49 CFR Part 173, Subpart H, with the additional legends:

CANCER-SUSPECT AGENT

Applied near the label or placard.

(g) No statement shall appear on or near any required sign, label or instruction which contradicts or detracts from the effect of any required warning, information or instruction.

(12) Records.

(a) All records maintained in accordance with this section shall include the name and Social Security number of each employee

where relevant.

(b) Records of required monitoring and measuring and medical records shall be provided upon request to employees, designated representatives, and the director in accordance with chapter 296-802 WAC. These records shall be provided upon request to the director. Authorized personnel rosters shall also be provided upon request to the director.

(i) Monitoring and measuring records shall:

(A) State the date of such monitoring and measuring and the concentrations determined and identify the instruments and methods used;

(B) Include any additional information necessary to determine individual employee exposures where such exposures are determined by means other than individual monitoring of employees; and

(C) Be maintained for not less than 30 years.

(ii) Medical records shall be maintained for the duration of the employment of each employee plus 20 years, or 30 years, whichever is longer.

(c) ~~((In the event that the employer ceases to do business and there is no successor to receive and retain his/her records for the prescribed period, these records shall be transmitted by registered mail to the director, and each employee individually notified in writing of this transfer.))~~ The employer shall ~~((also))~~ comply with any additional requirements set forth in chapter 296-802 WAC.

(d) Employees or their designated representatives shall be provided access to examine and copy records of required monitoring and measuring.

(e) Former employees shall be provided access to examine and copy required monitoring and measuring records reflecting their own exposures.

(f) Upon written request of any employee, a copy of the medical record of that employee shall be furnished to any physician designated by the employee.

(13) Reports.

(a) Not later than 1 month after the establishment of a regulated area, the following information shall be reported to the director. Any changes to such information shall be reported within fifteen days.

(i) The address and location of each establishment which has one or more regulated areas; and

(ii) The number of employees in each regulated area during normal operations, including maintenance.

(b) Emergencies and the facts obtainable at that time, shall be reported within twenty-four hours to the director. Upon request of the director, the employer shall submit additional information in writing relevant to the nature and extent of employee exposures and measures taken to prevent future emergencies of similar nature.

(c) Within ten working days following any monitoring and measuring which discloses that any employee has been exposed, without regard to the use of respirators, in excess of the permissible exposure limit, each such employee shall be notified in writing of the results of the exposure measurement and the steps being taken to reduce the exposure to within the permissible

exposure limit.

(14) Appendix A supplementary medical information.

When required tests under subsection (10)(a) of this section show abnormalities, the tests should be repeated as soon as practicable, preferably within three to four weeks. If tests remain abnormal, consideration should be given to withdrawal of the employee from contact with vinyl chloride, while a more comprehensive examination is made.

Additional tests which may be useful:

~~((A))~~ (a) For kidney dysfunction: Urine examination for albumin, red blood cells, and exfoliative abnormal cells.

~~((B))~~ (b) Pulmonary system: Forced vital capacity, forced expiratory volume at one second, and chest roentgenogram (posterior-anterior, 14 x 17 inches).

~~((C))~~ (c) Additional serum tests: Lactic acid dehydrogenase, lactic acid dehydrogenase isoenzyme, protein determination, and protein electrophoresis.

~~((D))~~ (d) For a more comprehensive examination on repeated abnormal serum tests: Hepatitis B antigen, and liver scanning.

AMENDATORY SECTION (Amending WSR 09-15-145, filed 7/21/09, effective 9/1/09)

**WAC 296-62-07336 Acrylonitrile.** (1) Scope and application.

(a) This section applies to all occupational exposure to acrylonitrile (AN), Chemical Abstracts Service Registry No. 000107131, except as provided in (b) and (c) of this subsection.

(b) This section does not apply to exposures which result solely from the processing, use, and handling of the following materials:

(i) ABS resins, SAN resins, nitrile barrier resins, solid nitrile elastomers, and acrylic and modacrylic fibers, when these listed materials are in the form of finished polymers, and products fabricated from such finished polymers;

(ii) Materials made from and/or containing AN for which objective data is reasonably relied upon to demonstrate that the material is not capable of releasing AN in airborne concentrations in excess of 1 ppm as an eight-hour time-weighted average, under the expected conditions of processing, use, and handling which will cause the greatest possible release; and

(iii) Solid materials made from and/or containing AN which will not be heated above 170°F during handling, use, or processing.

(c) An employer relying upon exemption under (1)(b)(ii) shall maintain records of the objective data supporting that exemption, and of the basis of the employer's reliance on the data as provided in subsection (17) of this section.

(2) Definitions, as applicable to this section:

(a) "Acrylonitrile" or "AN" - Acrylonitrile monomer, chemical formula CH<sub>2</sub>=CHCN.

(b) "Action level" - A concentration of AN of 1 ppm as an eight-hour time-weighted average.

(c) "Authorized person" - Any person specifically authorized by the employer whose duties require the person to enter a regulated area, or any person entering such an area as a designated representative of employees for the purpose of exercising the opportunity to observe monitoring procedures under subsection (18) of this section.

(d) "Decontamination" means treatment of materials and surfaces by water washdown, ventilation, or other means, to assure that the materials will not expose employees to airborne concentrations of AN above 1 ppm as an eight-hour time-weighted average.

(e) "Director" - The director of labor and industries, or his authorized representative.

(f) "Emergency" - Any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment, which is likely to, or does, result in unexpected exposure to AN in excess of the ceiling limit.

(g) "Liquid AN" means AN monomer in liquid form, and liquid or semiliquid polymer intermediates, including slurries, suspensions, emulsions, and solutions, produced during the polymerization of AN.

(h) "Polyacrylonitrile" or "PAN" - Polyacrylonitrile homopolymers or copolymers, except for materials as exempted under subsection (1)(b) of this section.

(3) Permissible exposure limits.

(a) Inhalation.

(i) Time-weighted average limit (TWA). The employer shall assure that no employee is exposed to an airborne concentration of acrylonitrile in excess of two parts acrylonitrile per million parts of air (2 ppm), as an eight-hour time-weighted average.

(ii) Ceiling limit. The employer shall assure that no employee is exposed to an airborne concentration of acrylonitrile in excess of 10 ppm as averaged over any fifteen-minute period during the working day.

(b) Dermal and eye exposure. The employer shall assure that no employee is exposed to skin contact or eye contact with liquid AN or PAN.

(4) Notification of use and emergencies.

(a) Use. Within ten days of the effective date of this standard, or within fifteen days following the introduction of AN into the workplace, every employer shall report, unless he has done so pursuant to the emergency temporary standard, the following information to the director for each such workplace:

(i) The address and location of each workplace in which AN is present;

(ii) A brief description of each process of operation which may result in employee exposure to AN;

(iii) The number of employees engaged in each process or operation who may be exposed to AN and an estimate of the frequency and degree of exposure that occurs; and

(iv) A brief description of the employer's safety and health program as it relates to limitation of employee exposure to AN.

Whenever there has been a significant change in the information required by this subsection, the employer shall promptly amend such information previously provided to the director.

(b) Emergencies and remedial action. Emergencies, and the facts obtainable at that time, shall be reported within twenty-four hours of the initial occurrence to the director. Upon request of the director, the employer shall submit additional information in writing relevant to the nature and extent of employee exposures and measures taken to prevent future emergencies of a similar nature.

(5) Exposure monitoring.

(a) General.

(i) Determinations of airborne exposure levels shall be made from air samples that are representative of each employee's exposure to AN over an eight-hour period.

(ii) For the purposes of this section, employee exposure is that which would occur if the employee were not using a respirator.

(b) Initial monitoring. Each employer who has a place of employment in which AN is present shall monitor each such workplace and work operation to accurately determine the airborne concentrations of AN to which employees may be exposed. Such monitoring may be done on a representative basis, provided that the employer can demonstrate that the determinations are representative of employee exposures.

(c) Frequency.

(i) If the monitoring required by this section reveals employee exposure to be below the action level, the employer may discontinue monitoring for that employee. The employer shall continue these quarterly measurements until at least two consecutive measurements taken at least seven days apart, are below the action level, and thereafter the employer may discontinue monitoring for that employee.

(ii) If the monitoring required by this section reveals employee exposure to be at or above the action level but below the permissible exposure limits, the employer shall repeat such monitoring for each such employee at least quarterly.

(iii) If the monitoring required by this section reveals employee exposure to be in excess of the permissible exposure limits, the employer shall repeat these determinations for each such employee at least monthly. The employer shall continue these monthly measurements until at least two consecutive measurements, taken at least seven days apart, are below the permissible exposure limits, and thereafter the employer shall monitor at least quarterly.

(d) Additional monitoring. Whenever there has been a production, process, control or personnel change which may result in new or additional exposure to AN, or whenever the employer has any other reason to suspect a change which may result in new or additional exposures to AN, additional monitoring which complies with this subsection shall be conducted.

(e) Employee notification.

(i) Within five working days after the receipt of monitoring results, the employer shall notify each employee in writing of the results which represent that employee's exposure.

(ii) Whenever the results indicate that the representative employee exposure exceeds the permissible exposure limits, the employer shall include in the written notice a statement that the permissible exposure limits were exceeded and a description of the corrective action being taken to reduce exposure to or below the permissible exposure limits.

(f) Accuracy of measurement. The method of measurement of employee exposures shall be accurate, to a confidence level of ninety-five percent, to within plus or minus twenty-five percent for concentrations of AN at or above the permissible exposure limits, and plus or minus thirty-five percent for concentrations of AN between the action level and the permissible exposure limits.

(g) Weekly survey of operations involving liquid AN. In addition to monitoring of employee exposures to AN as otherwise required by this subsection, the employer shall survey areas of operations involving liquid AN at least weekly to detect points where AN liquid or vapor are being released into the workplace. The survey shall employ an infra-red gas analyzer calibrated for AN, a multipoint gas chromatographic monitor, or comparable system for detection of AN. A listing of levels detected and areas of AN release, as determined from the survey, shall be posted prominently in the workplace, and shall remain posted until the next survey is completed.

(6) Regulated areas.

(a) The employer shall establish regulated areas where AN concentrations are in excess of the permissible exposure limits.

(b) Regulated areas shall be demarcated and segregated from the rest of the workplace, in any manner that minimizes the number of persons who will be exposed to AN.

(c) Access to regulated areas shall be limited to authorized persons or to persons otherwise authorized by the act or regulations issued pursuant thereto.

(d) The employer shall assure that in the regulated area, food or beverages are not present or consumed, smoking products are not present or used, and cosmetics are not applied, (except that these activities may be conducted in the lunchrooms, change rooms and showers required under subsection((~~s~~)) (13)(a) (~~((13))~~)) through (c) of this section.

(7) Methods of compliance.

(a) Engineering and work practice controls.

(i) The employer shall institute engineering or work practice controls to reduce and maintain employee exposures to AN, to or below the permissible exposure limits, except to the extent that the employer establishes that such controls are not feasible.

(ii) Wherever the engineering and work practice controls which can be instituted are not sufficient to reduce employee exposures to or below the permissible exposure limits, the employer shall nonetheless use them to reduce exposures to the lowest levels achievable by these controls and shall supplement them by the use of respiratory protection which complies with the requirements of subsection (8) of this section.

(b) Compliance program.

(i) The employer shall establish and implement a written

program to reduce employee exposures to or below the permissible exposure limits solely by means of engineering and work practice controls, as required by subsection (7)(a) of this section.

(ii) Written plans for these compliance programs shall include at least the following:

(A) A description of each operation or process resulting in employee exposure to AN above the permissible exposure limits;

(B) Engineering plans and other studies used to determine the controls for each process;

(C) A report of the technology considered in meeting the permissible exposure limits;

(D) A detailed schedule for the implementation of engineering or work practice controls; and

(E) Other relevant information.

(iii) The employer shall complete the steps set forth in the compliance program by the dates in the schedule.

(iv) Written plans for such a program shall be submitted upon request to the director, and shall be available at the worksite for examination and copying by the director, or any affected employee or representative.

(v) The plans required by this subsection shall be revised and updated at least every six months to reflect the current status of the program.

(8) Respiratory protection.

(a) General. For employees who use respirators required by this section, the employer must provide each employee an appropriate respirator that complies with the requirements of this subsection. Respirators must be used during:

(i) Periods necessary to install or implement feasible engineering and work-practice controls;

(ii) Work operations, such as maintenance and repair activities or reactor cleaning, for which the employer establishes that engineering and work-practice controls are not feasible;

(iii) Work operations for which feasible engineering and work-practice controls are not yet sufficient to reduce employee exposure to or below the permissible exposure limits;

(iv) In emergencies.

(b) Respirator program.

Employers must develop, implement and maintain a respiratory protection program in accordance with chapter 296-842 WAC, Respirators, which covers each employee required by this chapter to use a respirator.

(c) Respirator selection. The employer must:

(i) Select and provide to employees appropriate respirators by following the requirements in this section and WAC 296-842-13005 in the respirator rule.

(ii) Provide to employees, for escape, any organic vapor, air-purifying respirator or any self-contained breathing apparatus (SCBA) that meets the selection requirements of WAC 296-842-13005 in the respirator rule.

(9) Emergency situations.

(a) Written plans.

(i) A written plan for emergency situations shall be developed

for each workplace where AN is present. Appropriate portions of the plan shall be implemented in the event of an emergency.

(ii) The plan shall specifically provide that employees engaged in correcting emergency conditions shall be equipped as required in subsection (8) of this section until the emergency is abated.

(b) Alerting employees.

(i) Where there is the possibility of employee exposure to AN in excess of the ceiling limit due to the occurrence of an emergency, a general alarm shall be installed and maintained to promptly alert employees of such occurrences.

(ii) Employees not engaged in correcting the emergency shall be evacuated from the area and shall not be permitted to return until the emergency is abated.

(10) Protective clothing and equipment.

(a) Provision and use. Where eye or skin contact with liquid AN or PAN may occur, the employer shall provide at no cost to the employee, and assure that employees wear, appropriate protective clothing or other equipment in accordance with WAC 296-800-160 to protect any area of the body which may come in contact with liquid AN or PAN.

(b) Cleaning and replacement.

(i) The employer shall clean, launder, maintain, or replace protective clothing and equipment required by this subsection, as needed to maintain their effectiveness. In addition, the employer shall provide clean protective clothing and equipment at least weekly to each affected employee.

(ii) The employer shall assure that impermeable protective clothing which contacts or is likely to have contacted liquid AN shall be decontaminated before being removed by the employee.

(iii) The employer shall assure that AN- or PAN-contaminated protective clothing and equipment is placed and stored in closable containers which prevent dispersion of the AN or PAN outside the container.

(iv) The employer shall assure that an employee whose nonimpermeable clothing becomes wetted with liquid AN shall immediately remove that clothing and proceed to shower. The clothing shall be decontaminated before it is removed from the regulated area.

(v) The employer shall assure that no employee removes AN- or PAN-contaminated protective equipment or clothing from the change room, except for those employees authorized to do so for the purpose of laundering, maintenance, or disposal.

(vi) The employer shall inform any person who launders or cleans AN- or PAN-contaminated protective clothing or equipment of the potentially harmful effects of exposure to AN.

(vii) The employer shall assure that containers of contaminated protective clothing and equipment which are to be removed from the workplace for any reason are labeled in accordance with subsection (16)(c)(ii) of this section, and that such labels remain affixed when such containers leave the employer's workplace.

(11) Housekeeping.

(a) All surfaces shall be maintained free of accumulations of

liquid AN and of PAN.

(b) For operations involving liquid AN, the employer shall institute a program for detecting leaks and spills of liquid AN, including regular visual inspections.

(c) Where spills of liquid AN are detected, the employer shall assure that surfaces contacted by the liquid AN are decontaminated. Employees not engaged in decontamination activities shall leave the area of the spill, and shall not be permitted in the area until decontamination is completed.

(d) Liquids. Where AN is present in a liquid form, or as a resultant vapor, all containers or vessels containing AN shall be enclosed to the maximum extent feasible and tightly covered when not in use, with adequate provision made to avoid any resulting potential explosion hazard.

(e) Surfaces.

(i) Dry sweeping and the use of compressed air for the cleaning of floors and other surfaces where AN and PAN are found is prohibited.

(ii) Where vacuuming methods are selected, either portable units or a permanent system may be used.

(A) If a portable unit is selected, the exhaust shall be attached to the general workplace exhaust ventilation system or collected within the vacuum unit, equipped with high efficiency filters or other appropriate means of contaminant removal, so that AN is not reintroduced into the workplace air; and

(B) Portable vacuum units used to collect AN may not be used for other cleaning purposes and shall be labeled as prescribed by subsection (16)(c)(ii) of this section.

(iii) Cleaning of floors and other contaminated surfaces may not be performed by washing down with a hose, unless a fine spray has first been laid down.

(12) Waste disposal. AN and PAN waste, scrap, debris, bags, containers or equipment, shall be disposed of in sealed bags or other closed containers which prevent dispersion of AN outside the container, and labeled as prescribed in subsection (16)(c)(ii) of this section.

(13) Hygiene facilities and practices. Where employees are exposed to airborne concentrations of AN above the permissible exposure limits, or where employees are required to wear protective clothing or equipment pursuant to subsection (11) of this section, or where otherwise found to be appropriate, the facilities required by WAC 296-800-230 shall be provided by the employer for the use of those employees, and the employer shall assure that the employees use the facilities provided. In addition, the following facilities or requirements are mandated.

(a) Change rooms. The employer shall provide clean change rooms in accordance with WAC 296-800-230.

(b) Showers.

(i) The employer shall provide shower facilities in accordance with WAC 296-800-230.

(ii) In addition, the employer shall also assure that employees exposed to liquid AN and PAN shower at the end of the work shift.

(iii) The employer shall assure that, in the event of skin or eye exposure to liquid AN, the affected employee shall shower immediately to minimize the danger of skin absorption.

(c) Lunchrooms.

(i) Whenever food or beverages are consumed in the workplace, the employer shall provide lunchroom facilities which have a temperature controlled, positive pressure, filtered air supply, and which are readily accessible to employees exposed to AN above the permissible exposure limits.

(ii) In addition, the employer shall also assure that employees exposed to AN above the permissible exposure limits wash their hands and face prior to eating.

(14) Medical surveillance.

(a) General.

(i) The employer shall institute a program of medical surveillance for each employee who is or will be exposed to AN above the action level. The employer shall provide each such employee with an opportunity for medical examinations and tests in accordance with this subsection.

(ii) The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee.

(b) Initial examinations. At the time of initial assignment, or upon institution of the medical surveillance program, the employer shall provide each affected employee an opportunity for a medical examination, including at least the following elements:

(i) A work history and medical history with special attention to skin, respiratory, and gastrointestinal systems, and those nonspecific symptoms, such as headache, nausea, vomiting, dizziness, weakness, or other central nervous system dysfunctions that may be associated with acute or chronic exposure to AN.

(ii) A physical examination giving particular attention to central nervous system, gastrointestinal system, respiratory system, skin and thyroid.

(iii) A 14" x 17" posteroanterior chest X ray.

(iv) Further tests of the intestinal tract, including fecal occult blood screening, and proctosigmoidoscopy, for all workers forty years of age or older, and for any other affected employees for whom, in the opinion of the physician, such testing is appropriate.

(c) Periodic examinations.

(i) The employer shall provide examinations specified in this subsection at least annually for all employees specified in subsection (14)(a) of this section.

(ii) If an employee has not had the examinations prescribed in subsection (14)(b) of this section within six months of termination of employment, the employer shall make such examination available to the employee upon such termination.

(d) Additional examinations. If the employee for any reason develops signs or symptoms commonly associated with exposure to AN, the employer shall provide appropriate examination and emergency medical treatment.

(e) Information provided to the physician. The employer shall provide the following information to the examining physician:

(i) A copy of this standard and its appendices;

(ii) A description of the affected employee's duties as they relate to the employee's exposure;

(iii) The employee's representative exposure level;

(iv) The employee's anticipated or estimated exposure level (for preplacement examinations or in cases of exposure due to an emergency);

(v) A description of any personal protective equipment used or to be used; and

(vi) Information from previous medical examinations of the affected employee, which is not otherwise available to the examining physician.

(f) Physician's written opinion.

(i) The employer shall obtain a written opinion from the examining physician which shall include:

(A) The results of the medical examination and test performed;

(B) The physician's opinion as to whether the employee has any detected medical condition which would place the employee at an increased risk of material impairment of the employee's health from exposure to AN;

(C) Any recommended limitations upon the employee's exposure to AN or upon the use of protective clothing and equipment such as respirators; and

(D) A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.

(ii) The employer shall instruct the physician not to reveal in the written opinion specific findings or diagnoses unrelated to occupational exposure to AN.

(iii) The employer shall provide a copy of the written opinion to the affected employee.

(15) Employee information and training.

(a) Training program.

(i) The employer shall train each employee exposed to AN above the action level, each employee whose exposures are maintained below the action level by engineering and work practice controls, and each employee subject to potential skin or eye contact with liquid AN in accordance with the requirements of this section. The employer shall institute a training program and ensure employee participation in the training program.

(ii) The training program shall be provided at the time of initial assignment, or upon institution of the training program, and at least annually thereafter, and the employer shall assure that each employee is informed of the following:

(A) The information contained in Appendices A, B and C;

(B) The quantity, location, manner of use, release or storage of AN and the specific nature of operations which could result in exposure to AN, as well as any necessary protective steps;

(C) The purpose, proper use, and limitations of respirators and protective clothing;

(D) The purpose and a description of the medical surveillance

program required by subsection (14) of this section;

(E) The emergency procedures developed, as required by subsection (9) of this section; and

(F) The engineering and work practice controls, their function and the employee's relationship thereto; and

(G) A review of this standard.

(b) Access to training materials.

(i) The employer shall make a copy of this standard and its appendices readily available to all affected employees.

(ii) The employer shall provide, upon request, all materials relating to the employee information and training program to the director.

(16) Signs and labels.

(a) General.

(i) The employer may use labels or signs required by other statutes, regulations, or ordinances in addition to, or in combination with, signs and labels required by this subsection.

(ii) The employer shall assure that no statement appears on or near any sign or label, required by this subsection, which contradicts or detracts from such effects of the required sign or label.

(b) Signs.

(i) The employer shall post signs to clearly indicate all workplaces where AN concentrations exceed the permissible exposure limits. The signs shall bear the following legend:

DANGER  
ACRYLONITRILE (AN)  
CANCER HAZARD  
AUTHORIZED PERSONNEL ONLY  
RESPIRATORS REQUIRED

(ii) The employer shall assure that signs required by this subsection are illuminated and cleaned as necessary so that the legend is readily visible.

(c) Labels.

(i) The employer shall assure that precautionary labels are affixed to all containers of AN, and to containers of PAN and products fabricated from PAN, except for those materials for which objective data is provided as to the conditions specified in subsection (1)(b) of this section. The employer shall assure that the labels remain affixed when the AN or PAN are sold, distributed or otherwise leave the employer's workplace.

(ii) The employer shall assure that the precautionary labels required by this subsection are readily visible and legible. The labels shall bear the following legend:

DANGER  
CONTAINS ACRYLONITRILE (AN)  
CANCER HAZARD

(17) Recordkeeping.

(a) Objective data for exempted operations.

(i) Where the processing, use, and handling of products fabricated from PAN are exempted pursuant to subsection (1)(b) of

this section, the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

(ii) This record shall include the following information:

(A) The relevant condition in subsection (1)(b) upon which exemption is based;

(B) The source of the objective data;

(C) The testing protocol, results of testing, and/or analysis of the material for the release of AN;

(D) A description of the operation exempted and how the data supports the exemption; and

(E) Other data relevant to the operations, materials, and processing covered by the exemption.

(iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(b) Exposure monitoring.

(i) The employer shall establish and maintain an accurate record of all monitoring required by subsection (5) of this section.

(ii) This record shall include:

(A) The dates, number, duration, and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure;

(B) A description of the sampling and analytical methods used and the data relied upon to establish that the methods used meet the accuracy and precision requirements of subsection (5)(f) of this section;

(C) Type of respiratory protective devices worn, if any; and

(D) Name, Social Security number and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent.

(iii) The employer shall maintain this record for at least 40 years or the duration of employment plus 20 years, whichever is longer.

(c) Medical surveillance.

(i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance as required by subsection (14) of this section.

(ii) This record shall include:

(A) A copy of the physicians' written opinions;

(B) Any employee medical complaints related to exposure to AN;

(C) A copy of the information provided to the physician as required by subsection (14)(f) of this section; and

(D) A copy of the employee's medical and work history.

(iii) The employer shall assure that this record be maintained for at least forty years or for the duration of employment plus twenty years, whichever is longer.

(d) Availability.

(i) The employer shall assure that all records required to be maintained by this section be made available upon request to the director for examination and copying.

(ii) Records required by subdivisions (a) through (c) of this subsection shall be provided upon request to employees, designated

representatives, and the assistant director in accordance with chapter 296-802 WAC. Records required by subdivision (a) of this section shall be provided in the same manner as exposure monitoring records.

(iii) The employer shall assure that employee medical records required to be maintained by this section, be made available, upon request, for examination and copying, to the affected employee or former employee, or to a physician designated by the affected employee, former employee, or designated representative.

(e) Transfer of records.

(i) Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by this section.

~~(ii) ((Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, these records shall be transmitted to the director.~~

~~(iii) At the expiration of the retention period for the records required to be maintained pursuant to this section, the employer shall transmit these records to the director.~~

~~(iv))~~ The employer shall also comply with any additional requirements involving transfer of records set forth in ~~((chapter 296-802))~~ WAC 296-802-60005.

(18) Observation of monitoring.

(a) Employee observation. The employer shall provide affected employees, or their designated representatives, an opportunity to observe any monitoring of employee exposure to AN conducted pursuant to subsection (5) of this section.

(b) Observation procedures.

(i) Whenever observation of the monitoring of employee exposure to AN requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide the observer with personal protective clothing or equipment required to be worn by employees working in the area, assure the use of such clothing and equipment, and require the observer to comply with all other applicable safety and health procedures.

(ii) Without interfering with the monitoring, observers shall be entitled:

(A) To receive an explanation of the measurement procedures;

(B) To observe all steps related to the measurement of airborne concentrations of AN performed at the place of exposure; and

(C) To record the results obtained.

(19) Appendices. The information contained in the appendices is not intended, by itself, to create any additional obligation not otherwise imposed, or to detract from any obligation.

AMENDATORY SECTION (Amending WSR 09-15-145, filed 7/21/09, effective 9/1/09)

**WAC 296-62-07342 1,2-Dibromo-3-chloropropane.** (1) Scope and application.

(a) This section applies to occupational exposure to 1,2-dibromo-3-chloropropane (DBCP).

(b) This section does not apply to:

(i) Exposure to DBCP which results solely from the application and use of DBCP as a pesticide; or

(ii) The storage, transportation, distribution or sale of DBCP in intact containers sealed in such a manner as to prevent exposure to DBCP vapors or liquids, except for the requirements of subsections (11), (16) and (17) of this section.

(2) Definitions applicable to this section:

(a) "Authorized person" - Any person specifically authorized by the employer and whose duties require the person to be present in areas where DBCP is present; and any person entering this area as a designated representative of employees exercising an opportunity to observe employee exposure monitoring.

(b) "DBCP" - 1,2-dibromo-3-chloropropane, Chemical Abstracts Service Registry Number 96-12-8, and includes all forms of DBCP.

(c) "Director" - The director of labor and industries, or his authorized representative.

(d) "Emergency" - Any occurrence such as, but not limited to equipment failure, rupture of containers, or failure of control equipment which may, or does, result in unexpected release of DBCP.

(3) Permissible exposure limits.

(a) Inhalation.

(i) Time-weighted average limit (TWA). The employer shall assure that no employee is exposed to an airborne concentration in excess of one part DBCP per billion part of air (ppb) as an eight-hour time-weighted average.

(ii) Ceiling limit. The employer shall assure that no employee is exposed to an airborne concentration in excess of five parts DBCP per billion parts of air (ppb) as averaged over any fifteen minutes during the working day.

(b) Dermal and eye exposure. The employer shall assure that no employee is exposed to eye or skin contact with DBCP.

(4) Notification of use. Within ten days of the effective date of this section or within ten days following the introduction of DBCP into the workplace, every employer who has a workplace where DBCP is present shall report the following information to the director for each such workplace:

(a) The address and location of each workplace in which DBCP is present;

(b) A brief description of each process or operation which may result in employee exposure to DBCP;

(c) The number of employees engaged in each process or operation who may be exposed to DBCP and an estimate of the frequency and degree of exposure that occurs;

(d) A brief description of the employer's safety and health program as it relates to limitation of employee exposure to DBCP.

(5) Regulated areas. The employer shall establish, within each place of employment, regulated areas wherever DBCP concentrations are in excess of the permissible exposure limit.

(a) The employer shall limit access to regulated areas to authorized persons.

(b) All employees entering or working in a regulated area shall wear respiratory protection in accordance with Table I.

(6) Exposure monitoring.

(a) General. Determinations of airborne exposure levels shall be made from air samples that are representative of each employee's exposure to DBCP over an eight-hour period. (For the purposes of this section, employee exposure is that exposure which would occur if the employee were not using a respirator.)

(b) Initial. Each employer who has a place of employment in which DBCP is present shall monitor each workplace and work operation to accurately determine the airborne concentrations of DBCP to which employees may be exposed.

(c) Frequency.

(i) If the monitoring required by this section reveals employee exposures to be below the permissible exposure limits, the employer shall repeat these determinations at least quarterly.

(ii) If the monitoring required by this section reveals employee exposure to be in excess of the permissible exposure limits, the employer shall repeat these determinations for each such employee at least monthly. The employer shall continue these monthly determinations until at least two consecutive measurements, taken at least seven days apart, are below the permissible exposure limit, thereafter the employer shall monitor at least quarterly.

(d) Additional. Whenever there has been a production process, control or personnel change which may result in any new or additional exposure to DBCP, or whenever the employer has any other reason to suspect a change which may result in new or additional exposure to DBCP, additional monitoring which complies with subsection (6) shall be conducted.

(e) Employee notification.

(i) Within five working days after the receipt of monitoring results, the employer shall notify each employee in writing of results which represent the employee's exposure.

(ii) Whenever the results indicate that employee exposure exceeds the permissible exposure limit, the employer shall include in the written notice a statement that the permissible exposure limit was exceeded and a description of the corrective action being taken to reduce exposure to or below the permissible exposure limits.

(f) Accuracy of measurement. The method of measurement shall be accurate, to a confidence level of ninety-five percent, to within plus or minus twenty-five percent for concentrations of DBCP at or above the permissible exposure limits.

(7) Methods of compliance.

(a) Priority of compliance methods. The employer shall institute engineering and work practice controls to reduce and maintain employee exposures to DBCP at or below the permissible exposure limit, except to the extent that the employer establishes that such controls are not feasible. Where feasible engineering and work practice controls are not sufficient to reduce employee exposures to within the permissible exposure limit, the employer shall nonetheless use them to reduce exposures to the lowest level achievable by these controls, and shall supplement them by use of respiratory protection.

(b) Compliance program.

(i) The employer shall establish and implement a written program to reduce employee exposure to DBCP to or below the permissible exposure limit solely by means of engineering and work practice controls as required by this section.

(ii) The written program shall include a detailed schedule for development and implementation of the engineering and work practice controls. These plans shall be revised at least every six months to reflect the current status of the program.

(iii) Written plans for these compliance programs shall be submitted upon request to the director, and shall be available at the worksite for examination and copying by the director, and any affected employee or designated representative of employees.

(iv) The employer shall institute and maintain at least the controls described in his most recent written compliance program.

(8) Respiratory protection.

(a) General. For employees who are required to use respirators under this section, the employer must provide each employee an appropriate respirator that complies with the requirements of this subsection. Respirators must be used during:

(i) Period necessary to install or implement feasible engineering and work-practice controls;

(ii) Maintenance and repair activities for which engineering and work-practice controls are not feasible;

(iii) Work operations for which feasible engineering and work-practice controls are not yet sufficient to reduce employee exposure to or below the permissible exposure limit;

(iv) Emergencies.

(b) The employer must establish, implement, and maintain a respiratory protection program as required by chapter 296-842 WAC, Respirators, which covers each employee required by this chapter to use a respirator.

(c) Respirator selection. The employer must:

(i) Select and provide to employees appropriate respirators according to this chapter and WAC 296-842-13005 in the respirator rule.

(ii) Provide employees with one of the following respirator options to use for entry into, or escape from, unknown DBCP concentrations:

(A) A combination respirator that includes a full-facepiece air-line respirator operated in a pressure-demand or other positive-pressure mode or continuous-flow mode and an auxiliary

self-contained breathing apparatus (SCBA) operated in a pressure-demand or positive-pressure mode;

**OR**

(B) A full-facepiece SCBA operated in a pressure-demand or other positive-pressure mode.

(9) Reserved.

(10) Emergency situations.

(a) Written plans.

(i) A written plan for emergency situations shall be developed for each workplace in which DBCP is present.

(ii) Appropriate portions of the plan shall be implemented in the event of an emergency.

(b) Employees engaged in correcting conditions shall be equipped as required in subsection (11) of this section until the emergency is abated.

(c) Evacuation. Employees not engaged in correcting the emergency shall be removed and restricted from the area and normal operations in the affected area shall not be resumed until the emergency is abated.

(d) Alerting employees. Where there is a possibility of employee exposure to DBCP due to the occurrence of an emergency, a general alarm shall be installed and maintained to promptly alert employees of such occurrences.

(e) Medical surveillance. For any employee exposed to DBCP in an emergency situation, the employer shall provide medical surveillance in accordance with subsection (14) of this section.

(f) Exposure monitoring.

(i) Following an emergency, the employer shall conduct monitoring which complies with subsection (6) of this section.

(ii) In workplaces not normally subject to periodic monitoring, the employer may terminate monitoring when two consecutive measurements indicate exposures below the permissible exposure limit.

(11) Protective clothing and equipment.

(a) Provision and use. Where eye or skin contact with liquid or solid DBCP may occur, employers shall provide at no cost to the employee, and assure that employees wear impermeable protective clothing and equipment in accordance with WAC 296-800-160 to protect the area of the body which may come in contact with DBCP.

(b) Cleaning and replacement.

(i) The employer shall clean, launder, maintain, or replace protective clothing and equipment required by this subsection to maintain their effectiveness. In addition, the employer shall provide clean protective clothing and equipment at least daily to each affected employee.

(ii) Removal and storage.

(A) The employer shall assure that employees remove DBCP contaminated work clothing only in change rooms provided in accordance with subsection (13) of this section.

(B) The employer shall assure that employees promptly remove any protective clothing and equipment which becomes contaminated with DBCP-containing liquids and solids. This clothing shall not be reworn until the DBCP has been removed from the clothing or

equipment.

(C) The employer shall assure that no employee takes DBCP contaminated protective devices and work clothing out of the change room, except those employees authorized to do so for the purpose of laundering, maintenance, or disposal.

(iii) The employer shall assure that DBCP-contaminated protective work clothing and equipment is placed and stored in closed containers which prevent dispersion of DBCP outside the container.

(iv) The employer shall inform any person who launders or cleans DBCP-contaminated protective clothing or equipment of the potentially harmful effects of exposure to DBCP.

(v) The employer shall assure that the containers of contaminated protective clothing and equipment which are to be removed from the workplace for any reason are labeled in accordance with subsection (16)(c) of this section.

(vi) The employer shall prohibit the removal of DBCP from protective clothing and equipment by blowing or shaking.

(12) Housekeeping.

(a) Surfaces.

(i) All surfaces shall be maintained free of accumulations of DBCP.

(ii) Dry sweeping and the use of air for the cleaning of floors and other surfaces where DBCP dust or liquids are found is prohibited.

(iii) Where vacuuming methods are selected, either portable units or a permanent system may be used.

(A) If a portable unit is selected, the exhaust shall be attached to the general workplace exhaust ventilation system or collected within the vacuum unit, equipped with high efficiency filters or other appropriate means of contaminant removal, so that DBCP is not reintroduced into the workplace air; and

(B) Portable vacuum units used to collect DBCP may not be used for other cleaning purposes and shall be labeled as prescribed by subsection (16)(c) of this section.

(iv) Cleaning of floors and other contaminated surfaces may not be performed by washing down with a hose, unless a fine spray has first been laid down.

(b) Liquids. Where DBCP is present in a liquid form, or as a resultant vapor, all containers or vessels containing DBCP shall be enclosed to the maximum extent feasible and tightly covered when not in use.

(c) Waste disposal. DBCP waste, scrap, debris, bags, containers or equipment, shall be disposed in sealed bags or other closed containers which prevent dispersion of DBCP outside the container.

(13) Hygiene facilities and practices.

(a) Change rooms. The employer shall provide clean change rooms equipped with storage facilities for street clothes and separate storage facilities for protective clothing and equipment whenever employees are required to wear protective clothing and equipment in accordance with subsections (8), (9) and (11) of this section.

(b) Showers.

(i) The employer shall assure that employees working in the regulated area shower at the end of the work shift.

(ii) The employer shall assure that employees whose skin becomes contaminated with DBCP-containing liquids or solids immediately wash or shower to remove any DBCP from the skin.

(iii) The employer shall provide shower facilities in accordance with WAC 296-800-230.

(c) Lunchrooms. The employer shall provide lunchroom facilities which have a temperature controlled, positive pressure, filtered air supply, and which are readily accessible to employees working in regulated areas.

(d) Lavatories.

(i) The employer shall assure that employees working in the regulated area remove protective clothing and wash their hands and face prior to eating.

(ii) The employer shall provide a sufficient number of lavatory facilities which comply with WAC 296-800-230.

(e) Prohibition of activities in regulated areas. The employer shall assure that, in regulated areas, food or beverages are not present or consumed, smoking products and implements are not present or used, and cosmetics are not present or applied.

(14) Medical surveillance.

(a) General. The employer shall institute a program of medical surveillance for each employee who is or will be exposed, without regard to the use of respirators, to DBCP. The employer shall provide each such employee with an opportunity for medical examinations and tests in accordance with this subsection. All medical examinations and procedures shall be performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee.

(b) Frequency and content. At the time of initial assignment, annually thereafter, and whenever exposure to DBCP occurs, the employer shall provide a medical examination for employees who work in regulated areas, which includes at least the following:

(i) A complete medical and occupational history with emphasis on reproductive history.

(ii) A complete physical examination with emphasis on the genito-urinary tract, testicle size, and body habitus including the following tests:

- (A) Sperm count;
- (B) Complete urinalysis (U/A);
- (C) Complete blood count; and
- (D) Thyroid profile.

(iii) A serum specimen shall be obtained and the following determinations made by radioimmunoassay techniques utilizing National Institutes of Health (NIH) specific antigen or one of equivalent sensitivity:

- (A) Serum multiphasic analysis (SMA 12);
- (B) Serum follicle stimulating hormone (FSH);
- (C) Serum luteinizing hormone (LH); and
- (D) Serum estrogen (females).

(iv) Any other tests deemed appropriate by the examining

physician.

(c) Additional examinations. If the employee for any reason develops signs or symptoms commonly associated with exposure to DBCP, the employer shall provide the employee with a medical examination which shall include those elements considered appropriate by the examining physician.

(d) Information provided to the physician. The employer shall provide the following information to the examining physician:

(i) A copy of this standard and its appendices;

(ii) A description of the affected employee's duties as they relate to the employee's exposure;

(iii) The level of DBCP to which the employee is exposed; and

(iv) A description of any personal protective equipment used or to be used.

(e) Physician's written opinion.

(i) For each examination under this section, the employer shall obtain and provide the employee with a written opinion from the examining physician which shall include:

(A) The results of the medical tests performed;

(B) The physician's opinion as to whether the employee has any detected medical condition which would place the employee at an increased risk of material impairment of health from exposure to DBCP;

(C) Any recommended limitations upon the employee's exposure to DBCP or upon the use of protective clothing and equipment such as respirators; and

(D) A statement that the employee was informed by the physician of the results of the medical examination, and any medical conditions which require further examination or treatment.

(ii) The employer shall instruct the physician not to reveal in the written opinion specific findings or diagnoses unrelated to occupational exposure to DBCP.

(iii) The employer shall provide a copy of the written opinion to the affected employee.

(f) Emergency situations. If the employee is exposed to DBCP in an emergency situation, the employer shall provide the employee with a sperm count test as soon as practicable, or, if the employee is unable to produce a semen specimen, the hormone tests contained in subsection (14)(b) of this section. The employer shall provide these same tests three months later.

(15) Employee information and training.

(a) Training program.

(i) Within thirty days of the effective date of this standard, the employer shall institute a training program for all employees who may be exposed to DBCP and shall assure their participation in such training program.

(ii) The employer shall assure that each employee is informed of the following:

(A) The information contained in Appendices A, B and C;

(B) The quantity, location, manner of use, release or storage of DBCP and the specific nature of operations which could result in exposure to DBCP as well as any necessary protective steps;

(C) The purpose, proper use, limitations, and other training

requirements covering respiratory protection as required in chapter 296-62 WAC, Part E;

(D) The purpose and description of the medical surveillance program required by subsection (14) of this section; and

(E) A review of this standard.

(b) Access to training materials.

(i) The employer shall make a copy of this standard and its appendices readily available to all affected employees.

(ii) The employer shall provide, upon request, all materials relating to the employee information and training program to the director.

(16) Signs and labels.

(a) General.

(i) The employer may use labels or signs required by other statutes, regulations, or ordinances in addition to or in combination with, signs and labels required by this subsection.

(ii) The employer shall assure that no statement appears on or near any sign or label required by this subsection which contradicts or detracts from the required sign or label.

(b) Signs.

(i) The employer shall post signs to clearly indicate all work areas where DBCP may be present. These signs shall bear the legend:

DANGER

1,2-Dibromo-3-chloropropane

(Insert appropriate trade or common names)

CANCER HAZARD

AUTHORIZED PERSONNEL ONLY

(ii) Where airborne concentrations of DBCP exceed the permissible exposure limits, the signs shall bear the additional legend:

RESPIRATOR REQUIRED

(c) Labels.

(i) The employer shall assure that precautionary labels are affixed to all containers of DBCP and of products containing DBCP, and that the labels remain affixed when the DBCP or products containing DBCP are sold, distributed, or otherwise leave the employer's workplace. Where DBCP or products containing DBCP are sold, distributed or otherwise leave the employer's workplace bearing appropriate labels required by EPA under the regulations in 40 CFR Part 162, the labels required by this subsection need not be affixed.

(ii) The employer shall assure that the precautionary labels required by this subsection are readily visible and legible. The labels shall bear the following legend:

DANGER

1,2-Dibromo-3-chloropropane

CANCER HAZARD

(17) Recordkeeping.

(a) Exposure monitoring.

(i) The employer shall establish and maintain an accurate record of all monitoring required by subsection (6) of this section.

(ii) This record shall include:

(A) The dates, number, duration and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure;

(B) A description of the sampling and analytical methods used;

(C) Type of respiratory worn, if any; and

(D) Name, Social Security number, and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent.

(iii) The employer shall maintain this record for at least forty years or the duration of employment plus twenty years, whichever is longer.

(b) Medical surveillance.

(i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance required by subsection (14) of this section.

(ii) This record shall include:

(A) The name and Social Security number of the employee;

(B) A copy of the physician's written opinion;

(C) Any employee medical complaints related to exposure to DBCP;

(D) A copy of the information provided the physician as required by subsection (14)(c) of this section; and

(E) A copy of the employee's medical and work history.

(iii) The employer shall maintain this record for at least forty years or the duration of employment plus twenty years, whichever is longer.

(c) Availability.

(i) The employer shall assure that all records required to be maintained by this section be made available upon request to the director for examination and copying.

(ii) Employee exposure monitoring records and employee medical records required by this subsection shall be provided upon request to employees' designated representatives and the assistant director in accordance with chapter 296-802 WAC.

(d) Transfer of records.

(i) If the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by this section for the prescribed period.

~~(ii) ((If the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall transmit these records by mail to the director.~~

~~(iii) At the expiration of the retention period for the records required to be maintained under this section, the employer shall transmit these records by mail to the director.~~

~~(iv))~~ The employer shall also comply with any additional requirements involving transfer of records set forth in ~~((chapter 296-802))~~ WAC 296-802-60005.

(18) Observation of monitoring.

(a) Employee observation. The employer shall provide affected employees, or their designated representatives, an opportunity to observe any monitoring of employee exposure to DBCP conducted under subsection (6) of this section.

(b) Observation procedures.

(i) Whenever observation of the measuring or monitoring of employee exposure to DBCP requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide the observer with personal protective clothing or equipment required to be worn by employees working in the area, assure the use of such clothing and equipment, and require the observer to comply with all other applicable safety and health procedures.

(ii) Without interfering with the monitoring or measurement, observers shall be entitled to:

(A) Receive an explanation of the measurement procedures;

(B) Observe all steps related to the measurement of airborne concentrations of DBCP performed at the place of exposure; and

(C) Record the results obtained.

(19) Appendices. The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

AMENDATORY SECTION (Amending WSR 09-15-145, filed 7/21/09, effective 9/1/09)

**WAC 296-62-07460 Butadiene.** (1) Scope and application.

(a) This section applies to all occupational exposures to 1,3-Butadiene (BD), Chemical Abstracts Service Registry No. 106-99-0, except as provided in (b) of this subsection.

(b)(i) Except for the recordkeeping provisions in subsection (13)(a) of this section, this section does not apply to the processing, use, or handling of products containing BD or to other work operations and streams in which BD is present where objective data are reasonably relied upon that demonstrate the work operation or the product or the group of products or operations to which it belongs may not reasonably be foreseen to release BD in airborne concentrations at or above the action level or in excess of the STEL under the expected conditions of processing, use, or handling that will cause the greatest possible release or in any plausible accident.

(ii) This section also does not apply to work operations, products or streams where the only exposure to BD is from liquid mixtures containing 0.1% or less of BD by volume or the vapors released from such liquids, unless objective data become available that show that airborne concentrations generated by such mixtures can exceed the action level or STEL under reasonably predictable conditions of processing, use or handling that will cause the greatest possible release.

(iii) Except for labeling requirements and requirements for emergency response, this section does not apply to the storage, transportation, distribution or sale of BD or liquid mixtures in intact containers or in transportation pipelines sealed in such a manner as to fully contain BD vapors or liquids.

(c) Where products or processes containing BD are exempted under (b) of this subsection, the employer shall maintain records of the objective data supporting that exemption and the basis for the employer's reliance on the data, as provided in subsection (13)(a) of this section.

(2) Definitions: For the purpose of this section, the following definitions shall apply:

"Action level" means a concentration of airborne BD of 0.5 ppm calculated as an 8-hour time-weighted average.

"Director" means the director of the department of labor and industries, or authorized representatives.

"Authorized person" means any person specifically designated by the employer, whose duties require entrance into a regulated area, or a person entering such an area as a designated representative of employees to exercise the right to observe monitoring and measuring procedures under subsection (4)(h) of this section, or a person designated under the WISH Act or regulations

issued under the WISH Act to enter a regulated area.

"1,3-Butadiene" means an organic compound with chemical formula  $\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2$  that has a molecular weight of approximately 54.15 gm/mole.

"Business day" means any Monday through Friday, except those days designated as federal, state, local or company specific holidays.

"Complete blood count (CBC)" means laboratory tests performed on whole blood specimens and includes the following: White blood cell count (WBC), hematocrit (Hct), red blood cell count (RBC), hemoglobin (Hgb), differential count of white blood cells, red blood cell morphology, red blood cell indices, and platelet count.

"Day" means any part of a calendar day.

"Emergency situation" means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of BD.

"Employee exposure" means exposure of a worker to airborne concentrations of BD which would occur if the employee were not using respiratory protective equipment.

"Objective data" means monitoring data, or mathematical modelling or calculations based on composition, chemical and physical properties of a material, stream or product.

"Permissible exposure limits (PELs)" means either the 8-hour time-weighted average (8-hour TWA) exposure or the short-term exposure limit (STEL).

"Physician or other licensed health care professional" is an individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide or be delegated the responsibility to provide one or more of the specific health care services required by (k) of this subsection.

"Regulated area" means any area where airborne concentrations of BD exceed or can reasonably be expected to exceed the 8-hour time-weighted average (8-hour TWA) exposure of 1 ppm or the short-term exposure limit (STEL) of 5 ppm for 15 minutes.

"This section" means this 1,3-butadiene standard.

(3) Permissible exposure limits (PELs).

(a) Time-weighted average (TWA) limit. The employer shall ensure that no employee is exposed to an airborne concentration of BD in excess of one part BD per million parts of air (ppm) measured as an eight (8)-hour time-weighted average.

(b) Short-term exposure limit (STEL). The employer shall ensure that no employee is exposed to an airborne concentration of BD in excess of five parts of BD per million parts of air (5 ppm) as determined over a sampling period of fifteen minutes.

(4) Exposure monitoring.

(a) General.

(i) Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA and 15-minute short-term exposures of each employee.

(ii) Representative 8-hour TWA employee exposure shall be determined on the basis of one or more samples representing full-

shift exposure for each shift and for each job classification in each work area.

(iii) Representative 15-minute short-term employee exposures shall be determined on the basis of one or more samples representing 15-minute exposures associated with operations that are most likely to produce exposures above the STEL for each shift and for each job classification in each work area.

(iv) Except for the initial monitoring required under (b) of this subsection, where the employer can document that exposure levels are equivalent for similar operations on different work shifts, the employer need only determine representative employee exposure for that operation from the shift during which the highest exposure is expected.

(b) Initial monitoring.

(i) Each employer who has a workplace or work operation covered by this section, shall perform initial monitoring to determine accurately the airborne concentrations of BD to which employees may be exposed, or shall rely on objective data pursuant to subsection (1)(b)(i) of this section to fulfill this requirement. The initial monitoring required under this subitem shall be completed within sixty days of the introduction of BD into the workplace.

(ii) Where the employer has monitored within two years prior to the effective date of this section and the monitoring satisfies all other requirements of this section, the employer may rely on such earlier monitoring results to satisfy the requirements of (b)(i) of this subsection, provided that the conditions under which the initial monitoring was conducted have not changed in a manner that may result in new or additional exposures.

(c) Periodic monitoring and its frequency.

(i) If the initial monitoring required by (b) of this subsection reveals employee exposure to be at or above the action level but at or below both the 8-hour TWA limit and the STEL, the employer shall repeat the representative monitoring required by (a) of this subsection every twelve months.

(ii) If the initial monitoring required by (b) of this subsection reveals employee exposure to be above the 8-hour TWA limit, the employer shall repeat the representative monitoring required by (a)(ii) of this subsection at least every three months until the employer has collected two samples per quarter (each at least 7 days apart) within a two-year period, after which such monitoring must occur at least every six months.

(iii) If the initial monitoring required by (b) of this subsection reveals employee exposure to be above the STEL, the employer shall repeat the representative monitoring required by (a)(iii) of this subsection at least every three months until the employer has collected two samples per quarter (each at least 7 days apart) within a two-year period, after which such monitoring must occur at least every six months.

(iv) The employer may alter the monitoring schedule from every six months to annually for any required representative monitoring for which two consecutive measurements taken at least 7 days apart indicate that employee exposure has decreased to or below the 8-

hour TWA, but is at or above the action level.

(d) Termination of monitoring.

(i) If the initial monitoring required by (b) of this subsection reveals employee exposure to be below the action level and at or below the STEL, the employer may discontinue the monitoring for employees whose exposures are represented by the initial monitoring.

(ii) If the periodic monitoring required by (c) of this subsection reveals that employee exposures, as indicated by at least two consecutive measurements taken at least 7 days apart, are below the action level and at or below the STEL, the employer may discontinue the monitoring for those employees who are represented by such monitoring.

(e) Additional monitoring.

(i) The employer shall institute the exposure monitoring required under subsection (4) of this section whenever there has been a change in the production, process, control equipment, personnel or work practices that may result in new or additional exposures to BD or when the employer has any reason to suspect that a change may result in new or additional exposures.

(ii) Whenever spills, leaks, ruptures or other breakdowns occur that may lead to employee exposure above the 8-hour TWA limit or above the STEL, the employer shall monitor (using leak source, such as direct reading instruments, area or personal monitoring), after the cleanup of the spill or repair of the leak, rupture or other breakdown, to ensure that exposures have returned to the level that existed prior to the incident.

(f) Accuracy of monitoring.

Monitoring shall be accurate, at a confidence level of 95 percent, to within plus or minus 25 percent for airborne concentrations of BD at or above the 1 ppm TWA limit and to within plus or minus 35 percent for airborne concentrations of BD at or above the action level of 0.5 ppm and below the 1 ppm TWA limit.

(g) Employee notification of monitoring results.

(i) The employer shall, within 5 business days after the receipt of the results of any monitoring performed under this section, notify the affected employees of these results in writing either individually or by posting of results in an appropriate location that is accessible to affected employees.

(ii) The employer shall, within 15 business days after receipt of any monitoring performed under this section indicating the 8-hour TWA or STEL has been exceeded, provide the affected employees, in writing, with information on the corrective action being taken by the employer to reduce employee exposure to or below the 8-hour TWA or STEL and the schedule for completion of this action.

(h) Observation of monitoring.

(i) Employee observation. The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to BD conducted in accordance with this section.

(ii) Observation procedures. When observation of the monitoring of employee exposure to BD requires entry into an area where the use of protective clothing or equipment is required, the

employer shall provide the observer at no cost with protective clothing and equipment, and shall ensure that the observer uses this equipment and complies with all other applicable safety and health procedures.

(5) Regulated areas.

(a) The employer shall establish a regulated area wherever occupational exposures to airborne concentrations of BD exceed or can reasonably be expected to exceed the permissible exposure limits, either the 8-hour TWA or the STEL.

(b) Access to regulated areas shall be limited to authorized persons.

(c) Regulated areas shall be demarcated from the rest of the workplace in any manner that minimizes the number of employees exposed to BD within the regulated area.

(d) An employer at a multiemployer worksite who establishes a regulated area shall communicate the access restrictions and locations of these areas to other employers with work operations at that worksite whose employees may have access to these areas.

(6) Methods of compliance.

(a) Engineering controls and work practices.

(i) The employer shall institute engineering controls and work practices to reduce and maintain employee exposure to or below the PELs, except to the extent that the employer can establish that these controls are not feasible or where subsection (8)(a)(i) of this section applies.

(ii) Wherever the feasible engineering controls and work practices which can be instituted are not sufficient to reduce employee exposure to or below the 8-hour TWA or STEL, the employer shall use them to reduce employee exposure to the lowest levels achievable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of subsection (8) of this section.

(b) Compliance plan.

(i) Where any exposures are over the PELs, the employer shall establish and implement a written plan to reduce employee exposure to or below the PELs primarily by means of engineering and work practice controls, as required by (a) of this subsection, and by the use of respiratory protection where required or permitted under this section. No compliance plan is required if all exposures are under the PELs.

(ii) The written compliance plan shall include a schedule for the development and implementation of the engineering controls and work practice controls including periodic leak detection surveys.

(iii) Copies of the compliance plan required in (b) of this subsection shall be furnished upon request for examination and copying to the director, affected employees and designated employee representatives. Such plans shall be reviewed at least every 12 months, and shall be updated as necessary to reflect significant changes in the status of the employer's compliance program.

(iv) The employer shall not implement a schedule of employee rotation as a means of compliance with the PELs.

(7) Exposure goal program.

(a) For those operations and job classifications where

employee exposures are greater than the action level, in addition to compliance with the PELs, the employer shall have an exposure goal program that is intended to limit employee exposures to below the action level during normal operations.

(b) Written plans for the exposure goal program shall be furnished upon request for examination and copying to the director, affected employees and designated employee representatives.

(c) Such plans shall be updated as necessary to reflect significant changes in the status of the exposure goal program.

(d) Respirator use is not required in the exposure goal program.

(e) The exposure goal program shall include the following items unless the employer can demonstrate that the item is not feasible, will have no significant effect in reducing employee exposures, or is not necessary to achieve exposures below the action level:

(i) A leak prevention, detection, and repair program.

(ii) A program for maintaining the effectiveness of local exhaust ventilation systems.

(iii) The use of pump exposure control technology such as, but not limited to, mechanical double-sealed or seal-less pumps.

(iv) Gauging devices designed to limit employee exposure, such as magnetic gauges on rail cars.

(v) Unloading devices designed to limit employee exposure, such as a vapor return system.

(vi) A program to maintain BD concentration below the action level in control rooms by use of engineering controls.

(8) Respiratory protection.

(a) General. For employees who use respirators required by this section, the employer must provide each employee an appropriate respirator that complies with the requirements of this subsection. Respirators must be used during:

(i) Periods necessary to install or implement feasible engineering and work-practice controls;

(ii) Nonroutine work operations that are performed infrequently and for which exposures are limited in duration;

(iii) Work operations for which feasible engineering controls and work-practice controls are not yet sufficient to reduce employee exposures to or below the PELs;

(iv) Emergencies.

(b) Respirator program.

(i) The employer must implement a respiratory protection program as required by chapter 296-842 WAC, except WAC 296-842-13005 and 296-842-14005, which covers each employee required by this section to use a respirator.

(ii) If air-purifying respirators are used, the employer must replace the air-purifying filter elements according to the replacement schedule set for the class of respirators listed in Table 1 of this section, and at the beginning of each work shift.

(iii) Instead of using the replacement schedule listed in Table 1 of this section, the employer may replace cartridges or canisters at 90% of their expiration service life, provided the employer:

(A) Demonstrates that employees will be adequately protected by this procedure;

(B) Uses BD breakthrough data for this purpose that have been derived from tests conducted under worst-case conditions of humidity, temperature, and air-flow rate through the filter element, and the employer also describes the data supporting the cartridge- or canister-change schedule, as well as the basis for using the data in the employer's respirator program.

(iv) A label must be attached to each filter element to indicate the date and time it is first installed on the respirator.

(v) If NIOSH approves an end-of-service-life indicator (ESLI) for an air-purifying filter element, the element may be used until the ESLI shows no further useful service life or until the element is replaced at the beginning of the next work shift, whichever occurs first.

(vi) Regardless of the air-purifying element used, if an employee detects the odor of BD, the employer must replace the air-purifying element immediately.

(c) Respirator selection.

(i) The employer must select appropriate respirators from Table 1 of this section.

**Table 1. - Minimum Requirements for Respiratory Protection for Airborne BD**

Concentration of Airborne BD (ppm) or condition of use	Minimum required respirator
Less than or equal to 5 ppm (5 times PEL)	(a) Air-purifying half mask or full facepiece respirator equipped with approved BD or organic vapor cartridges or canisters. Cartridges or canisters shall be replaced every 4 hours.
Less than or equal to 10 ppm (10 times PEL)	(a) Air-purifying half mask or full facepiece respirator equipped with approved BD or organic vapor cartridges or canisters. Cartridges or canisters shall be replaced every 3 hours.
Less than or equal to 25 ppm (25 times PEL)	(a) Air-purifying full facepiece respirator equipped with approved BD or organic vapor cartridges or canisters. Cartridges or canisters shall be replaced every 2 hours.

**Table 1. - Minimum Requirements for Respiratory Protection for Airborne BD**

Concentration of Airborne BD (ppm) or condition of use	Minimum required respirator
Less than or equal to 50 ppm (50 times PEL)	<p>(b) Any powered air-purifying respirator equipped with approved BD or organic vapor cartridges. PAPR cartridges shall be replaced every 2 hours.</p> <p>(c) Continuous flow supplied air respirator equipped with a hood or helmet.</p> <p>(a) Air-purifying full facepiece respirator equipped with approved BD or organic vapor cartridges or canisters. Cartridges or canisters shall be replaced every 1 hour.</p>
Less than or equal to 1,000 ppm (1,000 times PEL)	<p>(b) Powered air purifying respirator equipped with a tight-fitting facepiece and an approved BD or organic vapor cartridges. PAPR cartridges shall be replaced every 1 hour.</p> <p>(a) Supplied air respirator equipped with a half mask or full facepiece and operated in a pressure demand or other positive pressure mode.</p>
Greater than 1,000 ppm	<p>(a) Self-contained breathing unknown concentration, or apparatus equipped with a fire fighting full facepiece and operated in a pressure demand or other positive pressure mode.</p>

**Table 1. - Minimum Requirements for Respiratory Protection for Airborne BD**

Concentration of Airborne BD (ppm) or condition of use	Minimum required respirator
	(b) Any supplied air respirator equipped with a full facepiece and operated in a pressure demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in a pressure demand or other positive pressure mode.
Escape from IDLH Conditions	(a) Any positive pressure self-contained breathing apparatus with an appropriate service life.  (b) Any air-purifying full facepiece respirator equipped with a front or back mounted BD or organic vapor canister.

Notes: Respirators approved for use in higher concentrations are permitted to be used in lower concentrations. Full facepiece is required when eye irritation is anticipated.

(ii) Air-purifying respirators must have filter elements certified by NIOSH for organic vapor or BD.

(iii) When an employee whose job requires the use of a respirator cannot use a negative-pressure respirator, the employer must provide the employee with a respirator that has less breathing resistance than the negative-pressure respirator, such as a powered air-purifying respirator or supplied-air respirator, when the employee is able to use it and if it provides the employee adequate protection.

(9) Protective clothing and equipment. Where appropriate to prevent eye contact and limit dermal exposure to BD, the employer shall provide protective clothing and equipment at no cost to the employee and shall ensure its use. Eye and face protection shall meet the requirements of WAC 296-800-160.

(10) Emergency situations. Written plan. A written plan for emergency situations shall be developed, or an existing plan shall be modified, to contain the applicable elements specified in WAC 296-24-567, Employee emergency plans and fire prevention plans, and in WAC 296-62-3112, hazardous waste operations and emergency responses, for each workplace where there is a possibility of an emergency.

(11) Medical screening and surveillance.

(a) Employees covered. The employer shall institute a medical screening and surveillance program as specified in this subsection for:

(i) Each employee with exposure to BD at concentrations at or

above the action level on 30 or more days or for employees who have or may have exposure to BD at or above the PELs on 10 or more days a year;

(ii) Employers (including successor owners) shall continue to provide medical screening and surveillance for employees, even after transfer to a non-BD exposed job and regardless of when the employee is transferred, whose work histories suggest exposure to BD:

(A) At or above the PELs on 30 or more days a year for 10 or more years;

(B) At or above the action level on 60 or more days a year for 10 or more years; or

(C) Above 10 ppm on 30 or more days in any past year; and

(iii) Each employee exposed to BD following an emergency situation.

(b) Program administration.

(i) The employer shall ensure that the health questionnaire, physical examination and medical procedures are provided without cost to the employee, without loss of pay, and at a reasonable time and place.

(ii) Physical examinations, health questionnaires, and medical procedures shall be performed or administered by a physician or other licensed health care professional.

(iii) Laboratory tests shall be conducted by an accredited laboratory.

(c) Frequency of medical screening activities. The employer shall make medical screening available on the following schedule:

(i) For each employee covered under (a)(i) and (ii) of this subsection, a health questionnaire and complete blood count (CBC) with differential and platelet count every year, and a physical examination as specified below:

(A) An initial physical examination that meets the requirements of this rule, if twelve months or more have elapsed since the last physical examination conducted as part of a medical screening program for BD exposure;

(B) Before assumption of duties by the employee in a job with BD exposure;

(C) Every 3 years after the initial physical examination;

(D) At the discretion of the physician or other licensed health care professional reviewing the annual health questionnaire and CBC;

(E) At the time of employee reassignment to an area where exposure to BD is below the action level, if the employee's past exposure history does not meet the criteria of (a)(ii) of this subsection for continued coverage in the screening and surveillance program, and if twelve months or more have elapsed since the last physical examination; and

(F) At termination of employment if twelve months or more have elapsed since the last physical examination.

(ii) Following an emergency situation, medical screening shall be conducted as quickly as possible, but not later than 48 hours after the exposure.

(iii) For each employee who must wear a respirator, physical

ability to perform the work and use the respirator must be determined as required by chapter 296-842 WAC.

(d) Content of medical screening.

(i) Medical screening for employees covered by (a)(i) and (ii) of this subsection shall include:

(A) A baseline health questionnaire that includes a comprehensive occupational and health history and is updated annually. Particular emphasis shall be placed on the hematopoietic and reticuloendothelial systems, including exposure to chemicals, in addition to BD, that may have an adverse effect on these systems, the presence of signs and symptoms that might be related to disorders of these systems, and any other information determined by the examining physician or other licensed health care professional to be necessary to evaluate whether the employee is at increased risk of material impairment of health from BD exposure. Health questionnaires shall consist of the sample forms in Appendix C to this section, or be equivalent to those samples;

(B) A complete physical examination, with special emphasis on the liver, spleen, lymph nodes, and skin;

(C) A CBC; and

(D) Any other test which the examining physician or other licensed health care professional deems necessary to evaluate whether the employee may be at increased risk from exposure to BD.

(ii) Medical screening for employees exposed to BD in an emergency situation shall focus on the acute effects of BD exposure and at a minimum include: A CBC within 48 hours of the exposure and then monthly for three months; and a physical examination if the employee reports irritation of the eyes, nose, throat, lungs, or skin, blurred vision, coughing, drowsiness, nausea, or headache. Continued employee participation in the medical screening and surveillance program, beyond these minimum requirements, shall be at the discretion of the physician or other licensed health care professional.

(e) Additional medical evaluations and referrals.

(i) Where the results of medical screening indicate abnormalities of the hematopoietic or reticuloendothelial systems, for which a nonoccupational cause is not readily apparent, the examining physician or other licensed health care professional shall refer the employee to an appropriate specialist for further evaluation and shall make available to the specialist the results of the medical screening.

(ii) The specialist to whom the employee is referred under this subsection shall determine the appropriate content for the medical evaluation, e.g., examinations, diagnostic tests and procedures, etc.

(f) Information provided to the physician or other licensed health care professional. The employer shall provide the following information to the examining physician or other licensed health care professional involved in the evaluation:

(i) A copy of this section including its appendices;

(ii) A description of the affected employee's duties as they relate to the employee's BD exposure;

(iii) The employee's actual or representative BD exposure

level during employment tenure, including exposure incurred in an emergency situation;

(iv) A description of pertinent personal protective equipment used or to be used; and

(v) Information, when available, from previous employment-related medical evaluations of the affected employee which is not otherwise available to the physician or other licensed health care professional or the specialist.

(g) The written medical opinion.

(i) For each medical evaluation required by this section, the employer shall ensure that the physician or other licensed health care professional produces a written opinion and provides a copy to the employer and the employee within 15 business days of the evaluation. The written opinion shall be limited to the following information:

(A) The occupationally pertinent results of the medical evaluation;

(B) A medical opinion concerning whether the employee has any detected medical conditions which would place the employee's health at increased risk of material impairment from exposure to BD;

(C) Any recommended limitations upon the employee's exposure to BD; and

(D) A statement that the employee has been informed of the results of the medical evaluation and any medical conditions resulting from BD exposure that require further explanation or treatment.

(ii) The written medical opinion provided to the employer shall not reveal specific records, findings, and diagnoses that have no bearing on the employee's ability to work with BD.

Note: This provision does not negate the ethical obligation of the physician or other licensed health care professional to transmit any other adverse findings directly to the employee.

(h) Medical surveillance.

(i) The employer shall ensure that information obtained from the medical screening program activities is aggregated (with all personal identifiers removed) and periodically reviewed, to ascertain whether the health of the employee population of that employer is adversely affected by exposure to BD.

(ii) Information learned from medical surveillance activities must be disseminated to covered employees, as defined in (a) of this subsection, in a manner that ensures the confidentiality of individual medical information.

(12) Communication of BD hazards to employees.

(a) Hazard communication. The employer shall communicate the hazards associated with BD exposure in accordance with the requirements of the chemical hazard communication standard, WAC 296-800-170.

(b) Employee information and training.

(i) The employer shall train each employee who is potentially exposed to BD at or above the action level or the STEL in accordance with the requirements of the chemical hazard communication standard, WAC 296-800-170.

(ii) The employer shall institute a training program for all

employees who are potentially exposed to BD at or above the action level or the STEL, ensure employee participation in the program and maintain a record of the contents of such program.

(iii) Training shall be provided prior to or at the time of initial assignment to a job potentially involving exposure to BD at or above the action level or STEL and at least annually thereafter.

(iv) The training program shall be conducted in a manner that the employee is able to understand. The employer shall ensure that each employee exposed to BD over the action level or STEL is informed of the following:

(A) The health hazards associated with BD exposure, and the purpose and a description of the medical screening and surveillance program required by this section;

(B) The quantity, location, manner of use, release, and storage of BD and the specific operations that could result in exposure to BD, especially exposures above the PEL or STEL;

(C) The engineering controls and work practices associated with the employee's job assignment, and emergency procedures and personal protective equipment;

(D) The measures employees can take to protect themselves from exposure to BD;

(E) The contents of this standard and its appendices; and

(F) The right of each employee exposed to BD at or above the action level or STEL to obtain:

(I) Medical examinations as required by subsection (10) of this section at no cost to the employee;

(II) The employee's medical records required to be maintained by subsection (13)(c) of this section; and

(III) All air monitoring results representing the employee's exposure to BD and required to be kept by subsection (13)(b) of this section.

(c) Access to information and training materials.

(i) The employer shall make a copy of this standard and its appendices readily available without cost to all affected employees and their designated representatives and shall provide a copy if requested.

(ii) The employer shall provide to the director, or the designated employee representatives, upon request, all materials relating to the employee information and the training program.

(13) Recordkeeping.

(a) Objective data for exemption from initial monitoring.

(i) Where the processing, use, or handling of products or streams made from or containing BD are exempted from other requirements of this section under subsection (1)(b) of this section, or where objective data have been relied on in lieu of initial monitoring under subsection (4)(b)(ii) of this section, the employer shall establish and maintain a record of the objective data reasonably relied upon in support of the exemption.

(ii) This record shall include at least the following information:

(A) The product or activity qualifying for exemption;

(B) The source of the objective data;

(C) The testing protocol, results of testing, and analysis of

the material for the release of BD;

(D) A description of the operation exempted and how the data support the exemption; and

(E) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(b) Exposure measurements.

(i) The employer shall establish and maintain an accurate record of all measurements taken to monitor employee exposure to BD as prescribed in subsection (4) of this section.

(ii) The record shall include at least the following information:

(A) The date of measurement;

(B) The operation involving exposure to BD which is being monitored;

(C) Sampling and analytical methods used and evidence of their accuracy;

(D) Number, duration, and results of samples taken;

(E) Type of protective devices worn, if any;

(F) Name, Social Security number and exposure of the employees whose exposures are represented; and

(G) The written corrective action and the schedule for completion of this action required by subsection (4)(g)(ii) of this section.

(iii) The employer shall maintain this record for at least 30 years in accordance with chapter 296-802 WAC.

(c) Medical screening and surveillance.

(i) The employer shall establish and maintain an accurate record for each employee subject to medical screening and surveillance under this section.

(ii) The record shall include at least the following information:

(A) The name and Social Security number of the employee;

(B) Physician's or other licensed health care professional's written opinions as described in subsection (11)(e) of this section;

(C) A copy of the information provided to the physician or other licensed health care professional as required by subsection (11)(e) of this section.

(iii) Medical screening and surveillance records shall be maintained for each employee for the duration of employment plus 30 years, in accordance with chapter 296-802 WAC.

(d) Availability.

(i) The employer, upon written request, shall make all records required to be maintained by this section available for examination and copying to the director.

(ii) Access to records required to be maintained by (a) and (b) of this subsection shall be granted in accordance with chapter 296-802 WAC.

~~(e) Transfer of records. ((i) Whenever the employer ceases to do business, the employer shall transfer records required by this section to the successor employer. The successor employer~~

~~shall receive and maintain these records. If there is no successor employer, the employer shall notify the director, at least three months prior to disposal, and transmit them to the director if requested by the director within that period.~~

~~(ii))~~ The employer shall transfer medical and exposure records as set forth in ~~((chapter 296-802))~~ WAC 296-802-60005.

(14) Dates.

(a) Effective date. This section shall become effective (day, month), 1997.

(b) Start-up dates.

(i) The initial monitoring required under subsection (4)(b) of this section shall be completed immediately or within sixty days of the introduction of BD into the workplace.

(ii) The requirements of subsections (3) through (13) of this section, including feasible work practice controls but not including engineering controls specified in subsection (6)(a) of this section, shall be complied with immediately.

(iii) Engineering controls specified by subsection (6)(a) of this section shall be implemented by February 4, 1999, and the exposure goal program specified in subsection (7) of this section shall be implemented by February 4, 2000.

(15) Appendices.

Appendices A, B, C, D, and F to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

Appendix A. Substance Safety Data Sheet For 1,3-Butadiene (Non-Mandatory)

(1) Substance Identification.

(a) Substance: 1,3-Butadiene (CH(2)=CH-CH=CH(2)).

(b) Synonyms: 1,3-Butadiene (BD); butadiene; biethylene; bi-vinyl; divinyl; butadiene-1,3; buta-1,3-diene; erythrene; NCI-C50602; CAS-106-99-0.

(c) BD can be found as a gas or liquid.

(d) BD is used in production of styrene-butadiene rubber and polybutadiene rubber for the tire industry. Other uses include copolymer latexes for carpet backing and paper coating, as well as resins and polymers for pipes and automobile and appliance parts. It is also used as an intermediate in the production of such chemicals as fungicides.

(e) Appearance and odor: BD is a colorless, noncorrosive, flammable gas with a mild aromatic odor at standard ambient temperature and pressure.

(f) Permissible exposure: Exposure may not exceed 1 part BD per million parts of air averaged over the 8-hour workday, nor may short-term exposure exceed 5 parts of BD per million parts of air averaged over any 15-minute period in the 8-hour workday.

(2) Health Hazard Data.

(a) BD can affect the body if the gas is inhaled or if the liquid form, which is very cold (cryogenic), comes in contact with the eyes or skin.

(b) Effects of overexposure: Breathing very high levels of BD for a short time can cause central nervous system effects, blurred

vision, nausea, fatigue, headache, decreased blood pressure and pulse rate, and unconsciousness. There are no recorded cases of accidental exposures at high levels that have caused death in humans, but this could occur. Breathing lower levels of BD may cause irritation of the eyes, nose, and throat. Skin contact with liquefied BD can cause irritation and frostbite.

(c) Long-term (chronic) exposure: BD has been found to be a potent carcinogen in rodents, inducing neoplastic lesions at multiple target sites in mice and rats. A recent study of BD-exposed workers showed that exposed workers have an increased risk of developing leukemia. The risk of leukemia increases with increased exposure to BD. OSHA has concluded that there is strong evidence that workplace exposure to BD poses an increased risk of death from cancers of the lymphohematopoietic system.

(d) Reporting signs and symptoms: You should inform your supervisor if you develop any of these signs or symptoms and suspect that they are caused by exposure to BD.

### (3) Emergency First-Aid Procedures.

In the event of an emergency, follow the emergency plan and procedures designated for your work area. If you have been trained in first-aid procedures, provide the necessary first aid measures. If necessary, call for additional assistance from co-workers and emergency medical personnel.

(a) Eye and Skin Exposures: If there is a potential that liquefied BD can come in contact with eye or skin, face shields and skin protective equipment must be provided and used. If liquefied BD comes in contact with the eye, immediately flush the eyes with large amounts of water, occasionally lifting the lower and the upper lids. Flush repeatedly. Get medical attention immediately. Contact lenses should not be worn when working with this chemical. In the event of skin contact, which can cause frostbite, remove any contaminated clothing and flush the affected area repeatedly with large amounts of tepid water.

(b) Breathing: If a person breathes in large amounts of BD, move the exposed person to fresh air at once. If breathing has stopped, begin cardiopulmonary resuscitation (CPR) if you have been trained in this procedure. Keep the affected person warm and at rest. Get medical attention immediately.

(c) Rescue: Move the affected person from the hazardous exposure. If the exposed person has been overcome, call for help and begin emergency rescue procedures. Use extreme caution so that you do not become a casualty. Understand the plant's emergency rescue procedures and know the locations of rescue equipment before the need arises.

### (4) Respirators and Protective Clothing.

(a) Respirators: Good industrial hygiene practices recommend that engineering and work practice controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when these controls fail and need to be supplemented or during brief,

nonroutine, intermittent exposure. Respirators may also be used in situations involving nonroutine work operations which are performed infrequently and in which exposures are limited in duration, and in emergency situations. In some instances cartridge respirator use is allowed, but only with strict time constraints. For example, at exposure below 5 ppm BD, a cartridge (or canister) respirator, either full or half face, may be used, but the cartridge must be replaced at least every 4 hours, and it must be replaced every 3 hours when the exposure is between 5 and 10 ppm.

If the use of respirators is necessary, the only respirators permitted are those that have been approved by the National Institute for Occupational Safety and Health (NIOSH). In addition to respirator selection, a complete respiratory protection program must be instituted which includes regular training, maintenance, fit testing, inspection, cleaning, and evaluation of respirators. If you can smell BD while wearing a respirator, proceed immediately to fresh air, and change cartridge (or canister) before reentering an area where there is BD exposure. If you experience difficulty in breathing while wearing a respirator, tell your supervisor.

(b) Protective Clothing: Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent the skin from becoming frozen by contact with liquefied BD (or a vessel containing liquid BD).

Employees should be provided with and required to use splash-proof safety goggles where liquefied BD may contact the eyes.

(5) Precautions for Safe Use, Handling, and Storage.

(a) Fire and Explosion Hazards: BD is a flammable gas and can easily form explosive mixtures in air. It has a lower explosive limit of 2%, and an upper explosive limit of 11.5%. It has an autoignition temperature of 420 deg. C (788 deg. F). Its vapor is heavier than air (vapor density, 1.9) and may travel a considerable distance to a source of ignition and flash back. Usually it contains inhibitors to prevent self-polymerization (which is accompanied by evolution of heat) and to prevent formation of explosive peroxides. At elevated temperatures, such as in fire conditions, polymerization may take place. If the polymerization takes place in a container, there is a possibility of violent rupture of the container.

(b) Hazard: Slightly toxic. Slight respiratory irritant. Direct contact of liquefied BD on skin may cause freeze burns and frostbite.

(c) Storage: Protect against physical damage to BD containers. Outside or detached storage of BD containers is preferred. Inside storage should be in a cool, dry, well-ventilated, noncombustible location, away from all possible sources of ignition. Store cylinders vertically and do not stack. Do not store with oxidizing material.

(d) Usual Shipping Containers: Liquefied BD is contained in steel pressure apparatus.

(e) Electrical Equipment: Electrical installations in Class I hazardous locations, as defined in Article 500 of the National Electrical Code, should be in accordance with Article 501 of the

Code. If explosion-proof electrical equipment is necessary, it shall be suitable for use in Group B. Group D equipment may be used if such equipment is isolated in accordance with Section 501-5(a) by sealing all conduit 1/2-inch size or larger. See Venting of Deflagrations (NFPA No. 68, 1994), National Electrical Code (NFPA No. 70, 1996), Static Electricity (NFPA No. 77, 1993), Lightning Protection Systems (NFPA No. 780, 1995), and Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids (NFPA No. 325, 1994).

(f) Fire Fighting: Stop flow of gas. Use water to keep fire-exposed containers cool. Fire extinguishers and quick drenching facilities must be readily available, and you should know where they are and how to operate them.

(g) Spill and Leak: Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until clean-up has been completed. If BD is spilled or leaked, the following steps should be taken:

(i) Eliminate all ignition sources.

(ii) Ventilate area of spill or leak.

(iii) If in liquid form, for small quantities, allow to evaporate in a safe manner.

(iv) Stop or control the leak if this can be done without risk. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place and repair the leak or allow the cylinder to empty.

(h) Disposal: This substance, when discarded or disposed of, is a hazardous waste according to Federal regulations (40 CFR part 261). It is listed as hazardous waste number D001 due to its ignitability. The transportation, storage, treatment, and disposal of this waste material must be conducted in compliance with 40 CFR parts 262, 263, 264, 268 and 270. Disposal can occur only in properly permitted facilities. Check state and local regulation of any additional requirements as these may be more restrictive than federal laws and regulation.

(i) You should not keep food, beverages, or smoking materials in areas where there is BD exposure, nor should you eat or drink in such areas.

(j) Ask your supervisor where BD is used in your work area and ask for any additional plant safety and health rules.

(6) Medical Requirements.

Your employer is required to offer you the opportunity to participate in a medical screening and surveillance program if you are exposed to BD at concentrations exceeding the action level (0.5 ppm BD as an 8-hour TWA) on 30 days or more a year, or at or above the 8-hr TWA (1 ppm) or STEL (5 ppm for 15 minutes) on 10 days or more a year. Exposure for any part of a day counts. If you have had exposure to BD in the past, but have been transferred to another job, you may still be eligible to participate in the medical screening and surveillance program.

The WISHA rule specifies the past exposures that would qualify you for participation in the program. These past exposure are work histories that suggest the following:

(a) That you have been exposed at or above the PELs on 30 days

a year for 10 or more years;

(b) That you have been exposed at or above the action level on 60 days a year for 10 or more years; or

(c) That you have been exposed above 10 ppm on 30 days in any past year.

Additionally, if you are exposed to BD in an emergency situation, you are eligible for a medical examination within 48 hours. The basic medical screening program includes a health questionnaire, physical examination, and blood test. These medical evaluations must be offered to you at a reasonable time and place, and without cost or loss of pay.

(7) Observation of Monitoring.

Your employer is required to perform measurements that are representative of your exposure to BD and you or your designated representative are entitled to observe the monitoring procedure. You are entitled to observe the steps taken in the measurement procedure, and to record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and equipment are required to be worn, you or your representative must also be provided with, and must wear, the protective clothing and equipment.

(8) Access to Information.

(a) Each year, your employer is required to inform you of the information contained in this appendix. In addition, your employer must instruct you in the proper work practices for using BD, emergency procedures, and the correct use of protective equipment.

(b) Your employer is required to determine whether you are being exposed to BD. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure. If your employer determines that you are being overexposed, he or she is required to inform you of the actions which are being taken to reduce your exposure to within permissible exposure limits and of the schedule to implement these actions.

(c) Your employer is required to keep records of your exposures and medical examinations. These records must be kept by the employer for at least thirty years.

(d) Your employer is required to release your exposure and medical records to you or your representative upon your request.

#### Appendix B. Substance Technical Guidelines for 1,3-Butadiene (Non-Mandatory)

(1) Physical and Chemical Data.

(a) Substance identification:

(i) Synonyms: 1,3-Butadiene (BD); butadiene; biethylene; bivinyl; divinyl; butadiene-1,3; buta-1,3-diene; erythrene; NCI-C50620; CAS-106-99-0.

(ii) Formula:  $(CH_2)=CH-CH=CH_2$ .

(iii) Molecular weight: 54.1.

(b) Physical data:

(i) Boiling point (760 mm Hg): -4.7 deg. C (23.5 deg. F).

(ii) Specific gravity (water = 1): 0.62 at 20 deg. C (68 deg.

F).

(iii) Vapor density (air = 1 at boiling point of BD): 1.87.  
(iv) Vapor pressure at 20 deg. C (68 deg. F): 910 mm Hg.  
(v) Solubility in water, g/100 g water at 20 deg. C (68 deg. F): 0.05.

(vi) Appearance and odor: Colorless, flammable gas with a mildly aromatic odor. Liquefied BD is a colorless liquid with a mildly aromatic odor.

(2) Fire, Explosion, and Reactivity Hazard Data.

(a) Fire:

(i) Flash point: -76 deg. C (-105 deg. F) for take out; liquefied BD; Not applicable to BD gas.

(ii) Stability: A stabilizer is added to the monomer to inhibit formation of polymer during storage. Forms explosive peroxides in air in absence of inhibitor.

(iii) Flammable limits in air, percent by volume: Lower: 2.0; Upper: 11.5.

(iv) Extinguishing media: Carbon dioxide for small fires, polymer or alcohol foams for large fires.

(v) Special fire fighting procedures: Fight fire from protected location or maximum possible distance. Stop flow of gas before extinguishing fire. Use water spray to keep fire-exposed cylinders cool.

(vi) Unusual fire and explosion hazards: BD vapors are heavier than air and may travel to a source of ignition and flash back. Closed containers may rupture violently when heated.

(vii) For purposes of compliance with the requirements of WAC 296-24-330, BD is classified as a flammable gas. For example, 7,500 ppm, approximately one-fourth of the lower flammable limit, would be considered to pose a potential fire and explosion hazard.

(viii) For purposes of compliance with WAC 296-24-585, BD is classified as a Class B fire hazard.

(ix) For purposes of compliance with WAC 296-24-956 and 296-800-280, locations classified as hazardous due to the presence of BD shall be Class I.

(b) Reactivity:

(i) Conditions contributing to instability: Heat. Peroxides are formed when inhibitor concentration is not maintained at proper level. At elevated temperatures, such as in fire conditions, polymerization may take place.

(ii) Incompatibilities: Contact with strong oxidizing agents may cause fires and explosions. The contacting of crude BD (not BD monomer) with copper and copper alloys may cause formations of explosive copper compounds.

(iii) Hazardous decomposition products: Toxic gases (such as carbon monoxide) may be released in a fire involving BD.

(iv) Special precautions: BD will attack some forms of plastics, rubber, and coatings. BD in storage should be checked for proper inhibitor content, for self-polymerization, and for formation of peroxides when in contact with air and iron. Piping carrying BD may become plugged by formation of rubbery polymer.

(c) Warning Properties:

(i) Odor Threshold: An odor threshold of 0.45 ppm has been reported in The American Industrial Hygiene Association (AIHA)

Report, Odor Thresholds for Chemicals with Established Occupational Health Standards. (Ex. 32-28C).

(ii) Eye Irritation Level: Workers exposed to vapors of BD (concentration or purity unspecified) have complained of irritation of eyes, nasal passages, throat, and lungs. Dogs and rabbits exposed experimentally to as much as 6700 ppm for 7 1/2 hours a day for 8 months have developed no histologically demonstrable abnormality of the eyes.

(iii) Evaluation of Warning Properties: Since the mean odor threshold is about half of the 1 ppm PEL, and more than 10-fold below the 5 ppm STEL, most wearers of air purifying respirators should still be able to detect breakthrough before a significant overexposure to BD occurs.

(3) Spill, Leak, and Disposal Procedures.

(a) Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed. If BD is spilled or leaked, the following steps should be taken:

(i) Eliminate all ignition sources.

(ii) Ventilate areas of spill or leak.

(iii) If in liquid form, for small quantities, allow to evaporate in a safe manner.

(iv) Stop or control the leak if this can be done without risk. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place and repair the leak or allow the cylinder to empty.

(b) Disposal: This substance, when discarded or disposed of, is a hazardous waste according to Federal regulations (40 CFR part 261). It is listed by the EPA as hazardous waste number D001 due to its ignitability. The transportation, storage, treatment, and disposal of this waste material must be conducted in compliance with 40 CFR parts 262, 263, 264, 268 and 270. Disposal can occur only in properly permitted facilities. Check state and local regulations for any additional requirements because these may be more restrictive than federal laws and regulations.

(4) Monitoring and Measurement Procedures.

(a) Exposure above the Permissible Exposure Limit (8-hr TWA) or Short-Term Exposure Limit (STEL):

(i) 8-hr TWA exposure evaluation: Measurements taken for the purpose of determining employee exposure under this standard are best taken with consecutive samples covering the full shift. Air samples must be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

(ii) STEL exposure evaluation: Measurements must represent 15 minute exposures associated with operations most likely to exceed the STEL in each job and on each shift.

(iii) Monitoring frequencies: Table 1 gives various exposure scenarios and their required monitoring frequencies, as required by the final standard for occupational exposure to butadiene.

Table 1. -- Five Exposure Scenarios and Their Associated Monitoring Frequencies

Action Level	8-hr TWA	STEL	Required Monitoring Activity
—*	—	—	No 8-hour TWA or STEL monitoring required.
+*	—	—	No STEL monitoring required. Monitor 8-hr TWA annually.
+	—	—	No STEL monitoring required. Periodic monitoring 8-hour TWA, in accordance with (4)(c)(iii).**
+	+	+	Periodic monitoring 8-hour TWA, in accordance with (4)(c)(iii)**. Periodic monitoring STEL in accordance with (4)(c)(iii).
+	—	+	Periodic monitoring STEL, in accordance with (4)(c)(iii). Monitor 8-hour TWA annually.

Footnote (\*) Exposure Scenario, Limit Exceeded: + = Yes, - = No.

Footnote (\*\*) The employer may decrease the frequency of exposure monitoring to annually when at least 2 consecutive measurements taken at least 7 days apart show exposures to be below the 8-hour TWA, but at or above the action level.

(iv) Monitoring techniques: Appendix D describes the validated method of sampling and analysis which has been tested by OSHA for use with BD. The employer has the obligation of selecting a monitoring method which meets the accuracy and precision requirements of the standard under his or her unique field conditions. The standard requires that the method of monitoring must be accurate, to a 95 percent confidence level, to plus or minus 25 percent for concentrations of BD at or above 1 ppm, and to plus or minus 35 percent for concentrations below 1 ppm.

(5) Personal Protective Equipment.

(a) Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent the skin from becoming frozen from contact with liquid BD.

(b) Any clothing which becomes wet with liquid BD should be removed immediately and not reworn until the butadiene has evaporated.

(c) Employees should be provided with and required to use splash proof safety goggles where liquid BD may contact the eyes.

(6) Housekeeping and Hygiene Facilities.

For purposes of complying with WAC 296-800-220 and 296-800-230, the following items should be emphasized:

(a) The workplace should be kept clean, orderly, and in a sanitary condition.

(b) Adequate washing facilities with hot and cold water are to be provided and maintained in a sanitary condition.

(7) Additional Precautions.

(a) Store BD in tightly closed containers in a cool, well-ventilated area and take all necessary precautions to avoid any explosion hazard.

(b) Nonsparking tools must be used to open and close metal containers. These containers must be effectively grounded.

(c) Do not incinerate BD cartridges, tanks or other containers.

(d) Employers must advise employees of all areas and operations where exposure to BD might occur.

Appendix C. Medical Screening and Surveillance for 1,3-Butadiene (Nonmandatory)

(1) Basis for Medical Screening and Surveillance Requirements.

(a) Route of Entry Inhalation.

(b) Toxicology.

Inhalation of BD has been linked to an increased risk of cancer, damage to the reproductive organs, and fetotoxicity. Butadiene can be converted via oxidation to epoxybutene and diepoxybutane, two genotoxic metabolites that may play a role in the expression of BD's toxic effects. BD has been tested for carcinogenicity in mice and rats. Both species responded to BD exposure by developing cancer at multiple primary organ sites. Early deaths in mice were caused by malignant lymphomas, primarily lymphocytic type, originating in the thymus.

Mice exposed to BD have developed ovarian or testicular atrophy. Sperm head morphology tests also revealed abnormal sperm in mice exposed to BD; lethal mutations were found in a dominant lethal test. In light of these results in animals, the possibility that BD may adversely affect the reproductive systems of male and female workers must be considered.

Additionally, anemia has been observed in animals exposed to butadiene. In some cases, this anemia appeared to be a primary response to exposure; in other cases, it may have been secondary to a neoplastic response.

(c) Epidemiology.

Epidemiologic evidence demonstrates that BD exposure poses an increased risk of leukemia. Mild alterations of hematologic parameters have also been observed in synthetic rubber workers exposed to BD.

(2) Potential Adverse Health Effects.

(a) Acute.

Skin contact with liquid BD causes characteristic burns or frostbite. BD in gaseous form can irritate the eyes, nasal passages, throat, and lungs. Blurred vision, coughing, and drowsiness may also occur. Effects are mild at 2,000 ppm and pronounced at 8,000 ppm for exposures occurring over the full workshift.

At very high concentrations in air, BD is an anesthetic, causing narcosis, respiratory paralysis, unconsciousness, and death. Such concentrations are unlikely, however, except in an extreme emergency because BD poses an explosion hazard at these levels.

(b) Chronic.

The principal adverse health effects of concern are BD-induced lymphoma, leukemia and potential reproductive toxicity. Anemia and other changes in the peripheral blood cells may be indicators of excessive exposure to BD.

(c) Reproductive.

Workers may be concerned about the possibility that their BD exposure may be affecting their ability to procreate a healthy child. For workers with high exposures to BD, especially those who have experienced difficulties in conceiving, miscarriages, or stillbirths, appropriate medical and laboratory evaluation of fertility may be necessary to determine if BD is having any adverse effect on the reproductive system or on the health of the fetus.

(3) Medical Screening Components At-A-Glance.

(a) Health Questionnaire.

The most important goal of the health questionnaire is to elicit information from the worker regarding potential signs or symptoms generally related to leukemia or other blood abnormalities. Therefore, physicians or other licensed health care professionals should be aware of the presenting symptoms and signs of lymphohematopoietic disorders and cancers, as well as the procedures necessary to confirm or exclude such diagnoses. Additionally, the health questionnaire will assist with the identification of workers at greatest risk of developing leukemia or adverse reproductive effects from their exposures to BD.

Workers with a history of reproductive difficulties or a personal or family history of immune deficiency syndromes, blood dyscrasias, lymphoma, or leukemia, and those who are or have been exposed to medicinal drugs or chemicals known to affect the hematopoietic or lymphatic systems may be at higher risk from their exposure to BD. After the initial administration, the health questionnaire must be updated annually.

(b) Complete Blood Count (CBC).

The medical screening and surveillance program requires an annual CBC, with differential and platelet count, to be provided for each employee with BD exposure. This test is to be performed on a blood sample obtained by phlebotomy of the venous system or, if technically feasible, from a fingerstick sample of capillary blood. The sample is to be analyzed by an accredited laboratory.

Abnormalities in a CBC may be due to a number of different etiologies. The concern for workers exposed to BD includes, but is not limited to, timely identification of lymphohematopoietic cancers, such as leukemia and non-Hodgkin's lymphoma. Abnormalities of portions of the CBC are identified by comparing an individual's results to those of an established range of normal values for males and females. A substantial change in any individual employee's CBC may also be viewed as "abnormal" for that individual even if all measurements fall within the population-based range of normal values. It is suggested that a flowsheet for laboratory values be included in each employee's medical record so that comparisons and trends in annual CBCs can be easily made.

A determination of the clinical significance of an abnormal CBC shall be the responsibility of the examining physician, other

licensed health care professional, or medical specialist to whom the employee is referred. Ideally, an abnormal CBC should be compared to previous CBC measurements for the same employee, when available. Clinical common sense may dictate that a CBC value that is very slightly outside the normal range does not warrant medical concern. A CBC abnormality may also be the result of a temporary physical stressor, such as a transient viral illness, blood donation, or menorrhagia, or laboratory error. In these cases, the CBC should be repeated in a timely fashion, i.e., within 6 weeks, to verify that return to the normal range has occurred. A clinically significant abnormal CBC should result in removal of the employee from further exposure to BD. Transfer of the employee to other work duties in a BD-free environment would be the preferred recommendation.

(c) Physical Examination.

The medical screening and surveillance program requires an initial physical examination for workers exposed to BD; this examination is repeated once every three years. The initial physical examination should assess each worker's baseline general health and rule out clinical signs of medical conditions that may be caused by or aggravated by occupational BD exposure. The physical examination should be directed at identification of signs of lymphohematopoietic disorders, including lymph node enlargement, splenomegaly, and hepatomegaly.

Repeated physical examinations should update objective clinical findings that could be indicative of interim development of a lymphohematopoietic disorder, such as lymphoma, leukemia, or other blood abnormality. Physical examinations may also be provided on an as needed basis in order to follow up on a positive answer on the health questionnaire, or in response to an abnormal CBC. Physical examination of workers who will no longer be working in jobs with BD exposure are intended to rule out lymphohematopoietic disorders.

The need for physical examinations for workers concerned about adverse reproductive effects from their exposure to BD should be identified by the physician or other licensed health care professional and provided accordingly. For these workers, such consultations and examinations may relate to developmental toxicity and reproductive capacity.

Physical examination of workers acutely exposed to significant levels of BD should be especially directed at the respiratory system, eyes, sinuses, skin, nervous system, and any region associated with particular complaints. If the worker has received a severe acute exposure, hospitalization may be required to assure proper medical management. Since this type of exposure may place workers at greater risk of blood abnormalities, a CBC must be obtained within 48 hours and repeated at one, two, and three months.

Appendix D: Sampling and Analytical Method for 1,3-Butadiene  
(Nonmandatory)

OSHA Method No.: 56.

Matrix: Air.

Target concentration: 1 ppm (2.21 mg/m<sup>3</sup>).

Procedure: Air samples are collected by drawing known volumes of air through sampling tubes containing charcoal adsorbent which has been coated with 4-tert-butylcatechol. The samples are desorbed with carbon disulfide and then analyzed by gas chromatography using a flame ionization detector.

Recommended sampling rate and air volume: 0.05 L/min and 3 L.

Detection limit of the overall procedure: 90 ppb (200 ug/m<sup>3</sup>) (based on 3 L air volume).

Reliable quantitation limit: 155 ppb (343 ug/m<sup>3</sup>) (based on 3 L air volume).

Standard error of estimate at the target concentration: 6.5%.

Special requirements: The sampling tubes must be coated with 4-tert-butylcatechol. Collected samples should be stored in a freezer.

Status of method: A sampling and analytical method has been subjected to the established evaluation procedures of the Organic Methods Evaluation Branch, OSHA Analytical Laboratory, Salt Lake City, Utah 84165.

(1) Background.

This work was undertaken to develop a sampling and analytical procedure for BD at 1 ppm. The current method recommended by OSHA for collecting BD uses activated coconut shell charcoal as the sampling medium (Ref. 5.2). This method was found to be inadequate for use at low BD levels because of sample instability.

The stability of samples has been significantly improved through the use of a specially cleaned charcoal which is coated with 4-tert-butylcatechol (TBC). TBC is a polymerization inhibitor for BD (Ref. 5.3).

(a) Toxic effects.

Symptoms of human exposure to BD include irritation of the eyes, nose and throat. It can also cause coughing, drowsiness and fatigue. Dermatitis and frostbite can result from skin exposure to liquid BD. (Ref. 5.1)

NIOSH recommends that BD be handled in the workplace as a potential occupational carcinogen. This recommendation is based on two inhalation studies that resulted in cancers at multiple sites in rats and in mice. BD has also demonstrated mutagenic activity in the presence of a liver microsomal activating system. It has also been reported to have adverse reproductive effects. (Ref. 5.1)

(b) Potential workplace exposure.

About 90% of the annual production of BD is used to manufacture styrene-butadiene rubber and Polybutadiene rubber. Other uses include: Polychloroprene rubber, acrylonitrile butadiene-styrene resins, nylon intermediates, styrene-butadiene latexes, butadiene polymers, thermoplastic elastomers, nitrile resins, methyl methacrylate-butadiene styrene resins and chemical intermediates. (Ref. 5.1)

(c) Physical properties (Ref. 5.1).

CAS No.: 106-99-0

Molecular weight: 54.1

Appearance: Colorless gas

Boiling point: -4.41 deg. C (760 mm Hg)  
Freezing point: -108.9 deg. C  
Vapor pressure: 2 atm (a) 15.3 deg. C; 5 atm (a) 47 deg. C  
Explosive limits: 2 to 11.5% (by volume in air)  
Odor threshold: 0.45 ppm  
Structural formula:  $H(2)C:CHCH:CH(2)$   
Synonyms: BD; biethylene; bivinyl; butadiene; divinyl; buta-1,3-diene; alpha-gamma-butadiene; erythrene; NCI-C50602; pyrrolylene; vinylethylene.

(d) Limit defining parameters.

The analyte air concentrations listed throughout this method are based on an air volume of 3 L and a desorption volume of 1 mL. Air concentrations listed in ppm are referenced to 25 deg. C and 760 mm Hg.

(e) Detection limit of the analytical procedure.

The detection limit of the analytical procedure was 304 pg per injection. This was the amount of BD which gave a response relative to the interferences present in a standard.

(f) Detection limit of the overall procedure.

The detection limit of the overall procedure was 0.60 ug per sample (90 ppb or 200 ug/m<sup>3</sup>). This amount was determined graphically. It was the amount of analyte which, when spiked on the sampling device, would allow recovery approximately equal to the detection limit of the analytical procedure.

(g) Reliable quantitation limit.

The reliable quantitation limit was 1.03 ug per sample (155 ppb or 343 ug/m<sup>3</sup>). This was the smallest amount of analyte which could be quantitated within the limits of a recovery of at least 75% and a precision (+/- 1.96 SD) of +/-25% or better.

(h) Sensitivity.(1)

Footnote (1)

The reliable quantitation limit and detection limits reported in the method are based upon optimization of the instrument for the smallest possible amount of analyte. When the target concentration of an analyte is exceptionally higher than these limits, they may not be attainable at the routine operation parameters.

The sensitivity of the analytical procedure over a concentration range representing 0.6 to 2 times the target concentration, based on the recommended air volume, was 387 area units per ug/mL. This value was determined from the slope of the calibration curve. The sensitivity may vary with the particular instrument used in the analysis.

(i) Recovery.

The recovery of BD from samples used in storage tests remained above 77% when the samples were stored at ambient temperature and above 94% when the samples were stored at refrigerated temperature. These values were determined from regression lines which were calculated from the storage data. The recovery of the analyte from the collection device must be at least 75% following storage.

(j) Precision (analytical method only).

The pooled coefficient of variation obtained from replicate determinations of analytical standards over the range of 0.6 to 2 times the target concentration was 0.011.

(k) Precision (overall procedure).

The precision at the 95% confidence level for the refrigerated

temperature storage test was +/- 12.7%. This value includes an additional +/- 5% for sampling error. The overall procedure must provide results at the target concentrations that are +/- 25% at the 95% confidence level.

(1) Reproducibility.

Samples collected from a controlled test atmosphere and a draft copy of this procedure were given to a chemist unassociated with this evaluation. The average recovery was 97.2% and the standard deviation was 6.2%.

(2) Sampling procedure.

(a) Apparatus. Samples are collected by use of a personal sampling pump that can be calibrated to within +/- 5% of the recommended 0.05 L/min sampling rate with the sampling tube in line.

(b) Samples are collected with laboratory prepared sampling tubes. The sampling tube is constructed of silane-treated glass and is about 5-cm long. The ID is 4 mm and the OD is 6 mm. One end of the tube is tapered so that a glass wool end plug will hold the contents of the tube in place during sampling. The opening in the tapered end of the sampling tube is at least one-half the ID of the tube (2 mm). The other end of the sampling tube is open to its full 4-mm ID to facilitate packing of the tube. Both ends of the tube are fire-polished for safety. The tube is packed with 2 sections of pretreated charcoal which has been coated with TBC. The tube is packed with a 50-mg backup section, located nearest the tapered end, and with a 100-mg sampling section of charcoal. The two sections of coated adsorbent are separated and retained with small plugs of silanized glass wool. Following packing, the sampling tubes are sealed with two 7/32 inch OD plastic end caps. Instructions for the pretreatment and coating of the charcoal are presented in Section 4.1 of this method.

(c) Reagents.

None required.

(d) Technique.

(i) Properly label the sampling tube before sampling and then remove the plastic end caps.

(ii) Attach the sampling tube to the pump using a section of flexible plastic tubing such that the larger front section of the sampling tube is exposed directly to the atmosphere. Do not place any tubing ahead of the sampling tube. The sampling tube should be attached in the worker's breathing zone in a vertical manner such that it does not impede work performance.

(iii) After sampling for the appropriate time, remove the sampling tube from the pump and then seal the tube with plastic end caps. Wrap the tube lengthwise.

(iv) Include at least one blank for each sampling set. The blank should be handled in the same manner as the samples with the exception that air is not drawn through it.

(v) List any potential interferences on the sample data sheet.

(vi) The samples require no special shipping precautions under normal conditions. The samples should be refrigerated if they are to be exposed to higher than normal ambient temperatures. If the samples are to be stored before they are shipped to the laboratory,

they should be kept in a freezer. The samples should be placed in a freezer upon receipt at the laboratory.

(e) Breakthrough.

(Breakthrough was defined as the relative amount of analyte found on the backup section of the tube in relation to the total amount of analyte collected on the sampling tube. Five-percent breakthrough occurred after sampling a test atmosphere containing 2.0 ppm BD for 90 min. at 0.05 L/min. At the end of this time 4.5 L of air had been sampled and 20.1 ug of the analyte was collected. The relative humidity of the sampled air was 80% at 23 deg. C.)

Breakthrough studies have shown that the recommended sampling procedure can be used at air concentrations higher than the target concentration. The sampling time, however, should be reduced to 45 min. if both the expected BD level and the relative humidity of the sampled air are high.

(f) Desorption efficiency.

The average desorption efficiency for BD from TBC coated charcoal over the range from 0.6 to 2 times the target concentration was 96.4%. The efficiency was essentially constant over the range studied.

(g) Recommended air volume and sampling rate.

(h) The recommended air volume is 3 L.

(i) The recommended sampling rate is 0.05 L/min. for 1 hour.

(j) Interferences.

There are no known interferences to the sampling method.

(k) Safety precautions.

(i) Attach the sampling equipment to the worker in such a manner that it will not interfere with work performance or safety.

(ii) Follow all safety practices that apply to the work area being sampled.

(3) Analytical procedure.

(a) Apparatus.

(i) A gas chromatograph (GC), equipped with a flame ionization detector (FID). (2)

Footnote (2) A Hewlett-Packard Model 5840A GC was used for this evaluation. Injections were performed using a Hewlett-Packard Model 7671A automatic sampler.

(ii) A GC column capable of resolving the analytes from any interference. (3)

Footnote (3) A 20-ft x 1/8-inch OD stainless steel GC column containing 20% FFAP on 80/100 mesh Chromabsorb W-AW-DMCS was used for this evaluation.

(iii) Vials, glass 2-mL with Teflon-lined caps.

(iv) Disposable Pasteur-type pipets, volumetric flasks, pipets and syringes for preparing samples and standards, making dilutions and performing injections.

(b) Reagents.

(i) Carbon disulfide. (4)

Footnote (4) Fisher Scientific Company A.C.S. Reagent Grade solvent was used in this evaluation.

The benzene contaminant that was present in the carbon disulfide was used as an internal standard (ISTD) in this evaluation.

(ii) Nitrogen, hydrogen and air, GC grade.

(iii) BD of known high purity.(5)

Footnote (5)

Matheson Gas Products, CP Grade 1,3-butadiene was used in this study.

(c) Standard preparation.

(i) Prepare standards by diluting known volumes of BD gas with carbon disulfide. This can be accomplished by injecting the appropriate volume of BD into the headspace above the 1-mL of carbon disulfide contained in sealed 2-mL vial. Shake the vial after the needle is removed from the septum.(6)

Footnote (6)

A standard containing 7.71 ug/mL (at ambient temperature and pressure) was prepared by diluting 4 uL of the gas with 1-mL of carbon disulfide.

(ii) The mass of BD gas used to prepare standards can be determined by use of the following equations:

$$MV = (760/BP) (273+t)/(273) (22.41)$$

Where:

MV = ambient molar volume

BP = ambient barometric pressure

T = ambient temperature

ug/uL = 54.09/MV

ug/standard = (ug/uL) (uL) BD used to prepare the standard

(d) Sample preparation.

(i) Transfer the 100-mg section of the sampling tube to a 2-mL vial. Place the 50-mg section in a separate vial. If the glass wool plugs contain a significant amount of charcoal, place them with the appropriate sampling tube section.

(ii) Add 1-mL of carbon disulfide to each vial.

(iii) Seal the vials with Teflon-lined caps and then allow them to desorb for one hour. Shake the vials by hand vigorously several times during the desorption period.

(iv) If it is not possible to analyze the samples within 4 hours, separate the carbon disulfide from the charcoal, using a disposable Pasteur-type pipet, following the one hour. This separation will improve the stability of desorbed samples.

(v) Save the used sampling tubes to be cleaned and repacked with fresh adsorbent.

(e) Analysis.

(i) GC Conditions.

Column temperature: 95 deg. C

Injector temperature: 180 deg. C

Detector temperature: 275 deg. C

Carrier gas flow rate: 30 mL/min.

Injection volume: 0.80 uL

GC column: 20-ft x 1/8-in OD stainless steel GC column containing 20%

FFAP on 80/100 Chromabsorb W-AW-DMCS.

(ii) Chromatogram. See Section 4.2.

(iii) Use a suitable method, such as electronic or peak heights, to measure detector response.

(iv) Prepare a calibration curve using several standard solutions of different concentrations. Prepare the calibration curve daily. Program the integrator to report the results in ug/mL.

(v) Bracket sample concentrations with standards.

(f) Interferences (analytical).

(i) Any compound with the same general retention time as the analyte and which also gives a detector response is a potential interference. Possible interferences should be reported by the industrial hygienist to the laboratory with submitted samples.

(ii) GC parameters (temperature, column, etc.) may be changed to circumvent interferences.

(iii) A useful means of structure designation is GC/MS. It is recommended that this procedure be used to confirm samples whenever possible.

(g) Calculations.

(i) Results are obtained by use of calibration curves. Calibration curves are prepared by plotting detector response against concentration for each standard. The best line through the data points is determined by curve fitting.

(ii) The concentration, in ug/mL, for a particular sample is determined by comparing its detector response to the calibration curve. If any analyte is found on the backup section, this amount is added to the amount found on the front section. Blank corrections should be performed before adding the results together.

(iii) The BD air concentration can be expressed using the following equation:

$$\text{mg/m}^3 = (A)(B)/(C)(D)$$

Where:

A = ug/mL from Section 3.7.2

B = volume

C = L of air sampled

D = efficiency

(iv) The following equation can be used to convert results in mg/m<sup>3</sup> to ppm:

$$\text{ppm} = (\text{mg/m}^3)(24.46)/54.09$$

Where:

mg/m<sup>3</sup> = result from Section 3.7.3.

24.46 = molar volume of an ideal gas at 760 mm Hg and 25 deg.

C.

(h) Safety precautions (analytical).

(i) Avoid skin contact and inhalation of all chemicals.

(ii) Restrict the use of all chemicals to a fume hood whenever possible.

(iii) Wear safety glasses and a lab coat in all laboratory areas.

(4) Additional Information.

(a) A procedure to prepare specially cleaned charcoal coated with TBC.

(i) Apparatus.

(A) Magnetic stirrer and stir bar.

(B) Tube furnace capable of maintaining a temperature of 700 deg. C and equipped with a quartz tube that can hold 30 g of charcoal. (8)

Footnote (8)

A Lindberg Type 55035 Tube furnace was used in this evaluation.

(C) A means to purge nitrogen gas through the charcoal inside the quartz tube.

(D) Water bath capable of maintaining a temperature of 60 deg. C.

(E) Miscellaneous laboratory equipment: One-liter vacuum flask, 1-L Erlenmeyer flask, 350-Ml Buchner funnel with a coarse fitted disc, 4-oz brown bottle, rubber stopper, Teflon tape etc.

(ii) Reagents.

(A) Phosphoric acid, 10% by weight, in water.(9)

Footnote (9) Baker Analyzed Reagent grade was diluted with water for use in this evaluation.

(B) 4-tert-Butylcatechol (TBC).(10)

Footnote (10) The Aldrich Chemical Company 99% grade was used in this evaluation.

(C) Specially cleaned coconut shell charcoal, 20/40 mesh.(11)

Footnote (11) Specially cleaned charcoal was obtained from Supelco, Inc. for use in this evaluation. The cleaning process used by Supelco is proprietary.

(D) Nitrogen gas, GC grade.

(iii) Procedure.

Weigh 30g of charcoal into a 500-mL Erlenmeyer flask. Add about 250 mL of 10% phosphoric acid to the flask and then swirl the mixture. Stir the mixture for 1 hour using a magnetic stirrer. Filter the mixture using a fitted Buchner funnel. Wash the charcoal several times with 250-mL portions of deionized water to remove all traces of the acid. Transfer the washed charcoal to the tube furnace quartz tube. Place the quartz tube in the furnace and then connect the nitrogen gas purge to the tube. Fire the charcoal to 700 deg. C. Maintain that temperature for at least 1 hour. After the charcoal has cooled to room temperature, transfer it to a tared beaker. Determine the weight of the charcoal and then add an amount of TBC which is 10% of the charcoal, by weight.

CAUTION-TBC is toxic and should only be handled in a fume hood while wearing gloves.

Carefully mix the contents of the beaker and then transfer the mixture to a 4-oz bottle. Stopper the bottle with a clean rubber stopper which has been wrapped with Teflon tape. Clamp the bottle in a water bath so that the water level is above the charcoal level. Gently heat the bath to 60 deg. C and then maintain that temperature for 1 hour. Cool the charcoal to room temperature and then transfer the coated charcoal to a suitable container.

The coated charcoal is now ready to be packed into sampling tubes. The sampling tubes should be stored in a sealed container to prevent contamination. Sampling tubes should be stored in the dark at room temperature. The sampling tubes should be segregated by coated adsorbent lot number.

(b) Chromatograms.

The chromatograms were obtained using the recommended analytical method. The chart speed was set at 1 cm/min. for the first three min. and then at 0.2 cm/min. for the time remaining in the analysis.

The peak which elutes just before BD is a reaction product between an impurity on the charcoal and TBC. This peak is always present, but it is easily resolved from the analyte. The peak which elutes immediately before benzene is an oxidation product of TBC.



8.

2. Please describe what you do during a typical work day.  
Be sure to tell about your work with BD.

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3. Please check any of these chemicals that you work with now or have worked with in the past:

benzene	_____
glues	_____
toluene	_____
inks, dyes	_____
other solvents, grease cutters	_____
insecticides (like DDT, lindane, etc.)	_____
paints, varnishes, thinners, strippers	_____
dusts	_____
carbon tetrachloride ("carbon tet")	_____
arsine	_____
carbon disulfide	_____
lead	_____
cement	_____
petroleum products	_____
nitrites	_____

4. Please check the protective clothing or equipment you use at the job you have now:

gloves	_____
coveralls	_____
respirator	_____
dust mask	_____
safety glasses, goggles	_____

Please circle your answer.

5. Does your protective clothing or equipment fit you properly? yes no

6. Have you ever made changes in your protective clothing or equipment to make it fit better? yes no

7. Have you been exposed to BD when you were not wearing protective clothing or equipment? yes no

8. Where do you eat, drink and/or smoke when you are at work? (Please check all that apply.)

Cafeteria/restaurant/snack bar	_____
Break room/employee lounge	_____
Smoking lounge	_____
At my work station	_____

Please circle your answer.

9. Have you been exposed to radiation (like x-rays or nuclear material) at the job you have now or at past jobs? yes no

10. Do you have any hobbies that expose you to dusts or chemicals (including paints, glues, etc.)? yes no

11. Do you have any second or side jobs? yes no  
If yes, what are your duties there?

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12. Were you in the military? yes no

If yes, what did you do in the military? \_\_\_\_\_

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Family Health History

1. In the FAMILY MEMBER column, across from the disease name, write which family member, if any, had the disease.

DISEASE	FAMILY MEMBER
Cancer	
Lymphoma	
Sickle Cell Disease or Trait	
Immune Disease	
Leukemia	
Anemia	

2. Please fill in the following information about family health

- Relative
- Alive?
- Age at Death?
- Cause of Death?
- Father
- Mother
- Brother/Sister
- Brother/Sister
- Brother/Sister

Personal Health History

Birth Date \_\_/\_\_/\_\_ Age \_\_\_\_ Sex \_\_\_\_ Height \_\_ Weight \_

Please circle your answer.

- 1. Do you smoke any tobacco products? yes no
- 2. Have you ever had any kind of surgery or operation?  
yes no

If yes, what type of surgery:

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3. Have you ever been in the hospital for any other reasons? yes no

If yes, please describe the reason \_\_\_\_\_

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4. Do you have any on-going or current medical problems or conditions? yes no

If yes, please describe: \_\_\_\_\_

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5. Do you now have or have you ever had any of the following? Please check all that apply to you.

- unexplained fever \_\_\_\_\_
- anemia ("low blood") \_\_\_\_\_
- HIV/AIDS \_\_\_\_\_
- weakness \_\_\_\_\_
- sickle cell \_\_\_\_\_
- miscarriage \_\_\_\_\_
- skin rash \_\_\_\_\_
- bloody stools \_\_\_\_\_
- leukemia/lymphoma \_\_\_\_\_
- neck mass/swelling \_\_\_\_\_
- wheezing \_\_\_\_\_
- yellowing of skin \_\_\_\_\_
- bruising easily \_\_\_\_\_
- lupus \_\_\_\_\_
- weight loss \_\_\_\_\_
- kidney problems \_\_\_\_\_
- enlarged lymph nodes \_\_\_\_\_
- liver disease \_\_\_\_\_
- cancer \_\_\_\_\_
- infertility \_\_\_\_\_
- drinking problems \_\_\_\_\_
- thyroid problems \_\_\_\_\_
- night sweats \_\_\_\_\_
- chest pain \_\_\_\_\_
- still birth \_\_\_\_\_
- eye redness \_\_\_\_\_
- lumps you can feel \_\_\_\_\_
- child with birth defect \_\_\_\_\_
- autoimmune disease \_\_\_\_\_
- overly tired \_\_\_\_\_
- lung problems \_\_\_\_\_
- rheumatoid arthritis \_\_\_\_\_
- mononucleosis ("mono") \_\_\_\_\_
- nagging cough \_\_\_\_\_

Please circle your answer.

6. Do you have any symptoms or health problems that you think may be related to your work with BD? yes no

If yes, please describe: \_\_\_\_\_

7. Have any of your co-workers had similar symptoms or problems? yes no don't know

If yes, please describe: \_\_\_\_\_

8. Do you notice any irritation of your eyes, nose, throat, lungs, or skin when working with BD? yes no

9. Do you notice any blurred vision, coughing, drowsiness, nausea, or headache when working with BD? yes no

10. Do you take any medications (including birth control or over-the-counter)? yes no

If yes, please list: \_\_\_\_\_

11. Are you allergic to any medication, food, or chemicals? yes no

If yes, please list: \_\_\_\_\_

12. Do you have any health conditions not covered by this questionnaire that you think are affected by your work with BD? yes no

If yes, please explain: \_\_\_\_\_

13. Did you understand all the questions? yes no

\_\_\_\_\_  
Signature

### 1,3-Butadiene (BD) Health Update Questionnaire

#### DIRECTIONS:

You have been asked to answer the questions on this form because you work with BD (butadiene). These questions are about your work, medical history, and health concerns. Please do your best to answer all of the questions. If you need help, please tell the doctor or health care professional who reviews this form.

This form is a confidential medical record. Only information directly related to your health and safety on the job may be given to your employer. Personal health information will not be given to anyone without your consent.

Date: \_\_\_\_\_

Name: \_\_\_\_\_ SSN \_/ \_/ \_\_\_\_  
Last First MI

Job Title: \_\_\_\_\_

Company's Name: \_\_\_\_\_

Supervisor's Name: \_\_\_\_\_

Supervisor's Phone No.: ( ) \_\_\_ - \_\_\_

1. Please describe any NEW duties that you have at your job. \_\_\_\_\_

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2. Please describe any additional job duties you have:

_____	_____
_____	_____
_____	_____
_____	_____

Please circle your answer.

3. Are you exposed to any other chemicals in your work since the last time you were evaluated for exposure to BD? yes no

If yes, please list what they are: \_\_\_\_\_

---

4. Does your personal protective equipment and clothing fit you properly? yes no

5. Have you made changes in this equipment or clothing to make it fit better? yes no

6. Have you been exposed to BD when you were not wearing protective clothing or equipment? yes no

7. Are you exposed to any NEW chemicals at home or while working on hobbies? yes no

If yes, please list what they are: \_\_\_\_\_

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8. Since your last BD health evaluation, have you started working any new second or side jobs? yes no

If yes, what are your duties there? \_\_\_\_\_

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#### Personal Health History

1. What is your current weight? \_\_\_ pounds

2. Have you been diagnosed with any new medical conditions or illness since your last evaluation?

yes no

If yes, please tell what they are: \_\_\_\_\_

---

3. Since your last evaluation, have you been in the hospital for any illnesses, injuries, or surgery? yes no

If yes, please describe: \_\_\_\_\_

---

4. Do you have any of the following? Please place a check for all that apply to you.

- unexplained fever \_\_\_\_\_
- anemia ("low blood") \_\_\_\_\_
- HIV/AIDS \_\_\_\_\_
- weakness \_\_\_\_\_
- sickle cell \_\_\_\_\_
- miscarriage \_\_\_\_\_
- skin rash \_\_\_\_\_
- bloody stools \_\_\_\_\_
- leukemia/lymphoma \_\_\_\_\_
- neck mass/swelling \_\_\_\_\_
- wheezing \_\_\_\_\_
- yellowing of skin \_\_\_\_\_
- bruising easily \_\_\_\_\_
- lupus \_\_\_\_\_
- weight loss \_\_\_\_\_
- kidney problems \_\_\_\_\_
- enlarged lymph nodes \_\_\_\_\_
- liver disease \_\_\_\_\_
- cancer \_\_\_\_\_
- infertility \_\_\_\_\_
- drinking problems \_\_\_\_\_
- thyroid problems \_\_\_\_\_
- night sweats \_\_\_\_\_
- chest pain \_\_\_\_\_
- still birth \_\_\_\_\_
- eye redness \_\_\_\_\_
- lumps you can feel \_\_\_\_\_
- child with birth defect \_\_\_\_\_
- autoimmune disease \_\_\_\_\_
- overly tired \_\_\_\_\_
- lung problems \_\_\_\_\_
- rheumatoid arthritis \_\_\_\_\_
- mononucleosis ("mono") \_\_\_\_\_
- nagging cough \_\_\_\_\_

Please circle your answer.

5. Do you have any symptoms or health problems that you think may be related to your work with BD? yes no

If yes, please describe: \_\_\_\_\_

---

6. Have any of your co-workers had similar symptoms or problems? yes no don't know

If yes, please describe: \_\_\_\_\_

7. Do you notice any irritation of your eyes, nose, throat, lungs, or skin when working with BD? yes no

8. Do you notice any blurred vision, coughing, drowsiness, nausea, or headache when working with BD? yes no

9. Have you been taking any NEW medications (including birth control or over-the-counter)? yes no

If yes, please list:

\_\_\_\_\_  
\_\_\_\_\_

10. Have you developed any new allergies to medications, foods, or chemicals? yes no

If yes, please list:

\_\_\_\_\_  
\_\_\_\_\_

11. Do you have any health conditions not covered by this questionnaire that you think are affected by your work with BD? yes no

If yes, please explain: \_\_\_\_\_

12. Do you understand all the questions? yes no

\_\_\_\_\_  
Signature

AMENDATORY SECTION (Amending WSR 09-15-145, filed 7/21/09, effective 9/1/09)

**WAC 296-62-07521 Lead.** (1) Scope and application.

(a) This section applies to all occupational exposure to lead, except as provided in subdivision (1)(b).

(b) This section does not apply to the construction industry or to agricultural operations covered by chapter 296-307 WAC.

(2) Definitions as applicable to this part.

(a) "Action level" - Employee exposure, without regard to the use of respirators, to an airborne concentration of lead of thirty micrograms per cubic meter of air ( $30 \mu\text{g}/\text{m}^3$ ) averaged over an eight-hour period.

(b) "Director" - The director of the department of labor and industries.

(c) "Lead" - Metallic lead, all inorganic lead compounds, and organic lead soaps. Excluded from this definition are all other organic lead compounds.

(3) General requirements.

(a) Employers will assess the hazards of lead in the work place and provide information to the employees about the hazards of the lead exposures to which they may be exposed.

(b) Information provided shall include:

(i) Exposure monitoring (including employee notification);

(ii) Written compliance programs;

(iii) Respiratory protection programs;

(iv) Personnel protective equipment and housekeeping;

(v) Medical surveillance and examinations;

(vi) Training requirements;

(vii) Recordkeeping requirements.

(4) Permissible exposure limit (PEL).

(a) The employer shall assure that no employee is exposed to lead at concentrations greater than fifty micrograms per cubic meter of air ( $50 \mu\text{g}/\text{m}^3$ ) averaged over an eight-hour period.

(b) If an employee is exposed to lead for more than eight hours in any work day, the permissible exposure limit, as a time weighted average (TWA) for that day, shall be reduced according to the following formula:

Maximum permissible limit (in  $\mu\text{g}/\text{m}^3$ ) =  $400 \div$   
hours worked in the day.

(c) When respirators are used to supplement engineering and work practice controls to comply with the PEL and all the requirements of subsection (7) have been met, employee exposure, for the purpose of determining whether the employer has complied with the PEL, may be considered to be at the level provided by the protection factor of the respirator for those periods the respirator is worn. Those periods may be averaged with exposure

levels during periods when respirators are not worn to determine the employee's daily TWA exposure.

(5) Exposure monitoring.

(a) General.

(i) For the purposes of subsection (5), employee exposure is that exposure which would occur if the employee were not using a respirator.

(ii) With the exception of monitoring under subdivision (5)(c), the employer shall collect full shift (for at least seven continuous hours) personal samples including at least one sample for each shift for each job classification in each work area.

(iii) Full shift personal samples shall be representative of the monitored employee's regular, daily exposure to lead.

(b) Initial determination. Each employer who has a workplace or work operation covered by this standard shall determine if any employee may be exposed to lead at or above the action level.

(c) Basis of initial determination.

(i) The employer shall monitor employee exposures and shall base initial determinations on the employee exposure monitoring results and any of the following, relevant considerations:

(A) Any information, observations, or calculations which would indicate employee exposure to lead;

(B) Any previous measurements of airborne lead; and

(C) Any employee complaints of symptoms which may be attributable to exposure to lead.

(ii) Monitoring for the initial determination may be limited to a representative sample of the exposed employees who the employer reasonably believes are exposed to the greatest airborne concentrations of lead in the workplace.

(iii) Measurements of airborne lead made in the preceding twelve months may be used to satisfy the requirement to monitor under item (5)(c)(i) if the sampling and analytical methods used meet the accuracy and confidence levels of subdivision (5)(i) of this section.

(d) Positive initial determination and initial monitoring.

(i) Where a determination conducted under subdivision (5)(b) and (5)(c) of this section shows the possibility of any employee exposure at or above the action level, the employer shall conduct monitoring which is representative of the exposure for each employee in the workplace who is exposed to lead.

(ii) Measurements of airborne lead made in the preceding twelve months may be used to satisfy this requirement if the sampling and analytical methods used meet the accuracy and confidence levels of subdivision (5)(i) of this section.

(e) Negative initial determination. Where a determination, conducted under subdivisions (5)(b) and (5)(c) of this section is made that no employee is exposed to airborne concentrations of lead at or above the action level, the employer shall make a written record of such determination. The record shall include at least the information specified in subdivision (5)(c) of this section and shall also include the date of determination, location within the worksite, and the name and Social Security number of each employee monitored.

(f) Frequency.

(i) If the initial monitoring reveals employee exposure to be below the action level the measurements need not be repeated except as otherwise provided in subdivision (5)(g) of this section.

(ii) If the initial determination or subsequent monitoring reveals employee exposure to be at or above the action level but below the permissible exposure limit the employer shall repeat monitoring in accordance with this subsection at least every six months. The employer shall continue monitoring at the required frequency until at least two consecutive measurements, taken at least seven days apart, are below the action level at which time the employer may discontinue monitoring for that employee except as otherwise provided in subdivision (5)(g) of this section.

(iii) If the initial monitoring reveals that employee exposure is above the permissible exposure limit the employer shall repeat monitoring quarterly. The employer shall continue monitoring at the required frequency until at least two consecutive measurements, taken at least seven days apart, are below the PEL but at or above the action level at which time the employer shall repeat monitoring for that employee at the frequency specified in item (5)(f)(ii), except as otherwise provided in subdivision (5)(g) of this section.

(g) Additional monitoring. Whenever there has been a production, process, control or personnel change which may result in new or additional exposure to lead, or whenever the employer has any other reason to suspect a change which may result in new or additional exposures to lead, additional monitoring in accordance with this subsection shall be conducted.

(h) Employee notification.

(i) Within five working days after the receipt of monitoring results, the employer shall notify each employee in writing of the results which represent that employee's exposure.

(ii) Whenever the results indicate that the representative employee exposure, without regard to respirators, exceeds the permissible exposure limit, the employer shall include in the written notice a statement that the permissible exposure limit was exceeded and a description of the corrective action taken or to be taken to reduce exposure to or below the permissible exposure limit.

(i) Accuracy of measurement. The employer shall use a method of monitoring and analysis which has an accuracy (to a confidence level of ninety-five percent) of not less than plus or minus twenty percent for airborne concentrations of lead equal to or greater than 30  $\mu\text{g}/\text{m}^3$ .

(6) Methods of compliance.

(a) Engineering and work practice controls.

(i) Where any employee is exposed to lead above the permissible exposure limit for more than thirty days per year, the employer shall implement engineering and work practice controls (including administrative controls) to reduce and maintain employee exposure to lead in accordance with the implementation schedule in Table I below, except to the extent that the employer can demonstrate that such controls are not feasible. Wherever the engineering and work practice controls which can be instituted are

not sufficient to reduce employee exposure to or below the permissible exposure limit, the employer shall nonetheless use them to reduce exposures to the lowest feasible level and shall supplement them by the use of respiratory protection which complies with the requirements of subsection (7) of this section.

(ii) Where any employee is exposed to lead above the permissible exposure limit, but for thirty days or less per year, the employer shall implement engineering controls to reduce exposures to 200 µg/m<sup>3</sup>, but thereafter may implement any combination of engineering, work practice (including administrative controls), and respiratory controls to reduce and maintain employee exposure to lead to or below 50 µg/m<sup>3</sup>.

TABLE 1

Industry	Compliance dates: <sup>1</sup> (50 µg/m <sup>3</sup> )
Lead chemicals, secondary copper smelting.	July 19, 1996
Nonferrous foundries .....	July 19, 1996. <sup>2</sup>
Brass and bronze ingot manufacture.	6 years. <sup>3</sup>

<sup>1</sup> Calculated by counting from the date the stay on implementation of subsection (6)(a) was lifted by the U.S. Court of Appeals for the District of Columbia, the number of years specified in the 1978 lead standard and subsequent amendments for compliance with the PEL of 50 µg/m<sup>3</sup> for exposure to airborne concentrations of lead levels for the particular industry.

<sup>2</sup> Large nonferrous foundries (20 or more employees) are required to achieve the PEL of 50 µg/m<sup>3</sup> by means of engineering and work practice controls. Small nonferrous foundries (fewer than 20 employees) are required to achieve an 8-hour TWA of 75 µg/m<sup>3</sup> by such controls.

<sup>3</sup> Expressed as the number of years from the date on which the Court lifts the stay on the implementation of subsection (6)(a) for this industry for employers to achieve a lead in air concentration of 75 µg/m<sup>3</sup>. Compliance with subsection (6) in this industry is determined by a compliance directive that incorporates elements from the settlement agreement between OSHA and representatives of the industry.

(b) Respiratory protection. Where engineering and work practice controls do not reduce employee exposure to or below the 50 µg/m<sup>3</sup> permissible exposure limit, the employer shall supplement these controls with respirators in accordance with subsection (7).

(c) Compliance program.

(i) Each employer shall establish and implement a written compliance program to reduce exposures to or below the permissible exposure limit, and interim levels if applicable, solely by means of engineering and work practice controls in accordance with the implementation schedule in subdivision (6)(a).

(ii) Written plans for these compliance programs shall include at least the following:

(A) A description of each operation in which lead is emitted; e.g., machinery used, material processed, controls in place, crew size, employee job responsibilities, operating procedures and maintenance practices;

(B) A description of the specific means that will be employed

to achieve compliance, including engineering plans and studies used to determine methods selected for controlling exposure to lead;

(C) A report of the technology considered in meeting the permissible exposure limit;

(D) Air monitoring data which documents the source of lead emissions;

(E) A detailed schedule for implementation of the program, including documentation such as copies of purchase orders for equipment, construction contracts, etc.;

(F) A work practice program which includes items required under subsections (8), (9) and (10) of this regulation;

(G) An administrative control schedule required by subdivision (6)(f), if applicable; and

(H) Other relevant information.

(iii) Written programs shall be submitted upon request to the director, and shall be available at the worksite for examination and copying by the director, any affected employee or authorized employee representatives.

(iv) Written programs shall be revised and updated at least every six months to reflect the current status of the program.

(d) Mechanical ventilation.

(i) When ventilation is used to control exposure, measurements which demonstrate the effectiveness of the system in controlling exposure, such as capture velocity, duct velocity, or static pressure shall be made at least every three months. Measurements of the system's effectiveness in controlling exposure shall be made within five days of any change in production, process, or control which might result in a change in employee exposure to lead.

(ii) Recirculation of air. If air from exhaust ventilation is recirculated into the workplace, the employer shall assure that (A) the system has a high efficiency filter with reliable back-up filter; and (B) controls to monitor the concentration of lead in the return air and to bypass the recirculation system automatically if it fails are installed, operating, and maintained.

(e) Administrative controls. If administrative controls are used as a means of reducing employees TWA exposure to lead, the employer shall establish and implement a job rotation schedule which includes:

(i) Name or identification number of each affected employee;

(ii) Duration and exposure levels at each job or work station where each affected employee is located; and

(iii) Any other information which may be useful in assessing the reliability of administrative controls to reduce exposure to lead.

(7) Respiratory protection.

(a) General. For employees who use respirators required by this section, the employer must provide each employee an appropriate respirator that complies with the requirements of this subsection. Respirators must be used during:

(i) Period necessary to install or implement engineering or work-practice controls;

(ii) Work operations for which engineering and work-practice controls are not sufficient to reduce exposures to or below the

permissible exposure limit;

(iii) Periods when an employee requests a respirator.

(b) Respirator program.

(i) The employer must develop, implement and maintain a respiratory protection program as required by chapter 296-842 WAC, Respirators, which covers each employee required by this chapter to use a respirator.

(ii) If an employee has breathing difficulty during fit testing or respirator use, the employer must provide the employee with a medical examination as required by subsection (11)(c)(ii)(C) of this section to determine whether or not the employee can use a respirator while performing the required duty.

(c) Respirator selection. The employer must:

(i) Select and provide to employees appropriate respirators according to this section and WAC 296-842-13005, found in the respirator rule.

(ii) Provide employees with a powered air-purifying respirator (PAPR) instead of a negative-pressure respirator selected when an employee chooses to use a PAPR and it provides adequate protection to the employee.

(iii) Provide employees with full-facepiece respirators instead of half-facepiece respirators for protection against lead aerosols that cause eye or skin irritation at the use concentration.

(iv) Provide HEPA filters or N-, R-, or P-100 filters for powered air-purifying respirators (PAPRs) and negative-pressure air-purifying respirators.

(8) Protective work clothing and equipment.

(a) Provision and use. If an employee is exposed to lead above the PEL, without regard to the use of respirators or where the possibility of skin or eye irritation exists, the employer shall provide at no cost to the employee and assure that the employee uses appropriate protective work clothing and equipment such as, but not limited to:

(i) Coveralls or similar full-body work clothing;

(ii) Gloves, hats, and shoes or disposable shoe coverlets; and

(iii) Face shields, vented goggles, or other appropriate protective equipment which complies with WAC 296-800-160.

(b) Cleaning and replacement.

(i) The employer shall provide the protective clothing required in subdivision (8)(a) of this section in a clean and dry condition at least weekly, and daily to employees whose exposure levels without regard to a respirator are over 200  $\mu\text{g}/\text{m}^3$  of lead as an eight-hour TWA.

(ii) The employer shall provide for the cleaning, laundering, or disposal of protective clothing and equipment required by subdivision (8)(a) of this section.

(iii) The employer shall repair or replace required protective clothing and equipment as needed to maintain their effectiveness.

(iv) The employer shall assure that all protective clothing is removed at the completion of a work shift only in change rooms provided for that purpose as prescribed in subdivision (10)(b) of this section.

(v) The employer shall assure that contaminated protective clothing which is to be cleaned, laundered, or disposed of, is placed in a closed container in the change-room which prevents dispersion of lead outside the container.

(vi) The employer shall inform in writing any person who cleans or launders protective clothing or equipment of the potentially harmful effects of exposure to lead.

(vii) The employer shall assure that the containers of contaminated protective clothing and equipment required by subdivision (8)(b)(v) are labeled as follows:

CAUTION: CLOTHING CONTAMINATED WITH LEAD.  
DO NOT REMOVE DUST BY BLOWING OR SHAKING.  
DISPOSE OF LEAD CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE  
LOCAL, STATE, OR FEDERAL REGULATIONS.

(viii) The employer shall prohibit the removal of lead from protective clothing or equipment by blowing, shaking, or any other means which disperses lead into the air.

(9) Housekeeping.

(a) Surfaces. All surfaces shall be maintained as free as practicable of accumulations of lead.

(b) Cleaning floors.

(i) Floors and other surfaces where lead accumulates may not be cleaned by the use of compressed air.

(ii) Shoveling, dry or wet sweeping, and brushing may be used only where vacuuming or other equally effective methods have been tried and found not to be effective.

(c) Vacuuming. Where vacuuming methods are selected, the vacuums shall be used and emptied in a manner which minimizes the reentry of lead into the workplace.

(10) Hygiene facilities and practices.

(a) The employer shall assure that in areas where employees are exposed to lead above the PEL, without regard to the use of respirators, food or beverage is not present or consumed, tobacco products are not present or used, and cosmetics are not applied, except in change rooms, lunchrooms, and showers required under subdivision (10)(b) through (10)(d) of this section.

(b) Change rooms.

(i) The employer shall provide clean change rooms for employees who work in areas where their airborne exposure to lead is above the PEL, without regard to the use of respirators.

(ii) The employer shall assure that change rooms are equipped with separate storage facilities for protective work clothing and equipment and for street clothes which prevent cross-contamination.

(c) Showers.

(i) The employer shall assure that employees who work in areas where their airborne exposure to lead is above the PEL, without regard to the use of respirators, shower at the end of the work shift.

(ii) The employer shall provide shower facilities in accordance with WAC 296-800-230.

(iii) The employer shall assure that employees who are required to shower pursuant to item (10)(c)(i) do not leave the

workplace wearing any clothing or equipment worn during the work shift.

(d) Lunchrooms.

(i) The employer shall provide lunchroom facilities for employees who work in areas where their airborne exposure to lead is above the PEL, without regard to the use of respirators.

(ii) The employer shall assure that lunchroom facilities have a temperature controlled, positive pressure, filtered air supply, and are readily accessible to employees.

(iii) The employer shall assure that employees who work in areas where their airborne exposure to lead is above the PEL without regard to the use of a respirator wash their hands and face prior to eating, drinking, smoking or applying cosmetics.

(iv) The employer shall assure that employees do not enter lunchroom facilities with protective work clothing or equipment unless surface lead dust has been removed by vacuuming, downdraft booth, or other cleaning method.

(e) Lavatories. The employer shall provide an adequate number of lavatory facilities which comply with WAC 296-800-230.

(11) Medical surveillance.

(a) General.

(i) The employer shall institute a medical surveillance program for all employees who are or may be exposed at or above the action level for more than thirty days per year.

(ii) The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician.

(iii) The employer shall provide the required medical surveillance including multiple physician review under item (11)(c)(iii) without cost to employees and at a reasonable time and place.

(b) Biological monitoring.

(i) Blood lead and ZPP level sampling and analysis. The employer shall make available biological monitoring in the form of blood sampling and analysis for lead and zinc protoporphyrin levels to each employee covered under item (11)(a)(i) of this section on the following schedule:

(A) At least every six months to each employee covered under item (11)(a)(i) of this section;

(B) At least every two months for each employee whose last blood sampling and analysis indicated a blood lead level at or above 40 µg/100 g of whole blood. This frequency shall continue until two consecutive blood samples and analyses indicate a blood lead level below 40 µg/100 g of whole blood; and

(C) At least monthly during the removal period of each employee removed from exposure to lead due to an elevated blood lead level.

(ii) Follow-up blood sampling tests. Whenever the results of a blood lead level test indicate that an employee's blood lead level (~~exceeds~~) is at or above the numerical criterion for medical removal under item (12)(a)(i)(A), the employer shall provide a second (follow-up) blood sampling test within two weeks after the employer receives the results of the first blood sampling

test.

(iii) Accuracy of blood lead level sampling and analysis. Blood lead level sampling and analysis provided pursuant to this section shall have an accuracy (to a confidence level of ninety-five percent) within plus or minus fifteen percent or 6 µg/100 ml, whichever is greater, and shall be conducted by a laboratory licensed by the Center for Disease Control (CDC), United States Department of Health, Education and Welfare or which has received a satisfactory grade in blood lead proficiency testing from CDC in the prior twelve months.

(iv) Employee notification. Within five working days after the receipt of biological monitoring results, the employer shall notify in writing each employee whose blood lead level (~~exceeds~~) is at or above 40 µg/100 g: (A) of that employee's blood lead level and (B) that the standard requires temporary medical removal with medical removal protection benefits when an employee's blood lead level exceeds the numerical criterion for medical removal under item (12)(a)(i) of this section.

(c) Medical examinations and consultations.

(i) Frequency. The employer shall make available medical examinations and consultations to each employee covered under item (11)(a)(i) of this section on the following schedule:

(A) At least annually for each employee for whom a blood sampling test conducted at any time during the preceding twelve months indicated a blood lead level at or above 40 µg/100 g;

(B) Prior to assignment for each employee being assigned for the first time to an area in which airborne concentrations of lead are at or above the action level;

(C) As soon as possible, upon notification by an employee either that the employee has developed signs or symptoms commonly associated with lead intoxication, that the employee desires medical advice concerning the effects of current or past exposure to lead on the employee's ability to procreate a healthy child, or that the employee has demonstrated difficulty in breathing during a respirator fitting test or during use; and

(D) As medically appropriate for each employee either removed from exposure to lead due to a risk of sustaining material impairment to health, or otherwise limited pursuant to a final medical determination.

(ii) Content. Medical examinations made available pursuant to subitems (11)(c)(i)(A) through (B) of this section shall include the following elements:

(A) A detailed work history and a medical history, with particular attention to past lead exposure (occupational and nonoccupational), personal habits (smoking, hygiene), and past gastrointestinal, hematologic, renal, cardiovascular, reproductive and neurological problems;

(B) A thorough physical examination, with particular attention to teeth, gums, hematologic, gastrointestinal, renal, cardiovascular, and neurological systems. Pulmonary status should be evaluated if respiratory protection will be used;

(C) A blood pressure measurement;

(D) A blood sample and analysis which determines:

- (I) Blood lead level;
- (II) Hemoglobin and hematocrit determinations, red cell indices, and examination of peripheral smear morphology;
- (III) Zinc protoporphyrin;
- (IV) Blood urea nitrogen; and
- (V) Serum creatinine;
- (E) A routine urinalysis with microscopic examination; and
- (F) Any laboratory or other test which the examining physician deems necessary by sound medical practice.

The content of medical examinations made available pursuant to subitems (11)(c)(i)(C) through (D) of this section shall be determined by an examining physician and, if requested by an employee, shall include pregnancy testing or laboratory evaluation of male fertility.

(iii) Multiple physician review mechanism.

(A) If the employer selects the initial physician who conducts any medical examination or consultation provided to an employee under this section, the employee may designate a second physician:

(I) To review any findings, determinations or recommendations of the initial physician; and

(II) To conduct such examinations, consultations, and laboratory tests as the second physician deems necessary to facilitate this review.

(B) The employer shall promptly notify an employee of the right to seek a second medical opinion after each occasion that an initial physician conducts a medical examination or consultation pursuant to this section. The employer may condition its participation in, and payment for, the multiple physician review mechanism upon the employee doing the following within fifteen days after receipt of the foregoing notification, or receipt of the initial physician's written opinion, whichever is later:

(I) The employee informing the employer that he or she intends to seek a second medical opinion, and

(II) The employee initiating steps to make an appointment with a second physician.

(C) If the findings, determinations or recommendations of the second physician differ from those of the initial physician, then the employer and the employee shall assure that efforts are made for the two physicians to resolve any disagreement.

(D) If the two physicians have been unable to quickly resolve their disagreement, then the employer and the employee through their respective physicians shall designate a third physician:

(I) To review any findings, determinations or recommendations of the prior physicians; and

(II) To conduct such examinations, consultations, laboratory tests and discussions with the prior physicians as the third physician deems necessary to resolve the disagreement of the prior physicians.

(E) The employer shall act consistent with the findings, determinations and recommendations of the third physician, unless the employer and the employee reach an agreement which is otherwise consistent with the recommendations of at least one of the three physicians.

(iv) Information provided to examining and consulting physicians.

(A) The employer shall provide an initial physician conducting a medical examination or consultation under this section with the following information:

(I) A copy of this regulation for lead including all appendices;

(II) A description of the affected employee's duties as they relate to the employee's exposure;

(III) The employee's exposure level or anticipated exposure level to lead and to any other toxic substance (if applicable);

(IV) A description of any personal protective equipment used or to be used;

(V) Prior blood lead determinations; and

(VI) All prior written medical opinions concerning the employee in the employer's possession or control.

(B) The employer shall provide the foregoing information to a second or third physician conducting a medical examination or consultation under this section upon request either by the second or third physician, or by the employee.

(v) Written medical opinions.

(A) The employer shall obtain and furnish the employee with a copy of a written medical opinion from each examining or consulting physician which contains the following information:

(I) The physician's opinion as to whether the employee has any detected medical condition which would place the employee at increased risk of material impairment of the employee's health from exposure to lead;

(II) Any recommended special protective measures to be provided to the employee, or limitations to be placed upon the employee's exposure to lead;

(III) Any recommended limitation upon the employee's use of respirators, including a determination of whether the employee can wear a powered air purifying respirator if a physician determines that the employee cannot wear a negative pressure respirator; and

(IV) The results of the blood lead determinations.

(B) The employer shall instruct each examining and consulting physician to:

(I) Not reveal either in the written opinion, or in any other means of communication with the employer, findings, including laboratory results, or diagnoses unrelated to an employee's occupational exposure to lead; and

(II) Advise the employee of any medical condition, occupational or nonoccupational, which dictates further medical examination or treatment.

(vi) Alternate physician determination mechanisms. The employer and an employee or authorized employee representative may agree upon the use of any expeditious alternate physician determination mechanism in lieu of the multiple physician review mechanism provided by this subsection so long as the alternate mechanism otherwise satisfies the requirements contained in this subsection.

(d) Chelation.

(i) The employer shall assure that any person whom he retains, employs, supervises or controls does not engage in prophylactic chelation of any employee at any time.

(ii) If therapeutic or diagnostic chelation is to be performed by any person in item (11)(d)(i), the employer shall assure that it be done under the supervision of a licensed physician in a clinical setting with thorough and appropriate medical monitoring and that the employee is notified in writing prior to its occurrence.

(12) Medical removal protection.

(a) Temporary medical removal and return of an employee.

(i) Temporary removal due to elevated blood lead levels.

(A) The employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that a periodic and a follow-up blood sampling test conducted pursuant to this section indicate that the employee's blood lead level is at or above 60  $\mu\text{g}/100\text{g}$  of whole blood; and

(B) The employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that the average of the last three blood sampling tests conducted pursuant to this section (or the average of all blood sampling tests conducted over the previous six months, whichever is longer) indicates that the employee's blood lead level is at or above 50  $\mu\text{g}/100\text{g}$  of whole blood; provided, however, that an employee need not be removed if the last blood sampling test indicates a blood lead level (~~at or~~) below 40  $\mu\text{g}/100\text{g}$  of whole blood.

(ii) Temporary removal due to a final medical determination.

(A) The employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that a final medical determination results in a medical finding, determination, or opinion that the employee has a detected medical condition which places the employee at increased risk of material impairment to health from exposure to lead.

(B) For the purposes of this section, the phrase "final medical determination" shall mean the outcome of the multiple physician review mechanism or alternate medical determination mechanism used pursuant to the medical surveillance provisions of this section.

(C) Where a final medical determination results in any recommended special protective measures for an employee, or limitations on an employee's exposure to lead, the employer shall implement and act consistent with the recommendation.

(iii) Return of the employee to former job status.

(A) The employer shall return an employee to his or her former job status:

(I) For an employee removed due to a blood lead level at or above 60  $\mu\text{g}/100\text{g}$ , or due to an average blood lead level at or above 50  $\mu\text{g}/100\text{g}$ , when two consecutive blood sampling tests indicate that the employee's blood lead level is (~~at or~~) below 40  $\mu\text{g}/100\text{g}$  of whole blood;

(II) For an employee removed due to a final medical determination, when a subsequent final medical determination results in a medical finding, determination, or opinion that the employee no longer has a detected medical condition which places

the employee at increased risk of material impairment to health from exposure to lead.

(B) For the purposes of this section, the requirement that an employer return an employee to his or her former job status is not intended to expand upon or restrict any rights an employee has or would have had, absent temporary medical removal, to a specific job classification or position under the terms of a collective bargaining agreement.

(iv) Removal of other employee special protective measure or limitations. The employer shall remove any limitations placed on an employee or end any special protective measures provided to an employee pursuant to a final medical determination when a subsequent final medical determination indicates that the limitations or special protective measures are no longer necessary.

(v) Employer options pending a final medical determination. Where the multiple physician review mechanism, or alternate medical determination mechanism used pursuant to the medical surveillance provisions of this section, has not yet resulted in a final medical determination with respect to an employee, the employer shall act as follows:

(A) Removal. The employer may remove the employee from exposure to lead, provide special protective measures to the employee, or place limitations upon the employee, consistent with the medical findings, determinations, or recommendations of any of the physicians who have reviewed the employee's health status.

(B) Return. The employer may return the employee to his or her former job status, end any special protective measures provided to the employee, and remove any limitations placed upon the employee, consistent with the medical findings, determinations, or recommendations of any of the physicians who have reviewed the employee's health status, with two exceptions. If:

(I) The initial removal, special protection, or limitation of the employee resulted from a final medical determination which differed from the findings, determinations, or recommendations of the initial physician; or

(II) The employee has been on removal status for the preceding eighteen months due to an elevated blood lead level, then the employer shall await a final medical determination.

(b) Medical removal protection benefits.

(i) Provision of medical removal protection benefits. The employer shall provide to an employee up to eighteen months of medical removal protection benefits on each occasion that an employee is removed from exposure to lead or otherwise limited pursuant to this section.

(ii) Definition of medical removal protection benefits. For the purposes of this section, the requirement that an employer provide medical removal protection benefits means that the employer shall maintain the earnings, seniority and other employment rights and benefits of an employee as though the employee had not been removed from normal exposure to lead or otherwise limited.

(iii) Follow-up medical surveillance during the period of employee removal or limitation. During the period of time that an employee is removed from normal exposure to lead or otherwise

limited, the employer may condition the provision of medical removal protection benefits upon the employee's participation in follow-up medical surveillance made available pursuant to this section.

(iv) Workers' compensation claims. If a removed employee files a claim for workers' compensation payments for a lead-related disability, then the employer shall continue to provide medical removal protection benefits pending disposition of the claim. To the extent that an award is made to the employee for earnings lost during the period of removal, the employer's medical removal protection obligation shall be reduced by such amount. The employer shall receive no credit for workers' compensation payments received by the employee for treatment related expenses.

(v) Other credits. The employer's obligation to provide medical removal protection benefits to a removed employee shall be reduced to the extent that the employee receives compensation for earnings lost during the period of removal either from a publicly or employer-funded compensation program, or receives income from employment with another employer made possible by virtue of the employee's removal.

(vi) Employees whose blood lead levels do not adequately decline within eighteen months of removal. The employer shall take the following measures with respect to any employee removed from exposure to lead due to an elevated blood lead level whose blood lead level has not declined within the past eighteen months of removal so that the employee has been returned to his or her former job status:

(A) The employer shall make available to the employee a medical examination pursuant to this section to obtain a final medical determination with respect to the employee;

(B) The employer shall assure that the final medical determination obtained indicates whether or not the employee may be returned to his or her former job status, and if not, what steps should be taken to protect the employee's health;

(C) Where the final medical determination has not yet been obtained, or once obtained indicates that the employee may not yet be returned to his or her former job status, the employer shall continue to provide medical removal protection benefits to the employee until either the employee is returned to former job status, or a final medical determination is made that the employee is incapable of ever safely returning to his or her former job status.

(D) Where the employer acts pursuant to a final medical determination which permits the return of the employee to his or her former job status despite what would otherwise be an unacceptable blood lead level, later questions concerning removing the employee again shall be decided by a final medical determination. The employer need not automatically remove such an employee pursuant to the blood lead level removal criteria provided by this section.

(vii) Voluntary removal or restriction of an employee. Where an employer, although not required by this section to do so, removes an employee from exposure to lead or otherwise places

limitations on an employee due to the effects of lead exposure on the employee's medical condition, the employer shall provide medical removal protection benefits to the employee equal to that required by item (12)(b)(i) of this section.

(13) Employee information and training.

(a) Training program.

(i) Each employer who has a workplace in which there is a potential exposure to airborne lead at any level shall inform employees of the content of Appendices A and B of this regulation.

(ii) The employer shall train each employee who is subject to exposure to lead at or above the action level or for whom the possibility of skin or eye irritation exists, in accordance with the requirements of this section. The employer shall institute a training program for and assure the participation of all employees.

(iii) The employer shall provide initial training by one hundred eighty days from the effective date for those employees covered by item (13)(a)(ii) on the standard's effective date and prior to the time of initial job assignment for those employees subsequently covered by this subsection.

(iv) The training program shall be repeated at least annually for each employee.

(v) The employer shall assure that each employee is informed of the following:

(A) The content of this standard and its appendices;

(B) The specific nature of the operations which could result in exposure to lead above the action level;

(C) The purpose, proper use, limitations, and other training requirements for respiratory protection as required by chapter 296-62 WAC, Part E;

(D) The purpose and a description of the medical surveillance program, and the medical removal protection program including information concerning the adverse health effects associated with excessive exposure to lead (with particular attention to the adverse reproductive effects on both males and females);

(E) The engineering controls and work practices associated with the employee's job assignment;

(F) The contents of any compliance plan in effect; and

(G) Instructions to employees that chelating agents should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician.

(b) Access to information and training materials.

(i) The employer shall make readily available to all affected employees a copy of this standard and its appendices.

(ii) The employer shall provide, upon request, all materials relating to the employee information and training program to the director.

(iii) In addition to the information required by item (13)(a)(v), the employer shall include as part of the training program, and shall distribute to employees, any materials pertaining to the Occupational Safety and Health Act, the regulations issued pursuant to the act, and this lead standard, which are made available to the employer by the director.

(14) Signs.

(a) General.

(i) The employer may use signs required by other statutes, regulations or ordinances in addition to, or in combination with, signs required by this subsection.

(ii) The employer shall assure that no statement appears on or near any sign required by this subsection which contradicts or detracts from the meaning of the required sign.

(b) Signs.

(i) The employer shall post the following warning signs in each work area where the PEL is exceeded:

WARNING  
LEAD WORK AREA  
POISON  
NO SMOKING OR EATING

(ii) The employer shall assure that signs required by this subsection are illuminated and cleaned as necessary so that the legend is readily visible.

(15) Recordkeeping.

(a) Exposure monitoring.

(i) The employer shall establish and maintain an accurate record of all monitoring required in subsection (5) of this section.

(ii) This record shall include:

(A) The date(s), number, duration, location and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure where applicable;

(B) A description of the sampling and analytical methods used and evidence of their accuracy;

(C) The type of respiratory protective devices worn, if any;

(D) Name, Social Security number, and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent; and

(E) The environmental variables that could affect the measurement of employee exposure.

(iii) The employer shall maintain these monitoring records for at least forty years or for the duration of employment plus twenty years, whichever is longer.

(b) Medical surveillance.

(i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance as required by subsection (11) of this section.

(ii) This record shall include:

(A) The name, Social Security number, and description of the duties of the employee;

(B) A copy of the physician's written opinions;

(C) Results of any airborne exposure monitoring done for that employee and the representative exposure levels supplied to the physician; and

(D) Any employee medical complaints related to exposure to lead.

(iii) The employer shall keep, or assure that the examining

physician keeps, the following medical records:

(A) A copy of the medical examination results including medical and work history required under subsection (11) of this section;

(B) A description of the laboratory procedures and a copy of any standards or guidelines used to interpret the test results or references to that information; and

(C) A copy of the results of biological monitoring.

(iv) The employer shall maintain or assure that the physician maintains those medical records for at least forty years, or for the duration of employment plus twenty years, whichever is longer.

(c) Medical removals.

(i) The employer shall establish and maintain an accurate record for each employee removed from current exposure to lead pursuant to subsection (12) of this section.

(ii) Each record shall include:

(A) The name and Social Security number of the employee;

(B) The date on each occasion that the employee was removed from current exposure to lead as well as the corresponding date on which the employee was returned to his or her former job status;

(C) A brief explanation of how each removal was or is being accomplished; and

(D) A statement with respect to each removal indicating whether or not the reason for the removal was an elevated blood lead level.

(iii) The employer shall maintain each medical removal record for at least the duration of an employee's employment.

(d) Availability.

(i) The employer shall make available upon request all records required to be maintained by subsection (15) of this section to the director for examination and copying.

(ii) Environmental monitoring, medical removal, and medical records required by this subsection shall be provided upon request to employees, designated representatives, and the assistant director in accordance with chapter 296-802 WAC. Medical removal records shall be provided in the same manner as environmental monitoring records.

(iii) Upon request, the employer shall make an employee's medical records required to be maintained by this section available to the affected employee or former employee or to a physician or other individual designated by such affected employee or former employees for examination and copying.

(e) Transfer of records.

~~((i) Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by subsection (15) of this section.~~

~~(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records required to be maintained by this section for the prescribed period, these records shall be transmitted to the director.~~

~~(iii) At the expiration of the retention period for the records required to be maintained by this section, the employer shall notify the director at least three months prior to the~~

~~disposal of such records and shall transmit those records to the director if requested within the period.~~

(iv)) The employer shall ((also)) comply with any additional requirements involving transfer of records set forth in ((chapter 296-802)) WAC 296-802-60005.

(16) Observation of monitoring.

(a) Employee observation. The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to lead conducted pursuant to subsection (5) of this section.

(b) Observation procedures.

(i) Whenever observation of the monitoring of employee exposure to lead requires entry into an area where the use of respirators, protective clothing or equipment is required, the employer shall provide the observer with and assure the use of such respirators, clothing and such equipment, and shall require the observer to comply with all other applicable safety and health procedures.

(ii) Without interfering with the monitoring, observers shall be entitled to:

(A) Receive an explanation of the measurement procedures;

(B) Observe all steps related to the monitoring of lead performed at the place of exposure; and

(C) Record the results obtained or receive copies of the results when returned by the laboratory.

(17) Appendices. The information contained in the appendices to this section is not intended by itself, to create any additional obligations not otherwise imposed by this standard nor detract from any existing obligation.

(a) Appendix A. Substance Data Sheet for Occupational Exposure to Lead.

(i) Substance identification.

(A) Substance. Pure lead (Pb) is a heavy metal at room temperature and pressure and is a basic chemical element. It can combine with various other substances to form numerous lead compounds.

(B) Compounds covered by the standard. The word "lead" when used in this standard means elemental lead, all inorganic lead compounds (except those which are not biologically available due to either solubility or specific chemical interaction), and a class of organic lead compounds called lead soaps. This standard does not apply to other organic lead compounds.

(C) Uses. Exposure to lead occurs in at least one hundred twenty different occupations, including primary and secondary lead smelting, lead storage battery manufacturing, lead pigment manufacturing and use, solder manufacturing and use, shipbuilding and ship repairing, auto manufacturing, and printing.

(D) Permissible exposure. The Permissible Exposure Limit (PEL) set by the standard is 50 micrograms of lead per cubic meter of air (50  $\mu\text{g}/\text{m}^3$ ), averaged over an eight-hour work day.

(E) Action level. The standard establishes an action level of 30 micrograms per cubic meter of air (30  $\mu\text{g}/\text{m}^3$ ) time weighted average, based on an eight-hour work day. The action level

initiates several requirements of the standard, such as exposure monitoring, medical surveillance, and training and education.

(ii) Health hazard data.

(A) Ways in which lead enters your body.

(I) When absorbed into your body in certain doses lead is a toxic substance. The object of the lead standard is to prevent absorption of harmful quantities of lead. The standard is intended to protect you not only from the immediate toxic effects of lead, but also from the serious toxic effects that may not become apparent until years of exposure have passed.

(II) Lead can be absorbed into your body by inhalation (breathing) and ingestion (eating). Lead (except for certain organic lead compounds not covered by the standard, such as tetraethyl lead) is not absorbed through your skin. When lead is scattered in the air as a dust, fume or mist, it can be inhaled and absorbed through your lungs and upper respiratory tract. Inhalation of airborne lead is generally the most important source of occupational lead absorption. You can also absorb lead through your digestive system if lead gets into your mouth and is swallowed. If you handle food, cigarettes, chewing tobacco, or make-up which have lead on them or handle them with hands contaminated with lead, this will contribute to ingestion.

(III) A significant portion of the lead that you inhale or ingest gets into your blood stream. Once in your blood stream lead is circulated throughout your body and stored in various organs and body tissues. Some of this lead is quickly filtered out of your body and excreted, but some remains in your blood and other tissue. As exposure to lead continues, the amount stored in your body will increase if you are absorbing more lead than your body is excreting. Even though you may not be aware of any immediate symptoms of disease, this lead stored in your tissues can be slowly causing irreversible damage, first to individual cells, then to your organs and whole body systems.

(B) Effects of overexposure to lead.

(I) Short-term (acute) overexposure. Lead is a potent, systemic poison that serves no known useful function once absorbed by your body. Taken in large enough doses, lead can kill you in a matter of days. A condition affecting the brain called acute encephalopathy may arise which develops quickly to seizures, coma, and death from cardiorespiratory arrest. A short-term dose of lead can lead to acute encephalopathy. Short-term occupational exposures of this magnitude are highly unusual, but not impossible. Similar forms of encephalopathy may, however arise from extended, chronic exposure to lower doses of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and chronic effects which take longer to acquire. Lead adversely affects numerous body systems, and causes forms of health impairment and disease which arise after periods of exposure as short as days or as long as several years.

(II) Long-term (chronic) overexposure.

a) Chronic overexposure to lead may result in severe damage to your blood-forming, nervous, urinary and reproductive systems. Some common symptoms of chronic overexposure include loss of

appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and colic. In lead colic there may be severe abdominal pain.

b) Damage to the central nervous system in general and the brain (encephalopathy) in particular is one of the most severe forms of lead poisoning. The most severe, often fatal, form of encephalopathy may be preceded by vomiting, a feeling of dullness progressing to drowsiness and stupor, poor memory, restlessness, irritability, tremor, and convulsions. It may arise suddenly with the onset of seizures, followed by coma, and death. There is a tendency for muscular weakness to develop at the same time. This weakness may progress to paralysis often observed as a characteristic "wrist drop" or "foot drop" and is a manifestation of a disease to the nervous system called peripheral neuropathy.

c) Chronic overexposure to lead also results in kidney disease with few, if any, symptoms appearing until extensive and most likely permanent kidney damage has occurred. Routine laboratory tests reveal the presence of this kidney disease only after about two-thirds of kidney function is lost. When overt symptoms of urinary dysfunction arise, it is often too late to correct or prevent worsening conditions, and progression of kidney dialysis or death is possible.

d) Chronic overexposure to lead impairs the reproductive systems of both men and women. Overexposure to lead may result in decreased sex drive, impotence and sterility in men. Lead can alter the structure of sperm cells raising the risk of birth defects. There is evidence of miscarriage and stillbirth in women whose husbands were exposed to lead or who were exposed to lead themselves. Lead exposure also may result in decreased fertility, and abnormal menstrual cycles in women. The course of pregnancy may be adversely affected by exposure to lead since lead crosses the placental barrier and poses risks to developing fetuses. Children born of parents either one of whom were exposed to excess lead levels are more likely to have birth defects, mental retardation, behavioral disorders or die during the first year of childhood.

e) Overexposure to lead also disrupts the blood-forming system resulting in decreased hemoglobin (the substance in the blood that carries oxygen to the cells) and ultimately anemia. Anemia is characterized by weakness, pallor and fatigability as a result of decreased oxygen carrying capacity in the blood.

(III) Health protection goals of the standard.

a) Prevention of adverse health effects for most workers from exposure to lead throughout a working lifetime requires that worker blood lead (PbB) levels be maintained at or below forty micrograms per one hundred grams of whole blood (40 µg/100g). The blood lead levels of workers (both male and female workers) who intend to have children should be maintained below 30 µg/100g to minimize adverse reproductive health effects to the parents and to the developing fetus.

b) The measurement of your blood lead level is the most useful

indicator of the amount of lead absorbed by your body. Blood lead levels (PbB) are most often reported in units of milligrams (mg) or micrograms ( $\mu\text{g}$ ) of lead (1 mg = 1000  $\mu\text{g}$ ) per 100 grams (100g), 100 milliliters (100 ml) or deciliter (dl) of blood. These three units are essentially the same. Sometimes PbB's are expressed in the form of mg% or  $\mu\text{g}\%$ . This is a shorthand notation for 100g, 100ml, or dl.

c) PbB measurements show the amount of lead circulating in your blood stream, but do not give any information about the amount of lead stored in your various tissues. PbB measurements merely show current absorption of lead, not the effect that lead is having on your body or the effects that past lead exposure may have already caused. Past research into lead-related diseases, however, has focused heavily on associations between PbBs and various diseases. As a result, your PbB is an important indicator of the likelihood that you will gradually acquire a lead-related health impairment or disease.

d) Once your blood lead level climbs above 40  $\mu\text{g}/100\text{g}$ , your risk of disease increases. There is a wide variability of individual response to lead, thus it is difficult to say that a particular PbB in a given person will cause a particular effect. Studies have associated fatal encephalopathy with PbBs as low as 150  $\mu\text{g}/100\text{g}$ . Other studies have shown other forms of disease in some workers with PbBs well below 80  $\mu\text{g}/100\text{g}$ . Your PbB is a crucial indicator of the risks to your health, but one other factor is extremely important. This factor is the length of time you have had elevated PbBs. The longer you have an elevated PbB, the greater the risk that large quantities of lead are being gradually stored in your organs and tissues (body burden). The greater your overall body burden, the greater the chances of substantial permanent damage.

e) The best way to prevent all forms of lead-related impairments and diseases--both short-term and long-term--is to maintain your PbB below 40  $\mu\text{g}/100\text{g}$ . The provisions of the standard are designed with this end in mind. Your employer has prime responsibility to assure that the provisions of the standard are complied with both by the company and by individual workers. You as a worker, however, also have a responsibility to assist your employer in complying with the standard. You can play a key role in protecting your own health by learning about the lead hazards and their control, learning what the standard requires, following the standard where it governs your own action, and seeing that your employer complies with the provisions governing his actions.

(IV) Reporting signs and symptoms of health problems. You should immediately notify your employer if you develop signs or symptoms associated with lead poisoning or if you desire medical advice concerning the effects of current or past exposure to lead on your ability to have a healthy child. You should also notify your employer if you have difficulty breathing during a respirator fit test or while wearing a respirator. In each of these cases your employer must make available to you appropriate medical examinations or consultations. These must be provided at no cost to you and at a reasonable time and place.

(b) Appendix B. Employee Standard Summary. This appendix summarizes key provisions of the standard that you as a worker should become familiar with. The appendix discusses the entire standard.

(i) Permissible exposure limit (PEL). The standard sets a permissible exposure limit (PEL) of fifty micrograms of lead per cubic meter of air ( $50 \mu\text{g}/\text{m}^3$ ), averaged over an eight-hour workday. This is the highest level of lead in air to which you may be permissibly exposed over an eight-hour workday. Since it is an eight-hour average it permits short exposures above the PEL so long as for each eight-hour workday your average exposure does not exceed the PEL.

(ii) Exposure monitoring.

(A) If lead is present in the work place where you work in any quantity, your employer is required to make an initial determination of whether the action level is exceeded for any employee. The initial determination must include instrument monitoring of the air for the presence of lead and must cover the exposure of a representative number of employees who are reasonably believed to have the highest exposure levels. If your employer has conducted appropriate air sampling for lead in the past year he may use these results. If there have been any employee complaints of symptoms which may be attributable to exposure to lead or if there is any other information or observations which would indicate employee exposure to lead, this must also be considered as part of the initial determination. If this initial determination shows that a reasonable possibility exists that any employee may be exposed, without regard to respirators, over the action level ( $30 \mu\text{g}/\text{m}^3$ ) your employer must set up an air monitoring program to determine the exposure level of every employee exposed to lead at your work place.

(B) In carrying out this air monitoring program, your employer is not required to monitor the exposure of every employee, but he or she must monitor a representative number of employees and job types. Enough sampling must be done to enable each employee's exposure level to be reasonably represented by at least one full shift (at least seven hours) air sample. In addition, these air samples must be taken under conditions which represent each employee's regular, daily exposure to lead.

(C) If you are exposed to lead and air sampling is performed, your employer is required to quickly notify you in writing of air monitoring results which represent your exposure. If the results indicate your exposure exceeds the PEL (without regard to your use of respirators), then your employer must also notify you of this in writing, and provide you with a description of the corrective action that will be taken to reduce your exposure.

(D) Your exposure must be rechecked by monitoring every six months if your exposure is over the action level but below the PEL. Air monitoring must be repeated every three months if you are exposed over the PEL. Your employer may discontinue monitoring for you if two consecutive measurements, taken at least two weeks apart, are below the action level. However, whenever there is a production, process, control, or personnel change at your work

place which may result in new or additional exposure to lead, or whenever there is any other reason to suspect a change which may result in new or additional exposure to lead, your employer must perform additional monitoring.

(iii) Methods of compliance. Your employer is required to assure that no employee is exposed to lead in excess of the PEL. The standard establishes a priority of methods to be used to meet the PEL.

(iv) Respiratory protection.

(A) Your employer is required to provide and assure your use of respirators when your exposure to lead is not controlled below the PEL by other means. The employer must pay the cost of the respirator. Whenever you request one, your employer is also required to provide you a respirator even if your air exposure level does not exceed the PEL. You might desire a respirator when, for example, you have received medical advice that your lead absorption should be decreased. Or, you may intend to have children in the near future, and want to reduce the level of lead in your body to minimize adverse reproductive effects. While respirators are the least satisfactory means of controlling your exposure, they are capable of providing significant protection if properly chosen, fitted, worn, cleaned, maintained, and replaced when they stop providing adequate protection.

(B) Your employer is required to select respirators from the seven types listed in Table II of the respiratory protection section of this standard (see subsection (7)(c) of this section). Any respirator chosen must be certified by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 42 CFR part 84. This respirator selection table will enable your employer to choose a type of respirator which will give you a proper amount of protection based on your airborne lead exposure. Your employer may select a type of respirator that provides greater protection than that required by the standard; that is, one recommended for a higher concentration of lead than is present in your work place. For example, a powered air purifying respirator (PAPR) is much more protective than a typical negative-pressure respirator, and may also be more comfortable to wear. A PAPR has a filter, cartridge or canister to clean the air, and a power source which continuously blows filtered air into your breathing zone. Your employer might make a PAPR available to you to ease the burden of having to wear a respirator for long periods of time. The standard provides that you can obtain a PAPR upon request.

(C) Your employer must also start a respiratory protection program. This program must include written procedures for the proper selection, use, cleaning, storage, and maintenance of respirators.

(D) Your employer must assure that your respirator facepiece fits properly. Proper fit of a respirator facepiece is critical to your protection against air borne lead. Obtaining a proper fit on each employee may require your employer to make available several different types of respirator masks. To ensure that your respirator fits properly and that facepiece leakage is minimal, your employer must give you either a qualitative or quantitative

fit test as required in chapter 296-842 WAC.

(E) You must also receive from your employer proper training in the use of respirators. Your employer is required to teach you how to wear a respirator, to know why it is needed, and to understand its limitations.

(F) The standard provides that if your respirator uses filter elements, you must be given an opportunity to change the filter elements whenever an increase in breathing resistance is detected. You also must be permitted to periodically leave your work area to wash your face and respirator facepiece whenever necessary to prevent skin irritation. If you ever have difficulty breathing during a fit test or while using a respirator, your employer must make a medical examination available to you to determine whether you can safely wear a respirator. The result of this examination may be to give you a positive pressure respirator (which reduces breathing resistance) or to provide alternative means of protection.

(v) Protective work clothing and equipment. If you are exposed to lead above the PEL, or if you are exposed to lead compounds such as lead arsenate or lead azide which can cause skin and eye irritation, your employer must provide you with protective work clothing and equipment appropriate for the hazard. If work clothing is provided, it must be provided in a clean and dry condition at least weekly, and daily if your airborne exposure to lead is greater than 200  $\mu\text{g}/\text{m}^3$ . Appropriate protective work clothing and equipment can include coveralls or similar full-body work clothing, gloves, hats, shoes or disposable shoe coverlets, and face shields or vented goggles. Your employer is required to provide all such equipment at no cost to you. He or she is responsible for providing repairs and replacement as necessary and also is responsible for the cleaning, laundering or disposal of protective clothing and equipment. Contaminated work clothing or equipment must be removed in change rooms and not worn home or you will extend your exposure and expose your family since lead from your clothing can accumulate in your house, car, etc. Contaminated clothing which is to be cleaned, laundered or disposed of must be placed in closed containers in the change room. At no time may lead be removed from protective clothing or equipment by any means which disperses lead into the work room air.

(vi) Housekeeping. Your employer must establish a housekeeping program sufficient to maintain all surfaces as free as practicable of accumulations of lead dust. Vacuuming is the preferred method of meeting this requirement, and the use of compressed air to clean floors and other surfaces is absolutely prohibited. Dry or wet sweeping, shoveling, or brushing may not be used except where vacuuming or other equally effective methods have been tried and do not work. Vacuums must be used and emptied in a manner which minimizes the reentry of lead into the work place.

(vii) Hygiene facilities and practices.

(A) The standard requires that change rooms, showers and filtered air lunchrooms be constructed and made available to workers exposed to lead above the PEL. When the PEL is exceeded, the employer must assure that food and beverage is not present or

consumed, tobacco products are not present or used, and cosmetics are not applied, except in these facilities. Change rooms, showers and lunchrooms, must be used by workers exposed in excess of the PEL. After showering, no clothing or equipment worn during the shift may be worn home and this includes shoes and underwear. Your own clothing worn during the shift should be carried home and cleaned carefully so that it does not contaminate your home. Lunchrooms may not be entered with protective clothing or equipment unless surface dust has been removed by vacuuming, downdraft booth or other cleaning methods. Finally, workers exposed above the PEL must wash both their hands and faces prior to eating, drinking, smoking or applying cosmetics.

(B) All of the facilities and hygiene practices just discussed are essential to minimize additional sources of lead absorption from inhalation or ingestion of lead that may accumulate on you, your clothes or your possessions. Strict compliance with these provisions can virtually eliminate several sources of lead exposure which significantly contribute to excessive lead absorption.

(viii) Medical surveillance.

(A) The medical surveillance program is part of the standard's comprehensive approach to the prevention of lead-related disease. Its purpose is to supplement the main thrust of the standard which is aimed at minimizing airborne concentrations of lead and sources of ingestion. Only medical surveillance can determine if the other provisions of the standard have effectively protected you as an individual. Compliance with the standard's provision will protect most workers from the adverse effects of lead exposure, but may not be satisfactory to protect individual workers (I) who have high body burdens of lead acquired over past years, (II) who have additional uncontrolled sources of nonoccupational lead exposure, (III) who exhibit unusual variations in lead absorption rates, or (IV) who have specific nonwork related medical conditions which could be aggravated by lead exposure (e.g., renal disease, anemia). In addition, control systems may fail, or hygiene and respirator programs may be inadequate. Periodic medical surveillance of individual workers will help detect those failures. Medical surveillance will also be important to protect your reproductive ability - regardless of whether you are a man or a woman.

(B) All medical surveillance required by the standard must be performed by or under the supervision of a licensed physician. The employer must provide required medical surveillance without cost to employees and at a reasonable time and place. The standard's medical surveillance program has two parts - Periodic biological monitoring, and medical examinations.

(C) Your employer's obligation to offer medical surveillance is triggered by the results of the air monitoring program. Medical surveillance must be made available to all employees who are exposed in excess of the action level for more than thirty days a year. The initial phase of the medical surveillance program, which included blood lead level tests and medical examinations, must be completed for all covered employees no later than one hundred eighty days from the effective date of this standard. Priority within this first round of medical surveillance must be given to

employees whom the employer believes to be at greatest risk from continued exposure (for example, those with the longest prior exposure to lead, or those with the highest current exposure). Thereafter, the employer must periodically make medical surveillance - both biological monitoring and medical examinations - available to all covered employees.

(D) Biological monitoring under the standard consists of blood lead level (PbB) and zinc protoporphyrin tests at least every six months after the initial PbB test. A zinc protoporphyrin (ZPP) test is a very useful blood test which measures an effect of lead on your body. If a worker's PbB exceeds 40 µg/100g, the monitoring frequency must be increased from every six months to at least every two months and not reduced until two consecutive PbBs indicate a blood lead level below 40 µg/100g. Each time your PbB is determined to be over 40 µg/100g, your employer must notify you of this in writing within five working days of the receipt of the test results. The employer must also inform you that the standard requires temporary medical removal with economic protection when your PbB exceeds certain criteria (see Discussion of Medical Removal Protection - subsection (12)). During the first year of the standard, this removal criterion is 80 µg/100g. Anytime your PbB exceeds 80 µg/100g your employer must make available to you a prompt follow-up PbB test to ascertain your PbB. If the two tests both exceed 80 µg/100g and you are temporarily removed, then your employer must make successive PbB tests available to you on a monthly basis during the period of your removal.

(E) Medical examinations beyond the initial one must be made available on an annual basis if your blood lead levels exceeds 40 µg/100g at any time during the preceding year. The initial examination will provide information to establish a baseline to which subsequent data can be compared. An initial medical examination must also be made available (prior to assignment) for each employee being assigned for the first time to an area where the airborne concentration of lead equals or exceeds the action level. In addition, a medical examination or consultation must be made available as soon as possible if you notify your employer that you are experiencing signs or symptoms commonly associated with lead poisoning or that you have difficulty breathing while wearing a respirator or during a respirator fit test. You must also be provided a medical examination or consultation if you notify your employer that you desire medical advice concerning the effects of current or past exposure to lead on your ability to procreate a healthy child.

(F) Finally, appropriate follow-up medical examinations or consultations may also be provided for employees who have been temporarily removed from exposure under the medical removal protection provisions of the standard (see item (ix) below).

(G) The standard specifies the minimum content of preassignment and annual medical examinations. The content of other types of medical examinations and consultations is left up to the sound discretion of the examining physician. Preassignment and annual medical examinations must include (I) a detailed work history and medical history, (II) a thorough physical examination,

and (III) a series of laboratory tests designed to check your blood chemistry and your kidney function. In addition, at any time upon your request, a laboratory evaluation of male fertility will be made (microscopic examination of a sperm sample), or a pregnancy test will be given.

(H) The standard does not require that you participate in any of the medical procedures, tests, etc., which your employer is required to make available to you. Medical surveillance can, however, play a very important role in protecting your health. You are strongly encouraged, therefore, to participate in a meaningful fashion. Generally, your employer will choose the physician who conducts medical surveillance under the lead standard - unless you and your employer can agree on the choice of a physician or physicians. Some companies and unions have agreed in advance, for example, to use certain independent medical laboratories or panels of physicians. Any of these arrangements are acceptable so long as required medical surveillance is made available to workers.

(I) The standard requires your employer to provide certain information to a physician to aid in his or her examination of you. This information includes (I) the standard and its appendices, (II) a description of your duties as they relate to lead exposure, (III) your exposure level, (IV) a description of personal protective equipment you wear, (V) prior blood level results, and (VI) prior written medical opinions concerning you that the employer has. After a medical examination or consultation the physician must prepare a written report which must contain (I) the physician's opinion as to whether you have any medical conditions which places you at increased risk of material impairment to health from exposure to lead, (II) any recommended special protective measures to be provided to you, (III) any blood lead level determinations, and (IV) any recommended limitation on your use of respirators. This last element must include a determination of whether you can wear a powered air purifying respirator (PAPR) if you are found unable to wear a negative pressure respirator.

(J) The medical surveillance program of the lead standard may at some point in time serve to notify certain workers that they have acquired a disease or other adverse medical condition as a result of occupational lead exposure. If this is true these workers might have legal rights to compensation from public agencies, their employers, firms that supply hazardous products to their employers, or other persons. Some states have laws, including worker compensation laws, that disallow a worker to learn of a job-related health impairment to sue, unless the worker sues within a short period of time after learning of the impairment. (This period of time may be a matter of months or years.) An attorney can be consulted about these possibilities. It should be stressed that WISHA is in no way trying to either encourage or discourage claims or lawsuits. However, since results of the standard's medical surveillance program can significantly affect the legal remedies of a worker who has acquired a job-related disease or impairment, it is proper for WISHA to make you aware of this.

(K) The medical surveillance section of the standard also

contains provisions dealing with chelation. Chelation is the use of certain drugs (administered in pill form or injected into the body) to reduce the amount of lead absorbed in body tissues. Experience accumulated by the medical and scientific communities has largely confirmed the effectiveness of this type of therapy for the treatment of very severe lead poisoning. On the other hand it has also been established that there can be a long list of extremely harmful side effects associated with the use of chelating agents. The medical community has balanced the advantages and disadvantages resulting from the use of chelating agents in various circumstances and has established when the use of these agents is acceptable. The standard includes these accepted limitations due to a history of abuse of chelation therapy by some lead companies. The most widely used chelating agents are calcium disodium EDTA, (Ca Na<sub>2</sub>EDTA), Calcium Disodium Versenate (Versenate), and d-penicillamine (penicillamine or Cupramine).

(L) The standard prohibits "prophylactic chelation" of any employee by any person the employer retains, supervises or controls. "Prophylactic chelation" is the routine use of chelating or similarly acting drugs to prevent elevated blood levels in workers who are occupationally exposed to lead, or the use of these drugs to routinely lower blood lead levels to predesignated concentrations believed to be safe. It should be emphasized that where an employer takes a worker who has no symptoms of lead poisoning and has chelation carried out by a physician (either inside or outside of a hospital) solely to reduce the worker's blood lead level, that will generally be considered prophylactic chelation. The use of a hospital and a physician does not mean that prophylactic chelation is not being performed. Routine chelation to prevent increased or reduce current blood lead levels is unacceptable whatever the setting.

(M) The standard allows the use of "therapeutic" or "diagnostic" chelation if administered under the supervision of a licensed physician in a clinical setting with thorough and appropriate medical monitoring. Therapeutic chelation responds to severe lead poisoning where there are marked symptoms. Diagnostic chelation, involves giving a patient a dose of the drug then collecting all urine excreted for some period of time as an aid to the diagnosis of lead poisoning.

(N) In cases where the examining physician determines that chelation is appropriate, you must be notified in writing of this fact before such treatment. This will inform you of a potentially harmful treatment, and allow you to obtain a second opinion.

(ix) Medical removal protection.

(A) Excessive lead absorption subjects you to increased risk of disease. Medical removal protection (MRP) is a means of protecting you when for whatever reasons, other methods, such as engineering controls, work practices, and respirators, have failed to provide the protection you need. MRP involves the temporary removal of a worker from his or her regular job to a place of significantly lower exposure without any loss of earnings, seniority, or other employment rights or benefits. The purpose of this program is to cease further lead absorption and allow your

body to naturally excrete lead which has previously been absorbed. Temporary medical removal can result from an elevated blood lead level, or a medical opinion. Up to eighteen months of protection is provided as a result of either form of removal. The vast majority of removed workers, however, will return to their former jobs long before this eighteen month period expires. The standard contains special provisions to deal with the extraordinary but possible case where a long-term worker's blood lead level does not adequately decline during eighteen months of removal.

(B) During the first year of the standard, if your blood lead level is 80  $\mu\text{g}/100\text{g}$  or above you must be removed from any exposure where your air lead level without a respirator would be 100  $\mu\text{g}/\text{m}^3$  or above. If you are removed from your normal job you may not be returned until your blood lead level declines to at least 60  $\mu\text{g}/100\text{g}$ . These criteria for removal and return will change according to the following schedule:

TABLE 1

Effective Date	Removal	Air Lead ( $\mu\text{g}/\text{m}^3$ )	Return
	Blood Level ( $\mu\text{g}/100\text{g}$ )		Blood Lead ( $\mu\text{g}/100\text{g}$ )
9/6/81	At or above 70	50 or above	At or below 50
9/6/82	At or above 60	30 or above	At or below 40
9/6/84	At or above 50 averaged over six months	30 or above	At or below 40

(C) You may also be removed from exposure even if your blood lead levels are below these criteria if a final medical determination indicates that you temporarily need reduced lead exposure for medical reasons. If the physician who is implementing your employer's medical program makes a final written opinion recommending your removal or other special protective measures, your employer must implement the physician's recommendation. If you are removed in this manner, you may only be returned when the physician indicates it is safe for you to do so.

(D) The standard does not give specific instructions dealing with what an employer must do with a removed worker. Your job assignment upon removal is a matter for you, your employer and your union (if any) to work out consistent with existing procedures for job assignments. Each removal must be accomplished in a manner consistent with existing collective bargaining relationships. Your employer is given broad discretion to implement temporary removals so long as no attempt is made to override existing agreements. Similarly, a removed worker is provided no right to veto an employer's choice which satisfies the standard.

(E) In most cases, employers will likely transfer removed employees to other jobs with sufficiently low lead exposure.

Alternatively, a worker's hours may be reduced so that the time weighted average exposure is reduced, or he or she may be temporarily laid off if no other alternative is feasible.

(F) In all of these situations, MRP benefits must be provided during the period of removal - i.e., you continue to receive the same earnings, seniority, and other rights and benefits you would have had if you had not been removed. Earnings include more than just your base wage; it includes overtime, shift differentials, incentives, and other compensation you would have earned if you had not been removed. During the period of removal you must also be provided with appropriate follow-up medical surveillance. If you were removed because your blood lead level was too high, you must be provided with a monthly blood test. If a medical opinion caused your removal, you must be provided medical tests or examinations that the physician believes to be appropriate. If you do not participate in this follow-up medical surveillance, you may lose your eligibility for MRP benefits.

(G) When you are medically eligible to return to your former job, your employer must return you to your "former job status." This means that you are entitled to the position, wages, benefits, etc., you would have had if you had not been removed. If you would still be in your old job if no removal had occurred, that is where you go back. If not, you are returned consistent with whatever job assignment discretion your employer would have had if no removal had occurred. MRP only seeks to maintain your rights, not expand them or diminish them.

(H) If you are removed under MRP and you are also eligible for worker compensation or other compensation for lost wages, your employer's MRP benefits obligation is reduced by the amount that you actually receive from these other sources. This is also true if you obtain other employment during the time you are laid off with MRP benefits.

(I) The standard also covers situations where an employer voluntarily removes a worker from exposure to lead due to the effects of lead on the employee's medical condition, even though the standard does not require removal. In these situations MRP benefits must still be provided as though the standard required removal. Finally, it is important to note that in all cases where removal is required, respirators cannot be used as a substitute. Respirators may be used before removal becomes necessary, but not as an alternative to a transfer to a low exposure job, or to a lay-off with MRP benefits.

(x) Employee information and training.

(A) Your employer is required to provide an information and training program for all employees exposed to lead above the action level or who may suffer skin or eye irritation from lead. This program must inform these employees of the specific hazards associated with their work environment, protective measures which can be taken, the danger of lead to their bodies (including their reproductive systems), and their rights under the standard. In addition, your employer must make readily available to all employees, including those exposed below the action level, a copy of the standard and its appendices and must distribute to all

employees any materials provided to the employer under the Washington Industrial Safety and Health Act (WISHA).

(B) Your employer is required to complete this training for all employees by March 4, 1981. After this date, all new employees must be trained prior to initial assignment to areas where there is possibility of exposure over the action level. This training program must also be provided at least annually thereafter.

(xi) Signs. The standard requires that the following warning sign be posted in work areas where the exposure to lead exceeds the PEL:

WARNING  
LEAD WORK AREA  
NO SMOKING OR EATING

(xii) Recordkeeping.

(A) Your employer is required to keep all records of exposure monitoring for airborne lead. These records must include the name and job classification of employees measured, details of the sampling and analytic techniques, the results of this sampling and the type of respiratory protection being worn by the person sampled. Your employer is also required to keep all records of biological monitoring and medical examination results. These must include the names of the employees, the physician's written opinion and a copy of the results of the examination. All of the above kinds of records must be kept for forty years, or for at least twenty years after your termination of employment, whichever is longer.

(B) Recordkeeping is also required if you are temporarily removed from your job under the MRP program. This record must include your name and Social Security number, the date of your removal and return, how the removal was or is being accomplished, and whether or not the reason for the removal was an elevated blood lead level. Your employer is required to keep each medical removal record only for as long as the duration of an employee's employment.

(C) The standard requires that if you request to see or copy environmental monitoring, blood lead level monitoring, or medical removal records, they must be made available to you or to a representative that you authorize. Your union also has access to these records. Medical records other than PbBs must also be provided to you upon request, to your physician or to any other person whom you may specifically designate. Your union does not have access to your personal medical records unless you authorize their access.

(xiii) Observations of monitoring. When air monitoring for lead is performed at your work place as required by this standard, your employer must allow you or someone you designate to act as an observer of the monitoring. Observers are entitled to an explanation of the measurement procedure, and to record the results obtained. Since results will not normally be available at the time of the monitoring, observers are entitled to record or receive the results of the monitoring when returned by the laboratory. Your employer is required to provide the observer with any personal

protective devices required to be worn by employees working in the areas that is being monitored. The employer must require the observer to wear all such equipment and to comply with all other applicable safety and health procedures.

(xiv) Effective date. The standard's effective date is September 6, 1980, and the employer's obligation under the standard begin to come into effect as of that date. The standard was originally adopted as WAC 296-62-07349 and later recodified to WAC 296-62-07521.

(c) Appendix C. Medical Surveillance Guidelines.

(i) Introduction.

(A) The primary purpose of the Washington Industrial Safety and Health Act of 1973 is to assure, so far as possible, safe and healthful working conditions for every working man and woman. The occupational health standard for inorganic lead\* was promulgated to protect workers exposed to inorganic lead including metallic lead, all inorganic lead compounds and organic lead soaps.

\*The term inorganic lead used throughout the medical surveillance appendices is meant to be synonymous with the definition of lead set forth in the standard.

(B) Under this final standard in effect as of September 6, 1980, occupational exposure to inorganic lead is to be limited to 50  $\mu\text{g}/\text{m}^3$  (micrograms per cubic meter) based on an eight-hour time-weighted average (TWA). This level of exposure eventually must be achieved through a combination of engineering, work practice and other administrative controls. Periods of time ranging from one to ten years are provided for different industries to implement these controls which are based on individual industry considerations. Until these controls are in place, respirators must be used to meet the 50  $\mu\text{g}/\text{m}^3$  exposure limit.

(C) The standard also provides for a program of biological monitoring and medical surveillance for all employees exposed to levels of inorganic lead above the action level of 30  $\mu\text{g}/\text{m}^3$  for more than thirty days per year.

(D) The purpose of this document is to outline the medical surveillance provisions of the standard for inorganic lead, and to provide further information to the physician regarding the examination and evaluation of workers exposed to inorganic lead.

(E) Item (ii) provides a detailed description of the monitoring procedure including the required frequency of blood testing for exposed workers, provisions for medical removal protection (MRP), the recommended right of the employee to a second medical opinion, and notification and recordkeeping requirements of the employer. A discussion of the requirements for respirator use and respirator monitoring and WISHA's position on prophylactic chelation therapy are also included in this section.

(F) Item (iii) discusses the toxic effects and clinical manifestations of lead poisoning and effects of lead intoxication on enzymatic pathways in heme synthesis. The adverse effects on both male and female reproductive capacity and on the fetus are also discussed.

(G) Item (iv) outlines the recommended medical evaluation of the worker exposed to inorganic lead including details of the

medical history, physical examination, and recommended laboratory tests, which are based on the toxic effects of lead as discussed in item (ii).

(H) Item (v) provides detailed information concerning the laboratory tests available for the monitoring of exposed workers. Included also is a discussion of the relative value of each test and the limitations and precautions which are necessary in the interpretation of the laboratory results.

(I) Airborne levels to be achieved without reliance or respirator protection through a combination of engineering and work practice or other administrative controls are illustrated in the following table:

Industry	Permissible Lead Level/Compliance Date		
	200µg/m <sup>3</sup>	100µg/m <sup>3</sup>	50µg/m <sup>3</sup>
Primary Lead Production	1973	06/29/84	06/29/91
Secondary Lead Production	1973	06/29/84	06/29/91
Lead Acid Battery Manufacturing	1973	06/29/83	06/29/91
Automobile Mfg./Solder, Grinding	1973	N/A	03/08/97
Electronics, Gray Iron Foundries, Ink Mfg., Paints and Coatings Mfg., Can Mfg., Wallpaper Mfg., and Printing.	1973	N/A	06/29/91
Lead Chemical Mfg., Nonferrous Foundries, Leaded Steel Mfg., Battery Breaking in the Collection and Processing of Scrap (when not a part of secondary lead smelter)			
Secondary Copper Smelter, Brass and Bronze Ingot Production.	1973	N/A	N/A <sup>1</sup> *
All Other Industries	1973	N/A	09/08/92

\* Feasibility of achieving the PEL by engineering and work practice controls for these industries has yet to be resolved in court, therefore no date has been scheduled.

(ii) Medical surveillance and monitoring requirements for workers exposed to inorganic lead.

(A) Under the occupational health standard for inorganic lead, a program of biological monitoring and medical surveillance is to be made available to all employees exposed to lead above the action level of 30 µg/m<sup>3</sup> TWA for more than thirty days each year. This program consists of periodic blood sampling and medical evaluation to be performed on a schedule which is defined by previous laboratory results, worker complaints or concerns, and the clinical assessment of the examining physician.

(B) Under this program, the blood lead level of all employees who are exposed to lead above the action level of 30 µg/m<sup>3</sup> is to be determined at least every six months. The frequency is increased to every two months for employees whose last blood lead level was between 40 µg/100g whole blood and the level requiring employee medical removal to be discussed below. For employees who are removed from exposure to lead due to an elevated blood lead, a new

blood lead level must be measured monthly. Zinc protoporphyrin (ZPP) measurement is required on each occasion that a blood lead level measurement is made.

(C) An annual medical examination and consultation performed under the guidelines discussed in item (iv) is to be made available to each employee for whom a blood test conducted at any time during the preceding twelve months indicated a blood lead level at or above 40 µg/100g. Also, an examination is to be given to all employees prior to their assignment to an area in which airborne lead concentrations reach or exceed the action level. In addition, a medical examination must be provided as soon as possible after notification by an employee that the employee has developed signs or symptoms commonly associated with lead intoxication, that the employee desires medical advice regarding lead exposure and the ability to procreate a healthy child, or that the employee has demonstrated difficulty in breathing during a respirator fitting test or during respirator use. An examination is also to be made available to each employee removed from exposure to lead due to a risk of sustaining material impairment to health, or otherwise limited or specially protected pursuant to medical recommendations.

(D) Results of biological monitoring or the recommendations of an examining physician may necessitate removal of an employee from further lead exposure pursuant to the standard's medical removal program (MRP). The object of the MRP program is to provide temporary medical removals to workers either with substantially elevated blood lead levels or otherwise at risk of sustaining material health impairment from continued substantial exposure to lead. The following guidelines which are summarized in Table 10 were created under the standard for the temporary removal of an exposed employee and his or her subsequent return to work in an exposure area.

TABLE 10

EFFECTIVE DATE

	Sept. 6, 1980	Sept. 6, 1981	Sept. 6, 1982	Sept. 6, 1983	Sept. 6, 1984
A. Blood lead level requiring employee medical removal (level must be confirmed with second follow-up blood lead level within two weeks of first report).	>80 µg/100g.	>70 µg/100g.	>60 µg/100g.	>60 µg/100g.	>60 µg/100g or average of last three blood samples or all blood samples over previous 6 months (whichever is over a longer time period) is 50 µg/100g. or greater unless last sample is 40 µg/100g or less.
B. Frequency which employees exposed is action level of lead (30 µg/m <sup>3</sup> TWA) must have blood lead level checked. (ZPP is also required in each occasion that a blood test is obtained):					
1. Last blood lead level less than 40 µg/100g . . .	Every 6 months.				
2. Last blood lead level between 40 µg/100g and level requiring medical removal (see A above) . . . . .	Every 2 months.				
3. Employees removed from exposure to lead because of an elevated blood lead level . . . . .	Every 1 month.				

	EFFECTIVE DATE				
	Sept. 6, 1980	Sept. 6, 1981	Sept. 6, 1982	Sept. 6, 1983	Sept. 6, 1984
C. Permissible airborne exposure limit for workers removed from work due to an elevated blood lead level (without regard to respirator protection).	100 $\mu\text{g}/\text{m}^3$ 8 hr TWA	50 $\mu\text{g}/\text{m}^3$ 8 hr TWA	30 $\mu\text{g}/\text{m}^3$ 8 hr TWA	30 $\mu\text{g}/\text{m}^3$ 8 hr TWA	30 $\mu\text{g}/\text{m}^3$ 8 hr TWA
D. Blood lead level confirmed with a second blood analysis, at which employee may return to work. Permissible exposure without regard to respirator protection is listed by industry in Table 1.	60 $\mu\text{g}/100\text{g}$	50 $\mu\text{g}/100\text{g}$	40 $\mu\text{g}/100\text{g}$	40 $\mu\text{g}/100\text{g}$	40 $\mu\text{g}/100\text{g}$

Note: Where medical opinion indicates that an employee is at risk of material impairment from exposure to lead, the physician can remove an employee from exposure exceeding the action level (or less) or recommend special protective measures as deemed appropriate and necessary. Medical monitoring during the medical removal period can be more stringent than noted in the table above if the physician so specifies. Return to work or removal of limitations and special protections is permitted when the physician indicates that the worker is no longer at risk of material impairment.

(E) Under the standard's ultimate worker removal criteria, a worker is to be removed from any work having any eight-hour TWA exposure to lead of 30  $\mu\text{g}/\text{m}^3$  or more whenever either of the following circumstances apply. (I) a blood lead level of 60  $\mu\text{g}/100\text{g}$  or greater is obtained and confirmed by a second follow-up blood lead level performed within two weeks after the employer receives the results of the first blood sample test, or (II) the average of the previous three blood lead determinations or the average of all blood lead determinations conducted during the previous six months, whichever encompasses the longest time period, equals or exceeds 50  $\mu\text{g}/100\text{g}$ , unless the last blood sample indicates a blood lead level at or below 40  $\mu\text{g}/100\text{g}$ , in which case the employee need not be removed. Medical removal is to continue until two consecutive blood lead levels are 40  $\mu\text{g}/100\text{g}$  or less.

(F) During the first two years that the ultimate removal criteria are being phased in, the return criteria have been set to assure that a worker's blood lead level has substantially declined during the period of removal. From March 1, 1979, to March 1, 1980, the blood lead level requiring employee medical removal is 80  $\mu\text{g}/100\text{g}$ . Workers found to have a confirmed blood lead at this level or greater need only be removed from work having a daily eight hour TWA exposure to lead at or above 100  $\mu\text{g}/\text{m}^3$ . Workers so removed are to be returned to work when their blood lead levels are at or below 60  $\mu\text{g}/100\text{g}$  of whole blood. From March 1, 1980, to March 1, 1981, the blood lead level requiring medical removal is 70  $\mu\text{g}/100\text{g}$ . During this period workers need only be removed from jobs having a daily eight hour TWA exposure to lead at or above 50  $\mu\text{g}/\text{m}^3$  and are to be returned to work when a level of 50  $\mu\text{g}/100\text{g}$  is achieved. Beginning March 1, 1981, return depends on the worker's

blood lead level declining to 40 µg/100g of whole blood.

(G) As part of the standard, the employer is required to notify in writing each employee whose whole blood lead level exceeds 40 µg/100g. In addition, each such employee is to be informed that the standard requires medical removal with MRP benefits, discussed below, when an employee's blood lead level exceeds the above defined limits.

(H) In addition to the above blood lead level criteria, temporary worker removal may also take place as a result of medical determinations and recommendations. Written medical opinions must be prepared after each examination pursuant to the standard. If the examining physician includes medical finding, determination or opinion that the employee has a medical condition which places the employee at increased risk of material health impairment from exposure to lead, then the employee must be removed from exposure to lead at or above the action level. Alternatively, if the examining physician recommends special protective measures for an employee (e.g., use of a powered air purifying respirator) or recommends limitations on an employee's exposure to lead, then the employer must implement these recommendations. Recommendations may be more stringent than the specific provisions of the standard. The examining physician, therefore, is given broad flexibility to tailor special protective procedures to the needs of individual employees. This flexibility extends to the evaluation and management of pregnant workers and male and female workers who are planning to conceive children. Based on the history, physical examination, and laboratory studies, the physician might recommend special protective measures or medical removal for an employee who is pregnant or who is planning to conceive a child when, in the physician's judgment, continued exposure to lead at the current job would pose a significant risk. The return of the employee to his or her former job status, or the removal of special protections or limitations, depends upon the examining physician determining that the employee is no longer at increased risk of material impairment or that the special measures are no longer needed.

(I) During the period of any form of special protection or removal, the employer must maintain the worker's earnings, seniority, and other employment rights and benefits (as though the worker has not been removed) for a period of up to eighteen months. This economic protection will maximize meaningful worker participation in the medical surveillance program, and is appropriate as part of the employer's overall obligation to provide a safe and healthful work place. The provisions of MRP benefits during the employee's removal period may, however, be conditioned upon participation in medical surveillance.

(J) On rare occasions, an employee's blood lead level may not acceptably decline within eighteen months of removal. This situation will arise only in unusual circumstances, thus the standard relies on an individual medical examination to determine how to protect such an employee. This medical determination is to be based on both laboratory values, including lead levels, zinc protoporphyrin levels, blood counts, and other tests felt to be warranted, as well as the physician's judgment that any symptoms or

findings on physical examination are a result of lead toxicity. The medical determination may be that the employee is incapable of ever safely returning to his or her former job status. The medical determination may provide additional removal time past eighteen months for some employees or specify special protective measures to be implemented.

(K) The lead standard provides for a multiple physician review in cases where the employee wishes a second opinion concerning potential lead poisoning or toxicity. If an employee wishes a second opinion, he or she can make an appointment with a physician of his or her choice. This second physician will review the findings, recommendations or determinations of the first physician and conduct any examinations, consultations or tests deemed necessary in an attempt to make a final medical determination. If the first and second physicians do not agree in their assessment they must try to resolve their differences. If they cannot reach an agreement then they must designate a third physician to resolve the dispute.

(L) The employer must provide examining and consulting physicians with the following specific information: A copy of the lead regulations and all appendices, a description of the employee's duties as related to exposure, the exposure level to lead and any other toxic substances (if applicable), a description of personal protective equipment used, blood lead levels, and all prior written medical opinions regarding the employee in the employer's possession or control. The employer must also obtain from the physician and provide the employee with a written medical opinion containing blood lead levels, the physician's opinion as to whether the employee is at risk of material impairment to health, any recommended protective measures for the employee if further exposure is permitted, as well as any recommended limitations upon an employee's use of respirators.

(M) Employers must instruct each physician not to reveal to the employer in writing or in any other way his or her findings, laboratory results, or diagnoses which are felt to be unrelated to occupational lead exposure. They must also instruct each physician to advise the employee of any occupationally or nonoccupationally related medical condition requiring further treatment or evaluation.

(N) The standard provides for the use of respirators when engineering and other primary controls have not been fully implemented. However, the use of respirator protection shall not be used in lieu of temporary medical removal due to elevated blood lead levels or findings that an employee is at risk of material health impairment. This is based on the numerous inadequacies of respirators including skin rash where the facepiece makes contact with the skin, unacceptable stress to breathing in some workers with underlying cardiopulmonary impairment, difficulty in providing adequate fit, the tendency for respirators to create additional hazards by interfering with vision, hearing, and mobility, and the difficulties of assuring the maximum effectiveness of a complicated work practice program involving respirators. Respirators do, however, serve a useful function where engineering and work

practice are inadequate by providing interim or short-term protection, provided they are properly selected for the environment in which the employee will be working, properly fitted to the employee, maintained and cleaned periodically, and worn by the employee when required.

(O) In its final standard on occupational exposure to inorganic lead, WISHA has prohibited prophylactic chelation. Diagnostic and therapeutic chelation are permitted only under the supervision of a licensed physician with appropriate medical monitoring in an acceptable clinical setting. The decision to initiate chelation therapy must be made on an individual basis and take into account the severity of symptoms felt to be a result of lead toxicity along with blood lead levels, ZPP levels and other laboratory tests as appropriate. EDTA and penicillamine, which are the primary chelating agents used in the therapy of occupational lead poisoning, have significant potential side effects and their use must be justified on the basis of expected benefits to the worker.

(P) Unless frank and severe symptoms are present, therapeutic chelation is not recommended given the opportunity to remove a worker from exposure and allow the body to naturally excrete accumulated lead. As a diagnostic aid, the chelation mobilization test using CA-EDTA has limited applicability. According to some investigators, the tests can differentiate between lead-induced and other nephropathies. The test may also provide an estimation of the mobile fraction of the total body lead burden.

(Q) Employers are required to assure that accurate records are maintained on exposure monitoring, medical surveillance, and medical removal for each employee. Exposure monitoring and medical surveillance records must be kept for forty years or the duration of employment plus twenty years, whichever is longer, while medical removal records must be maintained for the duration of employment. All records required under the standard must be made available upon request to representatives of the director of the department of labor and industries. Employers must also make environmental and biological monitoring and medical removal records available to affected employees and to former employees or their authorized employee representatives. Employees or their specifically designated representatives have access to their entire medical surveillance records.

(R) In addition, the standard requires that the employer inform all workers exposed to lead at or above the action level of the provisions of the standard and all its appendices, the purpose and description of medical surveillance and provisions for medical removal protection if temporary removal is required. An understanding of the potential health effects of lead exposure by all exposed employees along with full understanding of their rights under the lead standard is essential for an effective monitoring program.

(iii) Adverse health effects of inorganic lead.

(A) Although the toxicity of lead has been known for 2,000 years, the knowledge of the complex relationship between lead exposure and human response is still being refined. Significant

research into the toxic properties of lead continues throughout the world, and it should be anticipated that our understanding of thresholds of effects and margins of safety will be improved in future years. The provisions of the lead standard are founded on two prime medical judgments; first, the prevention of adverse health effects from exposure to lead throughout a working lifetime requires that worker blood lead levels be maintained at or below 40 µg/100g, and second, the blood lead levels of workers, male or female, who intend to parent in the near future should be maintained below 30 µg/100g to minimize adverse reproduction health effects to the parent and developing fetus. The adverse effects of lead on reproduction are being actively researched and WISHA encourages the physician to remain abreast of recent developments in the area to best advise pregnant workers or workers planning to conceive children.

(B) The spectrum of health effects caused by lead exposure can be subdivided into five developmental states; normal, physiological changes of uncertain significance, pathophysiological changes, overt symptoms (morbidity), and mortality. Within this process there are no sharp distinctions, but rather a continuum of effects. Boundaries between categories overlap due to the wide variation of individual responses and exposures in the working population. WISHA's development of the lead standard focused on pathophysiological changes as well as later stages of disease.

(I) Heme synthesis inhibition.

a) The earliest demonstrated effect of lead involves its ability to inhibit at least two enzymes of the heme synthesis pathway at very low blood levels. Inhibition of delta aminolevulinic acid dehydrase (ALA-D) which catalyzes the conversion of delta-aminolevulinic acid (ALA) to protoporphyrin is observed at a blood lead level below 20µg/100g whole blood. At a blood lead level of 40 µg/100g, more than twenty percent of the population would have seventy percent inhibition of ALA-D. There is an exponential increase in ALA excretion at blood lead levels greater than 40 µg/100g.

b) Another enzyme, ferrochelatase, is also inhibited at low blood lead levels. Inhibition of ferrochelatase leads to increased free erythrocyte protoporphyrin (FEP) in the blood which can then bind to zinc to yield zinc protoporphyrin. At a blood lead level of 50 µg/100g or greater, nearly one hundred percent of the population will have an increase FEP. There is also an exponential relationship between blood lead levels greater than 40 µg/100g and the associated ZPP level, which has led to the development of the ZPP screening test for lead exposure.

c) While the significance of these effects is subject to debate, it is WISHA's position that these enzyme disturbances are early stages of a disease process which may eventually result in the clinical symptoms of lead poisoning. Whether or not the effects do progress to the later stages of clinical disease, disruption of these enzyme processes over a working lifetime is considered to be a material impairment of health.

d) One of the eventual results of lead-induced inhibition of enzymes in the heme synthesis pathway is anemia which can be

asymptomatic if mild but associated with a wide array of symptoms including dizziness, fatigue, and tachycardia when more severe. Studies have indicated that lead levels as low as 50 µg/100g can be associated with a definite decreased hemoglobin, although most cases of lead-induced anemia, as well as shortened red-cell survival times, occur at lead levels exceeding 80 µg/100g. Inhibited hemoglobin synthesis is more common in chronic cases whereas shortened erythrocyte life span is more common in acute cases.

e) In lead-induced anemias, there is usually a reticulocytosis along with the presence of basophilic stippling, and ringed sideroblasts, although none of the above are pathognomonic for lead-induced anemia.

(II) Neurological effects.

a) Inorganic lead had been found to have toxic effects on both the central and peripheral nervous systems. The earliest stage of lead-induced central nervous system effects first manifest themselves in the form of behavioral disturbances and central nervous system symptoms including irritability, restlessness, insomnia and other sleep disturbances, fatigue, vertigo, headache, poor memory, tremor, depression, and apathy. With more severe exposure, symptoms can progress to drowsiness, stupor, hallucinations, delirium, convulsions and coma.

b) The most severe and acute form of lead poisoning which usually follows ingestion or inhalation of large amounts of lead is acute encephalopathy which may arise precipitously with the onset of intractable seizures, coma, cardiorespiratory arrest, and death within 48 hours.

c) While there is disagreement about what exposure levels are needed to produce the earliest symptoms, most experts agree that symptoms definitely can occur at blood lead levels of 60 µg/100g whole blood and therefore recommend a 40 µg/100g maximum. The central nervous system effects frequently are not reversible following discontinued exposure or chelation therapy and when improvement does occur, it is almost always only partial.

d) The peripheral neuropathy resulting from lead exposure characteristically involves only motor function with minimal sensory damage and has a marked predilection for the extensor muscles of the most active extremity. The peripheral neuropathy can occur with varying degrees of severity. The earliest and mildest form which can be detected in workers with blood lead levels as low as 50 µg/100g is manifested by slowing or motor nerve conduction velocity often without clinical symptoms. With progression of the neuropathy there is development of painless extensor muscle weakness usually involving the extensor muscles of the fingers and hand in the most active upper extremity, followed in severe cases by wrist drop, much less commonly, foot drop.

e) In addition to slowing of nerve conduction, electromyographical studies in patients with blood lead levels greater than 50 µg/100g have demonstrated a decrease in the number of acting motor unit potentials, an increase in the duration of motor unit potentials, and spontaneous pathological activity including fibrillations and fasciculation. Whether these effects

occur at levels of 40 µg/100g is undetermined.

f) While the peripheral neuropathies can occasionally be reversed with therapy, again such recovery is not assured particularly in the more severe neuropathies and often improvement is only partial. The lack of reversibility is felt to be due in part to segmental demyelination.

(III) Gastrointestinal. Lead may also effect the gastrointestinal system producing abdominal colic or diffuse abdominal pain, constipation, obstipation, diarrhea, anorexia, nausea and vomiting. Lead colic rarely develops at blood lead levels below 80 µg/100g.

(IV) Renal.

a) Renal toxicity represents one of the most serious health effects of lead poisoning. In the early stages of disease nuclear inclusion bodies can frequently be identified in proximal renal tubular cells. Renal functions remain normal and the changes in this stage are probably reversible. With more advanced disease there is progressive interstitial fibrosis and impaired renal function. Eventually extensive interstitial fibrosis ensues with sclerotic glomeruli and dilated and atrophied proximal tubules; all represent end stage kidney disease. Azotemia can be progressive, eventually resulting in frank uremia necessitating dialysis. There is occasionally associated hypertension and hyperuricemia with or without gout.

b) Early kidney disease is difficult to detect. The urinalysis is normal in early lead nephropathy and the blood urea nitrogen and serum creatinine increase only when two-thirds of kidney function is lost. Measurement of creatinine clearance can often detect earlier disease as can other methods of measurement of glomerular filtration rate. An abnormal Ca-EDTA mobilization test has been used to differentiate between lead-induced and other nephropathies, but this procedure is not widely accepted. A form of Fanconi syndrome with aminoaciduria, glycosuria, and hyperphosphaturia indicating severe injury to the proximal renal tubules is occasionally seen in children.

(V) Reproductive effects.

a) Exposure to lead can have serious effects on reproductive function in both males and females. In male workers exposed to lead there can be a decrease in sexual drive, impotence, decreased ability to produce healthy sperm, and sterility. Malformed sperm (teratospermia), decreased number of sperm (hypospermia), and sperm with decreased motility (asthenospermia) can occur. Teratospermia has been noted at mean blood lead levels of 53 µg/100g and hypospermia and asthenospermia at 41 µg/100g. Furthermore, there appears to be a dose-response relationship for teratospermia in lead exposed workers.

b) Women exposed to lead may experience menstrual disturbances including dysmenorrhea, menorrhagia and amenorrhea. Following exposure to lead, women have a higher frequency of sterility, premature births, spontaneous miscarriages, and stillbirths.

c) Germ cells can be affected by lead and cause genetic damage in the egg or sperm cells before conception and result in failure to implant, miscarriage, stillbirth, or birth defects.

d) Infants of mothers with lead poisoning have a higher mortality during the first year and suffer from lowered birth weights, slower growth, and nervous system disorders.

e) Lead can pass through the placental barrier and lead levels in the mother's blood are comparable to concentrations of lead in the umbilical cord at birth. Transplacental passage becomes detectable at twelve-fourteen weeks of gestation and increases until birth.

f) There is little direct data on damage to the fetus from exposure to lead but it is generally assumed that the fetus and newborn would be at least as susceptible to neurological damage as young children. Blood lead levels of 50-60  $\mu\text{g}/100\text{g}$  in children can cause significant neurobehavioral impairments, and there is evidence of hyperactivity at blood levels as low as 25  $\mu\text{g}/100\text{g}$ . Given the overall body of literature concerning the adverse health effects of lead in children, WISHA feels that the blood lead level in children should be maintained below 30  $\mu\text{g}/100\text{g}$  with a population mean of 15  $\mu\text{g}/100\text{g}$ . Blood lead levels in the fetus and newborn likewise should not exceed 30  $\mu\text{g}/100\text{g}$ .

g) Because of lead's ability to pass through the placental barrier and also because of the demonstrated adverse effects of lead on reproductive function in both males and females as well as the risk of genetic damage of lead on both the ovum and sperm, WISHA recommends a 30  $\mu\text{g}/100\text{g}$  maximum permissible blood lead level in both males and females who wish to bear children.

(VI) Other toxic effects.

a) Debate and research continue on the effects of lead on the human body. Hypertension has frequently been noted in occupationally exposed individuals although it is difficult to assess whether this is due to lead's adverse effects on the kidneys or if some other mechanism is involved.

b) Vascular and electrocardiographic changes have been detected but have not been well characterized. Lead is thought to impair thyroid function and interfere with the pituitary-adrenal axis, but again these effects have not been well defined.

(iv) Medical evaluation.

(A) The most important principle in evaluating a worker for any occupational disease including lead poisoning is a high index of suspicion on the part of the examining physician. As discussed in Section (ii), lead can affect numerous organ systems and produce a wide array of signs and symptoms, most of which are nonspecific and subtle in nature at least in the early stages of disease. Unless serious concern for lead toxicity is present, many of the early clues to diagnosis may easily be overlooked.

(B) The crucial initial step in the medical evaluation is recognizing that a worker's employment can result in exposure to lead. The worker will frequently be able to define exposures to lead and lead-containing materials but often will not volunteer this information unless specifically asked. In other situations the worker may not know of any exposures to lead but the suspicion might be raised on the part of the physician because of the industry or occupation of the worker. Potential occupational exposure to lead and its compounds occur in at least one twenty

occupations, including lead smelting, the manufacture of lead storage batteries, the manufacture of lead pigments and products containing pigments, solder manufacture, shipbuilding and ship repair, auto manufacturing, construction, and painting.

(C) Once the possibility for lead exposure is raised, the focus can then be directed toward eliciting information from the medical history, physical exam, and finally from laboratory data to evaluate the worker for potential lead toxicity.

(D) A complete and detailed work history is important in the initial evaluation. A listing of all previous employment with information on work processes, exposure to fumes or dust, known exposures to lead or other toxic substances, respiratory protection used, and previous medical surveillance should all be included in the worker's record. Where exposure to lead is suspected, information concerning on-the-job personal hygiene, smoking or eating habits in work areas, laundry procedures, and use of any protective clothing or respiratory protection equipment should be noted. A complete work history is essential in the medical evaluation of a worker with suspected lead toxicity, especially when long-term effects such as neurotoxicity and nephrotoxicity are considered.

(E) The medical history is also of fundamental importance and should include a listing of all past and current medical conditions, current medications including proprietary drug intake, previous surgeries and hospitalizations, allergies, smoking history, alcohol consumption, and also nonoccupational lead exposures such as hobbies (hunting, riflery). Also known childhood exposures should be elicited. Any previous history of hematological, neurological, gastrointestinal, renal, psychological, gynecological, genetic, or reproductive problems should be specifically noted.

(F) A careful and complete review of systems must be performed to assess both recognized complaints and subtle or slowly acquired symptoms which the worker might not appreciate as being significant. The review of symptoms should include the following:

- |  |  |
|--|--|
| General                                | - Weight loss, fatigue, decreased appetite.  |
| Head, Eyes, Ears, Nose, Throat (HEENT) | - Headaches, visual disturbance or decreased visual acuity, hearing deficits or tinnitus, pigmentation of the oral mucosa, or metallic taste in mouth. |
| Cardiopulmonary                        | - Shortness of breath, cough, chest pains, palpitations, or orthopnea.   |
| Gastrointestinal                       | - Nausea, vomiting, heartburn, abdominal pain, constipation or diarrhea.   |

Neurologic	- Irritability, insomnia, weakness (fatigue), dizziness, loss of memory, confusion, hallucinations, incoordination, ataxia, decreased strength in hands or feet, disturbance in gait, difficulty in climbing stairs, or seizures.
Hematologic	- Pallor, easy fatigability, abnormal blood loss, melena.
Reproductive (male or female and spouse where relevant)	- History of infertility, impotence, loss of libido, abnormal menstrual periods, history of miscarriages, stillbirths, or children with birth defects.
Musculoskeletal	- Muscle and joint pains.

(G) The physical examination should emphasize the neurological, gastrointestinal, and cardiovascular systems. The worker's weight and blood pressure should be recorded and the oral mucosa checked for pigmentation characteristic of a possible Burtonian or lead line on the gingiva. It should be noted, however, that the lead line may not be present even in severe lead poisoning if good oral hygiene is practiced.

(H) The presence of pallor on skin examination may indicate an anemia, which if severe might also be associated with a tachycardia. If an anemia is suspected, an active search for blood loss should be undertaken including potential blood loss through the gastrointestinal tract.

(I) A complete neurological examination should include an adequate mental status evaluation including a search for behavioral and psychological disturbances, memory testing, evaluation for irritability, insomnia, hallucinations, and mental clouding. Gait and coordination should be examined along with close observation for tremor. A detailed evaluation of peripheral nerve function including careful sensory and motor function testing is warranted. Strength testing particularly of extensor muscle groups of all extremities is of fundamental importance.

(J) Cranial nerve evaluation should also be included in the routine examination.

(K) The abdominal examination should include auscultation for bowel sounds and abnormal bruits and palpation for organomegaly, masses, and diffuse abdominal tenderness.

(L) Cardiovascular examination should evaluate possible early signs of congestive heart failure. Pulmonary status should be addressed particularly if respirator protection is contemplated.

(M) As part of the medical evaluation, the lead standard requires the following laboratory studies.

(I) Blood lead level.

(II) Hemoglobin and hematocrit determinations, red cell indices, and examination of the peripheral blood smear to evaluate red blood cell morphology.

(III) Blood urea nitrogen.

(IV) Serum creatinine.

(V) Routine urinalysis with microscopic examination.

(VI) A zinc protoporphyrin level.

(N) In addition to the above, the physician is authorized to order any further laboratory or other tests which he or she deems necessary in accordance with sound medical practice. The evaluation must also include pregnancy testing or laboratory evaluation of male fertility if requested by the employee.

(O) Additional tests which are probably not warranted on a routine basis but may be appropriate when blood lead and ZPP levels are equivocal include delta aminolevulinic acid and coproporphyrin concentrations in the urine, and dark-field illumination for detection of basophilic stippling in red blood cells.

(P) If an anemia is detected further studies including a careful examination of the peripheral smear, reticulocyte count, stool for occult blood, serum iron, total iron binding capacity, bilirubin, and, if appropriate vitamin B12 and folate may be of value in attempting to identify the cause of the anemia.

(Q) If a peripheral neuropathy is suspected, nerve conduction studies are warranted both for diagnosis and as a basis to monitor any therapy.

(R) If renal disease is questioned, a twenty-four-hour urine collection for creatinine clearance, protein, and electrolytes may be indicated. Elevated uric acid levels may result from lead-induced renal disease and a serum uric acid level might be performed.

(S) An electrocardiogram and chest X ray may be obtained as deemed appropriate.

(T) Sophisticated and highly specialized testing should not be done routinely and where indicated should be under the direction of a specialist.

(v) Laboratory evaluation.

(A) The blood level at present remains the single most important test to monitor lead exposure and is the test used in the medical surveillance program under the lead standard to guide employee medical removal. The ZPP has several advantages over the blood lead level. Because of its relatively recent development and the lack of extensive data concerning its interpretation, the ZPP currently remains an ancillary test.

(B) This section will discuss the blood lead level and ZPP in detail and will outline their relative advantages and disadvantages. Other blood tests currently available to evaluate lead exposure will also be reviewed.

(C) The blood lead level is a good index of current or recent lead absorption when there is no anemia present and when the worker has not taken any chelating agents. However, blood lead levels along with urinary lead levels do not necessarily indicate the total body burden of lead and are not adequate measures of past exposure. One reason for this is that lead has a high affinity for bone and up to ninety percent of the body's total lead is deposited there. A very important component of the total lead body burden is lead in soft tissue (liver, kidneys, and brain). This fraction of

the lead body burden, the biologically active lead, is not entirely reflected by blood lead levels since it is a function of the dynamics of lead absorption, distribution, deposition in bone and excretion. Following discontinuation of exposure to lead, the excess body burden is only slowly mobilized from bone and other relatively stable stores and excreted. Consequently, a high blood lead level may only represent recent heavy exposure to lead without a significant total body excess and likewise a low blood lead level does not exclude an elevated total body burden of lead.

(D) Also due to its correlation with recent exposures, the blood lead level may vary considerably over short time intervals.

(E) To minimize laboratory error and erroneous results due to contamination, blood specimens must be carefully collected after thorough cleaning of the skin with appropriate methods using lead-free containers and analyzed by a reliable laboratory. Under the standard, samples must be analyzed in laboratories which are approved by the Center for Disease Control (CDC) or which have received satisfactory grades in proficiency testing by the CDC in the previous year. Analysis is to be made using atomic absorption spectrophotometry anodic stripping; voltammetry or any method which meets the accuracy requirements set forth by the standard.

(F) The determination of lead in urine is generally considered a less reliable monitoring technique than analysis of whole blood primarily due to individual variability in urinary excretion capacity as well as the technical difficulty of obtaining accurate twenty-four hour urine collections. In addition, workers with renal insufficiency, whether due to lead or some other cause, may have decreased lead clearance and consequently urine lead levels may underestimate the true lead burden. Therefore, urine lead levels should not be used as a routine test.

(G) The zinc protoporphyrin test, unlike the blood lead determination, measures an adverse metabolic effect of lead and as such is a better indicator of lead toxicity than the level of blood lead itself. The level of ZPP reflects lead absorption over the preceding three to four months, and therefore is a better indicator of lead body burden. The ZPP requires more time than the blood lead to read significantly elevated levels; the return to normal after discontinuing lead exposure is also slower. Furthermore, the ZPP test is simpler, faster, and less expensive to perform and no contamination is possible. Many investigators believe it is the most reliable means of monitoring chronic lead absorption.

(H) Zinc protoporphyrin results from the inhibition of the enzyme ferrochelatase which catalyzes the insertion of an iron molecule into the protoporphyrin molecule, which then becomes heme. If iron is not inserted into the molecule then zinc, having a greater affinity for protoporphyrin, takes place in the iron, forming ZPP.

(I) An elevation in the level of circulating ZPP may occur at blood lead levels as low as 20-30  $\mu\text{g}/100\text{g}$  in some workers. Once the blood lead level has reached 40  $\mu\text{g}/100\text{g}$  there is more marked rise in the ZPP value from its normal range of less than 100  $\mu\text{g}/100\text{ml}$ . Increases in blood lead levels beyond 40  $\mu\text{g}/100\text{g}$  are associated with exponential increases in ZPP.

(J) Whereas blood lead levels fluctuate over short time spans, ZPP levels remain relatively stable. ZPP is measured directly in red blood cells and is present for the cell's entire one hundred twenty day lifespan. Therefore, the ZPP level in blood reflects the average ZPP production over the previous three to four months and consequently the average lead exposure during that time interval.

(K) It is recommended that a hematocrit be determined whenever a confirmed ZPP of 50  $\mu\text{g}/100\text{ml}$  whole blood is obtained to rule out a significant underlying anemia. If the ZPP is in excess of 100  $\mu\text{g}/100\text{ml}$  and not associated with abnormal elevations in blood lead levels, the laboratory should be checked to be sure the blood leads were determined using atomic absorption spectrophotometry, anodic stripping voltammetry or any method which meets the accuracy requirements set forth by the standard, by a CDC approved laboratory which is experienced in lead level determinations. Repeat periodic blood lead studies should be obtained in all individuals with elevated ZPP levels to be certain that an associated elevated blood lead level has not been missed due to transient fluctuations in blood leads.

(L) ZPP has characteristic fluorescence spectrum with a peak at 594nm which is detectable with a hematofluorimeter. The hematofluorimeter is accurate and portable and can provide on-site, instantaneous results for workers who can be frequently tested via a finger prick.

(M) However, careful attention must be given to calibration and quality control procedures. Limited data on blood lead -ZPP correlations and the ZPP levels which are associated with the adverse health effects discussed in item (ii) are the major limitations of the test. Also it is difficult to correlate ZPP levels with environmental exposure and there is some variation of response with age and sex. Nevertheless, the ZPP promises to be an important diagnostic test for the early detection of lead toxicity and its value will increase as more data is collected regarding its relationship to other manifestations of lead poisoning.

(N) Levels of delta-aminolevulinic acid (ALA) in the urine are also used as a measure of lead exposure. Increasing concentrations of ALA are believed to result from the inhibition of the enzyme delta-aminolevulinic acid dehydrase (ALA-D). Although the test is relatively easy to perform, inexpensive, and rapid, the disadvantages include variability in results, the necessity to collect a complete twenty-four hour urine sample which has a specific gravity greater than 1.010, and also the fact that ALA decomposes in the presence of light.

(O) The pattern of porphyrin excretion in the urine can also be helpful in identifying lead intoxication. With lead poisoning, the urine concentrations of coproporphyrins I and II, porphobilinogen and uroporphyrin I rise. The most important increase, however, is that of coproporphyrin III; levels may exceed 5,000  $\mu\text{g}/1$  in the urine in lead poisoned individuals, but its correlation with blood lead levels and ZPP are not as good as those of ALA. Increases in urinary porphyrins are not diagnostic of lead toxicity and may be seen in porphyria, some liver diseases, and in

patients with high reticulocyte counts.

(vi) Summary.

(A) The WISHA standard for inorganic lead places significant emphasis on the medical surveillance of all workers exposed to levels of inorganic lead above the action level of 30  $\mu\text{g}/\text{m}^3$  TWA. The physician has a fundamental role in this surveillance program, and in the operation of the medical removal protection program.

(B) Even with adequate worker education on the adverse health effects of lead and appropriate training in work practices, personal hygiene and other control measures, the physician has a primary responsibility for evaluating potential lead toxicity in the worker. It is only through a careful and detailed medical and work history, a complete physical examination and appropriate laboratory testing that an accurate assessment can be made. Many of the adverse health effects of lead toxicity are either irreversible or only partially reversible and therefore early detection of disease is very important.

(C) This document outlines the medical monitoring program as defined by the occupational safety and health standard for inorganic lead. It reviews the adverse health effects of lead poisoning and describes the important elements of the history and physical examinations as they relate to these adverse effects.

(D) It is hoped that this review and discussion will give the physician a better understanding of the WISHA standard with the ultimate goal of protecting the health and well-being of the worker exposed to lead under his or her care.

(d) Appendix D. Recommendations to employers concerning high-risk tasks (nonmandatory).

The department advises employers that the following tasks have a high risk for lead overexposure (this list is not complete; other tasks also can result in lead over-exposure):

- Any open flame operation involving lead-containing solder in a manner producing molten solder, including the manufacture or repair of motor vehicle radiators;
- Sanding, cutting or grinding of lead-containing solder;
- Breaking, recycling or manufacture of lead-containing batteries;
- Casting objects using lead, brass, or lead-containing alloys;
- Where lead-containing coatings or paints are present:
  - abrasive blasting
  - welding
  - cutting
  - torch burning
  - manual demolition of structures
  - manual scraping
  - manual sanding
  - heat gun applications
  - power tool cleaning
  - rivet busting
  - clean-up activities where dry expendable abrasives are used
  - abrasive blasting enclosure movement and removal;

- Spray-painting with lead-containing paint;
- Using lead-containing mortar;
- Lead burning;
- Operation or cleaning of shooting facilities where lead bullets are used;
- Formulation or processing of lead-containing pigments or paints;
- Cutting, burning, or melting of lead-containing materials.

The department recommends that annual blood lead testing be offered to all employees potentially overexposed to lead, including those performing the tasks listed above, regardless of air lead levels. Research has shown that air lead levels often do not accurately predict workers' lead overexposure. The blood lead testing will provide the most information if performed during a period of peak lead exposure.

Employers should be aware that the United States Public Health Service has set a goal of eliminating occupational exposures which result in whole blood lead levels of 25 µg/dl or greater. This goal should guide whether employees' blood lead levels indicate lead overexposure.

If blood lead levels are elevated in an employee performing a task associated with lead overexposure, employers should assess the maintenance and effectiveness of exposure controls, hygiene facilities, respiratory protection program, the employee's work practices and personal hygiene, and the employee's respirator use, if any. If a deficiency exists in any of these areas, the employer should correct the problem.

AMENDATORY SECTION (Amending WSR 04-10-026, filed 4/27/04, effective 8/1/04)

**WAC 296-62-07631 Recordkeeping.** (1) Monitoring data for exempted employers.

(a) Where as a result of the initial monitoring the processing, use, or handling of products made from or containing MDA are exempted from other requirements of this section under WAC 296-62-07601(2), the employer shall establish and maintain an accurate record of monitoring relied on in support of the exemption.

(b) This record shall include at least the following information:

(i) The product qualifying for exemption;

(ii) The source of the monitoring data (e.g., was monitoring performed by the employer or a private contractor);

(iii) The testing protocol, results of testing, and/or analysis of the material for the release of MDA;

(iv) A description of the operation exempted and how the data support the exemption (e.g., are the monitoring data representative of the conditions at the affected facility); and

(v) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(c) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(2) Objective data for exempted employers.

(a) Where the processing, use, or handling of products made from or containing MDA are exempted from other requirements of WAC 296-62-076 under WAC 296-62-07601, the employer shall establish and maintain an accurate record of objective data relied upon in support of the exemption.

(b) This record shall include at least the following information:

(i) The product qualifying for exemption;

(ii) The source of the objective data;

(iii) The testing protocol, results of testing, and/or analysis of the material for the release of MDA;

(iv) A description of the operation exempted and how the data support the exemption; and

(v) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(c) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(3) Exposure measurements.

(a) The employer shall establish and maintain an accurate record of all measurements required by WAC 296-62-07609, in accordance with Part B of this chapter.

(b) This record shall include:

(i) The dates, number, duration, and results of each of the samples taken, including a description of the procedure used to determine representative employee exposures;

(ii) Identification of the sampling and analytical methods used;

(iii) A description of the type of respiratory protective devices worn, if any; and

(iv) The name, Social Security number, job classification, and exposure levels of the employee monitored and all other employees whose exposure the measurement is intended to represent.

(c) The employer shall maintain this record for at least 30 years, in accordance with Part B of this chapter.

(4) Medical surveillance.

(a) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance required by WAC 296-62-07625, 296-62-07627, and 296-62-07629, in accordance with Part B of this chapter.

(b) This record shall include:

(i) The name, Social Security number, and description of the duties of the employee;

(ii) The employer's copy of the physician's written opinion on the initial, periodic, and any special examinations, including results of medical examination and all tests, opinions, and recommendations;

(iii) Results of any airborne exposure monitoring done for that employee and the representative exposure levels supplied to the physician; and

(iv) Any employee medical complaints related to exposure to MDA.

(c) The employer shall keep, or assure that the examining physician keeps, the following medical records:

(i) A copy of this standard and its appendices, except that the employer may keep one copy of the standard and its appendices for all employees provided the employer references the standard and its appendices in the medical surveillance record of each employee;

(ii) A copy of the information provided to the physician as required by any sections in the regulatory text;

(iii) A description of the laboratory procedures and a copy of any standards or guidelines used to interpret the test results or references to the information;

(iv) A copy of the employee's medical and work history related to exposure to MDA.

(d) The employer shall maintain this record for at least the duration of employment plus thirty years, in accordance with Part B of this chapter.

(5) Medical removals.

(a) The employer shall establish and maintain an accurate record for each employee removed from current exposure to MDA pursuant to WAC 296-62-07625, 296-62-07627, and 296-62-07629.

(b) Each record shall include:

(i) The name and Social Security number of the employee;

(ii) The date of each occasion that the employee was removed from current exposure to MDA as well as the corresponding date on

which the employee was returned to his or her former job status;

(iii) A brief explanation of how each removal was or is being accomplished; and

(iv) A statement with respect to each removal indicating the reason for the removal.

(c) The employer shall maintain each medical removal record for at least the duration of an employee's employment plus thirty years.

(6) Availability.

(a) The employer shall assure that records required to be maintained by WAC 296-62-076 shall be made available, upon request, to the director for examination and copying.

(b) Employee exposure monitoring records required by WAC 296-62-076 shall be provided upon request for examination and copying to employees, employee representatives, and the director in accordance with the applicable sections of WAC 296-800-170.

(c) Employee medical records required by this section shall be provided upon request for examination and copying, to the subject employee, to anyone having the specific written consent of the subject employee, and to the director in accordance with Part B of this chapter.

(7) Transfer of records. (~~(a)~~) The employer shall comply with the requirements involving transfer of records set forth in chapter 296-802 WAC.

~~((b) If the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the director, at least ninety days prior to disposal, and transmit the records to the director if so requested by the director within that period.))~~

AMENDATORY SECTION (Amending WSR 09-15-145, filed 7/21/09, effective 9/1/09)

**WAC 296-62-14533 Cotton dust.** (1) Scope and application.

(a) This section, in its entirety, applies to the control of employee exposure to cotton dust in all workplaces where employees engage in yarn manufacturing, engage in slashing and weaving operations, or work in waste houses for textile operations.

(b) This section does not apply to the handling or processing of woven or knitted materials; to maritime operations covered by chapters 296-56 and 296-304 WAC; to harvesting or ginning of cotton; or to the construction industry.

(c) Only subsection (8) Medical surveillance, subsection (11)(b) Medical surveillance, subsection (11)(c) Availability, subsection (11)(d) Transfer of records, and Appendices B, C, and D of this section apply in all work places where employees exposed to cotton dust engage in cottonseed processing or waste processing operations.

(d) This section applies to yarn manufacturing and slashing and weaving operations exclusively using washed cotton (as defined by subsection (14) of this section) only to the extent specified by subsection (14) of this section.

(e) This section, in its entirety, applies to the control of all employees exposure to the cotton dust generated in the preparation of washed cotton from opening until the cotton is thoroughly wetted.

(f) This section does not apply to knitting, classing or warehousing operations except that employers with these operations, if requested by WISHA, shall grant WISHA access to their employees and workplaces for exposure monitoring and medical examinations for purposes of a health study to be performed by WISHA on a sampling basis.

(2) Definitions applicable to this section:

(a) "Blow down" - The cleaning of equipment and surfaces with compressed air.

(b) "Blow off" - The use of compressed air for cleaning of short duration and usually for a specific machine or any portion of a machine.

(c) "Cotton dust" - Dust present in the air during the handling or processing of cotton, which may contain a mixture of many substances including ground-up plant matter, fiber, bacteria, fungi, soil, pesticides, noncotton plant matter and other contaminants which may have accumulated with the cotton during the growing, harvesting and subsequent processing or storage periods. Any dust present during the handling and processing of cotton through the weaving or knitting of fabrics, and dust present in other operations or manufacturing processes using raw or waste cotton fibers or cotton fiber by-products from textile mills are

considered cotton dust within this definition. Lubricating oil mist associated with weaving operations is not considered cotton dust.

(d) "Director" - The director of labor and industries or his authorized representative.

(e) "Equivalent instrument" - A cotton dust sampling device that meets the vertical elutriator equivalency requirements as described in subsection (4)(a)(iii) of this section.

(f) "Lint-free respirable cotton dust" - Particles of cotton dust of approximately 15 microns or less aerodynamic equivalent diameter.

(g) "Vertical elutriator cotton dust sampler" or "vertical elutriator" - A dust sampler which has a particle size cut-off at approximately 15 microns aerodynamic equivalent diameter when operating at the flow rate of  $7.4 \pm 0.2$  liters per minute.

(h) "Waste processing" - Waste recycling (sorting, blending, cleaning and willowing) and garnetting.

(i) "Yarn manufacturing" - All textile mill operations from opening to, but not including, slashing and weaving.

(3) Permissible exposure limits and action levels.

(a) Permissible exposure limits (PEL).

(i) The employer shall assure that no employee who is exposed to cotton dust in yarn manufacturing and cotton washing operations is exposed to airborne concentrations of lint-free respirable cotton dust greater than  $200 \mu\text{g}/\text{m}^3$  mean concentration, averaged over an eight-hour period, as measured by a vertical elutriator or an equivalent instrument.

(ii) The employer shall assure that no employee who is exposed to cotton dust in textile mill waste house operations or is exposed in yarn manufacturing to dust from "lower grade washed cotton" as defined in subsection (14)(e) of this section is exposed to airborne concentrations of lint-free respirable cotton dust greater than  $500 \mu\text{g}/\text{m}^3$  mean concentration, averaged over an eight-hour period, as measured by a vertical elutriator or an equivalent instrument.

(iii) The employer shall assure that no employee who is exposed to cotton dust in the textile processes known as slashing and weaving is exposed to airborne concentrations of lint-free respirable cotton dust greater than  $750 \mu\text{g}/\text{m}^3$  mean concentration, averaged over an eight-hour period, as measured by a vertical elutriator or an equivalent instrument.

(b) Action levels.

(i) The action level for yarn manufacturing and cotton washing operations is an airborne concentration of lint-free respirable cotton dust of  $100 \mu\text{g}/\text{m}^3$  mean concentration, averaged over an eight-hour period, as measured by a vertical elutriator or an equivalent instrument.

(ii) The action level for waste houses for textile operations is an airborne concentration of lint-free respirable cotton dust of  $250 \mu\text{g}/\text{m}^3$  mean concentration, averaged over an eight-hour period, as measured by a vertical elutriator or an equivalent instrument.

(iii) The action level for the textile processes known as slashing and weaving is an airborne concentration of lint-free

respirable cotton dust of 375 µg/m<sup>3</sup> mean concentration, averaged over an eight-hour period, as measured by a vertical elutriator or an equivalent instrument.

(4) Exposure monitoring and measurement.

(a) General.

(i) For the purposes of this section, employee exposure is that exposure which would occur if the employee were not using a respirator.

(ii) The sampling device to be used shall be either the vertical elutriator cotton dust sampler or an equivalent instrument.

(iii) If an alternative to the vertical elutriator cotton dust sampler is used, the employer shall establish equivalency by demonstrating that the alternative sampling devices:

(A) It collects respirable particulates in the same range as the vertical elutriator (approximately 15 microns);

(B) Replicate exposure data used to establish equivalency are collected in side-by-side field and laboratory comparisons; and

(C) A minimum of 100 samples over the range of 0.5 to 2 times the permissible exposure limit are collected, and ninety percent of these samples have an accuracy range of plus or minus twenty-five percent of the vertical elutriator reading with a ninety-five percent confidence level as demonstrated by a statistically valid protocol. (An acceptable protocol for demonstrating equivalency is described in Appendix E of this section.)

(iv) WISHA will issue a written opinion stating that an instrument is equivalent to a vertical elutriator cotton dust sampler if:

(A) A manufacturer or employer requests an opinion in writing and supplies the following information:

(I) Sufficient test data to demonstrate that the instrument meets the requirements specified in this paragraph and the protocol specified in Appendix E of this section;

(II) Any other relevant information about the instrument and its testing requested by WISHA; and

(III) A certification by the manufacturer or employer that the information supplied is accurate (✓) and

(B) If WISHA finds, based on information submitted about the instrument, that the instrument meets the requirements for equivalency specified by this subsection.

(b) Initial monitoring. Each employer who has a place of employment within the scope of subsections (1)(a), (d) or (e) of this section shall conduct monitoring by obtaining measurements which are representative of the exposure of all employees to airborne concentrations of lint-free respirable cotton dust over an eight-hour period. The sampling program shall include at least one determination during each shift for each work area.

(c) Periodic monitoring.

(i) If the initial monitoring required by (4)(b) of this section or any subsequent monitoring reveals employee exposure to be at or below the permissible exposure limit, the employer shall repeat the monitoring for those employees at least annually.

(ii) If the initial monitoring required by (4)(b) of this

section or any subsequent monitoring reveals employee exposure to be above the PEL, the employer shall repeat the monitoring for those employees at least every six months.

(iii) Whenever there has been a production, process, or control change which may result in new or additional exposure to cotton dust, or whenever the employer has any other reason to suspect an increase in employee exposure, the employer shall repeat the monitoring and measurements for those employees affected by the change or increase.

(d) Employee notification.

(i) Within fifteen working days after the receipt of monitoring results, the employer shall notify each employee in writing of the exposure measurements which represent that employee's exposure.

(ii) Whenever the results indicate that the employee's exposure exceeds the applicable permissible exposure limit specified in subsection (3) of this section, the employer shall include in the written notice a statement that the permissible exposure limit was exceeded and a description of the corrective action taken to reduce exposure below the permissible exposure limit.

(5) Methods of compliance.

(a) Engineering and work practice controls. The employer shall institute engineering and work practice controls to reduce and maintain employee exposure to cotton dust at or below the permissible exposure limit specified in subsection (3) of this section, except to the extent that the employer can establish that such controls are not feasible.

(b) Whenever feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the permissible exposure limit, the employer shall nonetheless institute these controls to immediately reduce exposure to the lowest feasible level, and shall supplement these controls with the use of respirators which shall comply with the provisions of subsection (6) of this section.

(c) Compliance program.

(i) Where the most recent exposure monitoring data indicates that any employee is exposed to cotton dust levels greater than the permissible exposure limit, the employer shall establish and implement a written program sufficient to reduce exposures to or below the permissible exposure limit solely by means of engineering controls and work practices as required by (a) of this subsection.

(ii) The written program shall include at least the following:

(A) A description of each operation or process resulting in employee exposure to cotton dust;

(B) Engineering plans and other studies used to determine the controls for each process;

(C) A report of the technology considered in meeting the permissible exposure limit;

(D) Monitoring data obtained in accordance with subsection (4) of this section;

(E) A detailed schedule for development and implementation of engineering and work practice controls, including exposure levels

projected to be achieved by such controls;

(F) Work practice program; and

(G) Other relevant information.

(iii) The employer's schedule as set forth in the compliance program, shall project completion of the implementation of the compliance program no later than March 27, 1984 or as soon as possible if monitoring after March 27, 1984 reveals exposures over the PEL, except as provided in (13)(b)(ii)(B) of this section.

(iv) The employer shall complete the steps set forth in his program by the dates in the schedule.

(v) Written programs shall be submitted, upon request, to the director, and shall be available at the worksite for examination and copying by the director, and any affected employee or their designated representatives.

(vi) The written programs required under subsection (5)(c) of this section shall be revised and updated at least every six months to reflect the current status of the program and current exposure levels.

(d) Mechanical ventilation. When mechanical ventilation is used to control exposure, measurements which demonstrate the effectiveness of the system to control exposure, such as capture velocity, duct velocity, or static pressure shall be made at reasonable intervals.

(6) Use of respirators.

(a) General. For employees who are required to use respirators by this section, the employer must provide each employee an appropriate respirator that complies with the requirements of this section. Respirators must be used during:

(i) Periods necessary to install or implement feasible engineering controls and work-practice controls;

(ii) Maintenance and repair activities for which engineering and work-practice controls are not feasible;

(iii) Work operations for which feasible engineering and work-practice controls are not yet sufficient to reduce employee exposure to or below the permissible exposure limits;

(iv) Work operations specified under subsection (7)(a) of this section;

(v) Periods for which an employee requests a respirator.

(b) Respirator program.

(i) The employer must develop, implement and maintain a respiratory protection program as required by chapter 296-842 WAC, Respirators, which covers each employee required by this chapter to use a respirator.

(ii) Whenever a physician determines that an employee who works in an area in which the cotton-dust concentration exceeds the PEL is unable to use a respirator, including a powered air-purifying respirator, the employee must be given the opportunity to transfer to an available position, or to a position that becomes available later, that has a cotton-dust concentration at or below the PEL. The employer must ensure that such employees retain their current wage rate or other benefits as a result of the transfer.

(c) Respirator selection. The employer must:

(i) Select and provide to employees the appropriate

respirators by following requirements in this section and WAC 296-842-13005, found in the respirator rule.

(ii) Provide employees with a powered air-purifying respirator (PAPR) when the employee chooses to use a PAPR instead of a negative-pressure air-purifying respirator, and the PAPR will provide adequate protection.

(iii) Limit the use of filtering facepiece respirators for protection against cotton dust to concentrations less than or equal to five times (5x) the PEL.

(iv) Provide high-efficiency particulate air (HEPA) filters or N-, R-, or P-100 series filters for powered air-purifying respirators (PAPRs) and negative-pressure air-purifying respirators when used in cotton dust concentrations greater than ten times (10x) the PEL.

(7) Work practices. Each employer shall, regardless of the level of employee exposure, immediately establish and implement a written program of work practices which shall minimize cotton dust exposure. The following shall be included where applicable:

(a) Compressed air "blow down" cleaning shall be prohibited, where alternative means are feasible. Where compressed air is used for cleaning, the employees performing the "blow down" or "blow off" shall wear suitable respirators. Employees whose presence is not required to perform "blow down" or "blow off" shall be required to leave the area affected by the "blow down" or "blow off" during this cleaning operation.

(b) Cleaning of clothing or floors with compressed air shall be prohibited.

(c) Floor sweeping shall be performed with a vacuum or with methods designed to minimize dispersal of dust.

(d) In areas where employees are exposed to concentrations of cotton dust greater than the permissible exposure limit, cotton and cotton waste shall be stacked, sorted, baled, dumped, removed or otherwise handled by mechanical means, except where the employer can show that it is infeasible to do so. Where infeasible, the method used for handling cotton and cotton waste shall be the method which reduces exposure to the lowest level feasible.

(8) Medical surveillance.

(a) General.

(i) Each employer covered by the standard shall institute a program of medical surveillance for all employees exposed to cotton dust.

(ii) The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician and are provided without cost to the employee.

(iii) Persons other than licensed physicians, who administer the pulmonary function testing required by this section shall have completed a NIOSH approved training course in spirometry.

(b) Initial examinations. The employer shall provide medical surveillance to each employee who is or may be exposed to cotton dust. For new employees' this examination shall be provided prior to initial assignment. The medical surveillance shall include at least the following:

(i) A medical history;

(ii) The standardized questionnaire contained in WAC 296-62-14537; and

(iii) A pulmonary function measurement, including a determination of forced vital capacity (FVC) and forced expiratory volume in one second ( $FEV_1$ ), the  $FEV_1/FVC$  ratio, and the percentage that the measured values of  $FEV_1$  and FVC differ from the predicted values, using the standard tables in WAC 296-62-14539. These determinations shall be made for each employee before the employee enters the workplace on the first day of the work week, preceded by at least thirty-five hours of no exposure to cotton dust. The tests shall be repeated during the shift, no less than four hours and no more than ten hours after the beginning of the work shift; and, in any event, no more than one hour after cessation of exposure. Such exposure shall be typical of the employee's usual workplace exposure. The predicted  $FEV_1$  and FVC for blacks shall be multiplied by 0.85 to adjust for ethnic differences.

(iv) Based upon the questionnaire results, each employee shall be graded according to Schilling's byssinosis classification system.

(c) Periodic examinations.

(i) The employer shall provide at least annual medical surveillance for all employees exposed to cotton dust above the action level in yarn manufacturing, slashing and weaving, cotton washing and waste house operations. The employer shall provide medical surveillance at least every two years for all employees exposed to cotton dust at or below the action level, for all employees exposed to cotton dust from washed cotton (except from washed cotton defined in subsection (9)(c) of this section), and for all employees exposed to cotton dust in cottonseed processing and waste processing operations. Periodic medical surveillance shall include at least an update of the medical history, standardized questionnaire (Appendix B-111), Schilling byssinosis grade, and the pulmonary function measurements in (b)(iii) of this subsection.

(ii) Medical surveillance as required in (c)(i) of this subsection shall be provided every six months for all employees in the following categories:

(A) An  $FEV_1$  of greater than eighty percent of the predicted value, but with an  $FEV_1$  decrement of five percent or 200 ml. on a first working day;

(B) An  $FEV_1$  of less than eighty percent of the predicted value;  
or

(C) Where, in the opinion of the physician, any significant change in questionnaire findings, pulmonary function results, or other diagnostic tests have occurred.

(iii) An employee whose  $FEV_1$  is less than sixty percent of the predicted value shall be referred to a physician for a detailed pulmonary examination.

(iv) A comparison shall be made between the current examination results and those of previous examinations and a determination made by the physician as to whether there has been a significant change.

(d) Information provided to the physician. The employer shall

provide the following information to the examining physician:

- (i) A copy of this regulation and its appendices;
- (ii) A description of the affected employee's duties as they relate to the employee's exposure;
- (iii) The employee's exposure level or anticipated exposure level;
- (iv) A description of any personal protective equipment used or to be used; and
- (v) Information from previous medical examinations of the affected employee which is not readily available to the examining physician.

(e) Physician's written opinion.

(i) The employer shall obtain and furnish the employee with a copy of a written opinion from the examining physician containing the following:

(A) The results of the medical examination and tests including the FEV<sub>1</sub>, FVC, and FEV<sub>1</sub>/FVC ratio;

(B) The physician's opinion as to whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health from exposure to cotton dust;

(C) The physician's recommended limitations upon the employee's exposure to cotton dust or upon the employee's use of respirators including a determination of whether an employee can wear a negative pressure respirator, and where the employee cannot, a determination of the employee's ability to wear a powered air purifying respirator; and

(D) A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.

(ii) The written opinion obtained by the employer shall not reveal specific findings or diagnoses unrelated to occupational exposure.

(9) Employee education and training.

(a) Training program.

(i) The employer shall train each employee exposed to cotton dust in accordance with the requirements of this section and shall assure that each employee is informed of the following:

(A) The acute and long term health hazards associated with exposure to cotton dust;

(B) The names and descriptions of jobs and processes which could result in exposure to cotton dust at or above the PEL(~~(-)~~);

(C) The measures, including work practices required by subsection (7) of this section, necessary to protect the employee from exposures in excess of the permissible exposure limit;

(D) The purpose, proper use, limitations, and other training requirements for respiratory protection as required by subsection (6) of this section and chapter 296-842 WAC (see WAC 296-842-11005, 296-842-16005 and 296-842-19005);

(E) The purpose for and a description of the medical surveillance program required by subsection (8) of this section and other information which will aid exposed employees in understanding the hazards of cotton dust exposure; and

(F) The contents of this standard and its appendices.

(ii) The training program shall be provided prior to initial assignment and shall be repeated annually for each employee exposed to cotton dust, when job assignments or work processes change and when employee performance indicates a need for retraining.

(b) Access to training materials.

(i) Each employer shall post a copy of this section with its appendices in a public location at the workplace, and shall, upon request, make copies available to employees.

(ii) The employer shall provide all materials relating to the employee training and information program to the director upon request.

(10) Signs. The employer shall post the following warning sign in each work area where the permissible exposure limit for cotton dust is exceeded:

WARNING  
COTTON DUST WORK AREA  
MAY CAUSE ACUTE OR DELAYED LUNG INJURY  
(BYSSINOSIS)  
RESPIRATORS REQUIRED IN THIS AREA

(11) Recordkeeping.

(a) Exposure measurements.

(i) The employer shall establish and maintain an accurate record of all measurements required by subsection (4) of this section.

(ii) The record shall include:

(A) A log containing the items listed in WAC 296-62-14535 (4)(a), and the dates, number, duration, and results of each of the samples taken, including a description of the procedure used to determine representative employee exposures;

(B) The type of protective devices worn, if any, and length of time worn; and

(C) The names, Social Security number, job classifications, and exposure levels of employees whose exposure the measurement is intended to represent.

(iii) The employer shall maintain this record for at least twenty years.

(b) Medical surveillance.

(i) The employer shall establish and maintain an accurate medical record for each employee subject to medical surveillance required by subsection (8) of this section.

(ii) The record shall include:

(A) The name and Social Security number and description of the duties of the employee;

(B) A copy of the medical examination results including the medical history, questionnaire response, results of all tests, and the physician's recommendation;

(C) A copy of the physician's written opinion;

(D) Any employee medical complaints related to exposure to cotton dust;

(E) A copy of this standard and its appendices, except that

the employer may keep one copy of the standard and the appendices for all employees, provided that he references the standard and appendices in the medical surveillance record of each employee; and

(F) A copy of the information provided to the physician as required by subsection (8)(d) of this section.

(iii) The employer shall maintain this record for at least twenty years.

(c) Availability.

(i) The employer shall make all records required to be maintained by subsection (11) of this section available to the director for examination and copying.

(ii) Employee exposure measurement records and employee medical records required by this subsection shall be provided upon request to employees, designated representatives, and the assistant director in accordance with chapter 296-802 WAC.

(d) Transfer of records.

(i) Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by subsection (11) of this section.

~~(ii) ((Whenever the employer ceases to do business, and there is no successor employer to receive and retain the records for the prescribed period, these records shall be transmitted to the director.~~

~~(iii) At the expiration of the retention period for the records required to be maintained by this section, the employer shall notify the director at least three months prior to the disposal of such records and shall transmit those records to the director if he requests them within that period.~~

~~(iv))~~ The employer shall also comply with any additional requirements involving transfer of records set forth in ~~((chapter 296-802))~~ WAC 296-802-60005.

(12) Observation of monitoring.

(a) The employer shall provide affected employees or their designated representatives an opportunity to observe any measuring or monitoring of employee exposure to cotton dust conducted pursuant to subsection (4) of this section.

(b) Whenever observation of the measuring or monitoring of employee exposure to cotton dust requires entry into an area where the use of personal protective equipment is required, the employer shall provide the observer with and assure the use of such equipment and shall require the observer to comply with all other applicable safety and health procedures.

(c) Without interfering with the measurement, observers shall be entitled to:

(i) An explanation of the measurement procedures;

(ii) An opportunity to observe all steps related to the measurement of airborne concentrations of cotton dust performed at the place of exposure; and

(iii) An opportunity to record the results obtained.

(13) Washed cotton.

(a) Exemptions. Cotton, after it has been washed by the processes described in this section is exempt from all or parts of this section as specified if the requirements of this section are

met.

(b) Initial requirements.

(i) In order for an employer to qualify as exempt or partially exempt from this standard for operations using washed cotton, the employer must demonstrate that the cotton was washed in a facility which is open to inspection by the director and the employer must provide sufficient accurate documentary evidence to demonstrate that the washing methods utilized meet the requirements of this section.

(ii) An employer who handles or processes cotton which has been washed in a facility not under the employer's control and claims an exemption or partial exemption under this paragraph, must obtain from the cotton washer and make available at the worksite, to the director, or his designated representative, to any affected employee, or to their designated representative the following:

(A) A certification by the washer of the cotton of the grade of cotton, the type of washing process, and that the batch meets the requirements of this section:

(B) Sufficient accurate documentation by the washer of the cotton grades and washing process; and

(C) An authorization by the washer that the director may inspect the washer's washing facilities and documentation of the process.

(c) Medical and dyed cotton. Medical grade (USP) cotton, cotton that has been scoured, bleached and dyed, and mercerized yarn shall be exempt from all provisions of this standard.

(d) Higher grade washed cotton. The handling or processing of cotton classed as "low middling light spotted or better" (color grade 52 or better and leaf grade code 5 or better according to the 1993 USDA classification system) shall be exempt from all provisions of the standard except requirements of subsection (8) of this section, medical surveillance; subsection (11)(b) through (d) of this section, recordkeeping-medical records, and Appendices B, C, and D of this section, if they have been washed on one of the following systems:

(i) On a continuous batt system or a rayon rinse system including the following conditions:

(A) With water;

(B) At a temperature of no less than 60°C;

(C) With a water-to-fiber ratio of no less than 40:1; and

(D) With the bacterial levels in the wash water controlled to limit bacterial contamination of the cotton.

(ii) On a batch kier washing system including the following conditions:

(A) With water;

(B) With cotton fiber mechanically opened and thoroughly prewetted before forming the cake;

(C) For low-temperature processing, at a temperature of no less than 60°C with a water-to-fiber ratio of no less than 40:1; or, for high-temperature processing, at a temperature of no less than 93°C with a water-to-fiber ratio of no less than 15:1;

(D) With a minimum of one wash cycle followed by two rinse cycles for each batch, using fresh water in each cycle; and

(E) With bacterial levels in the wash water controlled to limit bacterial contamination of the cotton.

(e) Lower grade washed cotton. The handling and processing of cotton of grades lower than "low middling light spotted," that has been washed as specified in (d) of this subsection and has also been bleached, shall be exempt from all provisions of the standard except the requirements of subsection (3)(a) Permissible exposure limits, subsection (4) Exposure monitoring and measurement, subsection (8) Medical surveillance, subsection (11) Recordkeeping, and Appendices B, C and D of this section.

(f) Mixed grades of washed cotton. If more than one grade of washed cotton is being handled or processed together, the requirements of the grade with the most stringent exposure limit, medical and monitoring requirements shall be followed.

(14) Appendices.

(a) Appendix B (B-I, B-II and B-III), WAC 296-62-14537, Appendix C, WAC 296-62-14539 and Appendix D, WAC 296-62-14541 are incorporated as part of this chapter and the contents of these appendices are mandatory.

(b) Appendix A of this chapter, WAC 296-62-14535 contains information which is not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

(c) Appendix E of this chapter is a protocol which may be followed in the validation of alternative measuring devices as equivalent to the vertical elutriator cotton dust sampler. Other protocols may be used if it is demonstrated that they are statistically valid, meet the requirements in subsection (4)(a)(iii) of this section, and are appropriate for demonstrating equivalency.

AMENDATORY SECTION (Amending WSR 04-10-026, filed 4/27/04, effective 8/1/04)

**WAC 296-62-20023 Recordkeeping.** (1) Exposure measurements. The employer shall establish and maintain an accurate record of all measurements taken to monitor employee exposure to coke oven emissions required in WAC 296-62-20007.

(a) This record shall include:

(i) Name, Social Security number, and job classification of the employees monitored;

(ii) The date(s), number, duration and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure where applicable;

(iii) The type of respiratory protective devices worn, if any;

(iv) A description of the sampling and analytical methods used and evidence of their accuracy; and

(v) The environment variables that could affect the measurement of employee exposure.

(b) The employer shall maintain this record for at least (~~forth~~) forty years or for the duration of employment plus twenty years, whichever is longer.

(2) Medical surveillance. The employer shall establish and maintain an accurate record for each employee subject to medical surveillance as required by WAC 296-62-20017.

(a) The record shall include:

(i) The name, Social Security number, and description of duties of the employee;

(ii) A copy of the physician's written opinion;

(iii) The signed statement of any refusal to take a medical examination under WAC 296-62-20017; and

(iv) Any employee medical complaints related to exposure to coke oven emissions.

(b) The employer shall keep, or assure that the examining physician keeps, the following medical records:

(i) A copy of the medical examination results including medical and work history required under WAC 296-62-20017;

(ii) A description of the laboratory procedures used and a copy of any standards or guidelines used to interpret the test results;

(iii) The initial X ray;

(iv) The X rays for the most recent five years;

(v) Any X ray with a demonstrated abnormality and all subsequent X rays;

(vi) The initial cytologic examination slide and written description;

(vii) The cytologic examination slide and written description for the most recent ten years; and

(viii) Any cytologic examination slides with demonstrated atypia, if such atypia persists for three years, and all subsequent slides and written descriptions.

(c) The employer shall maintain medical records required under subsection (2) of this section for at least forty years, or for the duration of employment plus twenty years, whichever is longer.

(3) Availability.

(a) The employer shall make available upon request all records required to be maintained by this section to the director for examination and copying.

(b) Employee exposure measurement records and employee medical records required by this subsection shall be provided upon request to employees, designated representatives, and the assistant director in accordance with chapter 296-802 WAC.

(c) The employer shall make available upon request employee medical records required to be maintained by subsection (2) of this section to a physician designated by the affected employee or former employee.

(4) Transfer of records.

(a) Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by this section.

~~(b) ((Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, these records shall be transmitted by registered mail to the director.~~

~~(c) At the expiration of the retention period for the records required to be maintained under subsections (1) and (2) of this section, the employer shall transmit these records by registered mail to the director or shall continue to retain such records.~~

~~(d))~~ The employer shall also comply with any additional requirements involving transfer of records set forth in ~~((chapter 296-802))~~ WAC 296-802-60005.

AMENDATORY SECTION (Amending WSR 01-11-038, filed 5/9/01, effective 9/1/01)

**WAC 296-155-140 Sanitation.** (1) Potable water.

(a) An adequate supply of potable water shall be provided in all places of employment.

(b) Portable containers used to dispense drinking water shall be capable of being tightly closed and equipped with a tap. Water shall not be dipped from containers.

(c) Any container used to distribute drinking water shall be clearly marked as to the nature of its contents and not used for any other purpose.

(d) The common drinking cup is prohibited.

(e) Where single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.

(f) All water containers used to furnish drinking water shall be thoroughly cleaned at least once each week or more often as conditions require.

(g) The requirements of this subsection do not apply to mobile crews or to normally unattended work locations as long as employees working at these locations have transportation immediately available, within the normal course of their duties, to nearby facilities otherwise meeting the requirements of this section.

(h) The following definitions apply:

(i) Mobile crew: A work crew that routinely moves to a different work location periodically. Normally a mobile crew is not at the same location all day.

(ii) Normally unattended work location: An unattended site that is visited occasionally by one or more employees.

(iii) Nearby facility: A sanitary facility that is within three minutes travel by the transportation provided.

(iv) "Potable water" means water (~~which meets the quality standards for drinking purposes of state or local authority having jurisdiction or water that meets the quality standards prescribed by the United States Environmental Protection Agency's National Interim Primary Drinking Water Regulations, published in 40 CFR Part 141, and 40 CFR 147.2400~~) that is suitable for drinking by the public and meets the requirements of chapter 246-290 or 246-291 WAC.

(2) Wash water.

(a) Clean, tepid wash water, between 70 and 100 degrees Fahrenheit, shall be provided at all construction sites.

(b) Individual hand towels shall be provided. Both a sanitary container for the unused towels and a receptacle for disposal of used towels shall be provided.

(c) Hand soap, industrial hand cleaner or similar cleansing agents shall be provided. Cleansing agents shall be adequate to

remove any paints, coatings, herbicides, insecticides or other contaminants.

(d) The requirements of this subsection do not apply to mobile crews or to normally unattended work locations as long as employees working at these locations have transportation immediately available, within the normal course of their duties, to nearby facilities otherwise meeting the requirements of this section.

(e) Gasoline or solvents shall not be used for personal cleaning.

(f) Wash water areas will be maintained in a dry condition. Slipping or other hazards shall be eliminated from the wash water area before it is acceptable for use.

(3) Nonpotable water.

(a) Outlets for nonpotable water, such as water for industrial or firefighting purposes only, shall be identified by signs meeting the requirements of Part E of this chapter, to indicate clearly that the water is unsafe and is not to be used for drinking, washing or cooking purposes.

(b) There shall be no cross-connection, open or potential, between a system furnishing potable water, a system furnishing nonpotable water or a system furnishing wash water.

(4) Toilets.

(a) The provisions of this section apply to both portable chemical toilets and to flush toilets, except where flush toilets are used the requirements of WAC 296-800-230 shall apply instead of (b) of this subsection.

(b) Accessible toilets shall be provided for employees according to the following table:

**TABLE B-1**

<u>Number of Employees</u>	<u>Toilets Required</u>
1 - 10	1
11 - 25	2
26 - 40	3
41 - 60	4
61 - 80	5
Over 80	one additional toilet for each additional twenty employees or any fraction thereof.

(c) When the employer provides both flush and portable chemical toilets, the number of employees allowed to be served by the flush toilets, per WAC 296-800-230 will be calculated. That number will be subtracted from the total number of employees and the employer will be required to provide an adequate number of portable chemical toilets for the number of remaining employees, as required by (b) of this subsection.

(d) Toilets shall be maintained in clean, sanitary and functional condition. Internal latches shall be provided to secure the units from inadvertent entry. Where there are twenty or more

employees consisting of both sexes, facilities shall be provided for each sex.

(i) Each unit shall be properly cleaned on a routine basis.

(ii) Chemicals, toilet tissue and sanitary seat covers shall be maintained in a supply sufficient for use during the entire shift.

(iii) Any defective or inadequate unit shall be immediately removed from service.

(e) Specifications. The following specifications apply:

(i) A noncaustic chemical toilet (portable chemical toilet is) a self-contained unit equipped with a waste receiving chemical holding container.

(ii) Portable chemical toilets consisting of only a holding tank, commonly referred to as "elevator units" or "elevator toilets" are not acceptable. "Elevator units" may be used if they are individually located in a lockable room which affords privacy. When this type unit is used in a private individual lockable room the entire room will be considered a toilet facility, as such the room will meet all requirements of toilet facilities and be inspected in accordance with subsection (5)(b)(iii) of this section.

(iii) Rooms, buildings or shelters housing toilets shall be of sound construction, easy to clean, provide shelter and provide privacy. The toilet rooms shall be ventilated to the outside and adequately lighted. All openings into the toilet room shall be covered with 16-mesh screen.

(iv) Toilets shall be serviced on a regular schedule. Servicing shall include the use of a disinfectant for cleaning urinals and seats, removing waste from containers, recharging containers with an odor controlling chemical and installing an adequate supply of toilet tissue and seat covers.

(v) Service shall be performed in accordance with local codes by approved servicing organizations. Waste shall be disposed of or discharged in accordance with requirements of local health department regulations.

(vi) Waste containers shall be fabricated from impervious materials, e.g. plastic, steel, fiberglass or their equivalent. Containers shall be water tight and capable of containing the chemical waste in a sanitary manner. The container shall be fitted to the building in a manner so as to prevent insects from entering from the exterior of the building. Containers shall be adequate in size to be used by the number of persons, according to the schedule for minimum requirements, without filling the container to more than half of its volume before regularly scheduled servicing.

(vii) Removal of waste shall be handled in a clean and sanitary manner by means of a vacuum hose and received by a leak-proof tank truck. All valves on the tank shall be leak-proof.

(viii) Provisions shall be made so service trucks have a clear approach and convenient access to the toilets to be serviced.

(ix) Disposal of waste from tank trucks shall be in accordance with local health department requirements. In the absence of provisions by local health departments, waste must be disposed of through municipal or district sanitary sewage systems. Municipal

or area sanitary sewage districts shall provide sewage disposal locations and facilities which are adequate and convenient for duly authorized toilet service organizations.

(f) The requirements of this subsection do not apply to mobile crews or to normally unattended work locations as long as employees working at these locations have transportation immediately available, within the normal course of their duties, to nearby facilities otherwise meeting the requirements of this section.

(5)(a) On multiemployer worksites, the prime contractor shall ensure that the requirements of this section are met. Each employer is responsible for seeing that facilities for their own employees are provided.

(b) Each employer shall ensure, at the beginning of each shift, that the sanitation facilities required by this section are inspected. If any facility or unit fails to meet the following requirements, immediate corrective action shall be taken. Such action shall be documented and maintained at the site for at least 72 hours. Inspection shall establish:

(i) Potable water: Sufficient supply of water, sufficient supply of cups, container integrity, cleanliness of unit and area, capacity of trash receptacle (empty).

(ii) Wash water: Sufficient supply of clean water, proper temperature, sufficient supply of towels, sufficient supply of cleansing agents, container integrity, cleanliness of unit and area without the presence of physical hazards, capacity of trash receptacle (empty).

(iii) Toilets: Sufficient supply of toilet tissue and sanitary seat covers, capacity and condition of chemical agent, capacity and condition of holding tank, cleanliness of unit and area without the presence of physical hazards, physical and structural condition of unit, condition of lock, condition of toilet seat and tissue holder, absence of all foreign debris.

(c) The location of the facilities required by subsections (1), (2) and (4) of this section shall be as close as practical to the highest concentration of employees.

(i) On multistory structures they shall be furnished on every third floor.

(ii) At all sites they shall be located within 200 feet horizontally of all employees.

(iii) The requirements of subsection (5)(c)(i) and (ii) do not apply to mobile crews or to normally unattended work locations as long as employees working at these locations have transportation immediately available, within the normal course of their duties, to nearby facilities otherwise meeting the requirements of this section.

(6) Food handling. All employees' food service facilities and operations shall meet the applicable laws, ordinances and regulations of the jurisdictions in which they are located.

(7) Temporary sleeping quarters. When temporary sleeping quarters are provided, they shall be heated, ventilated and lighted.

AMENDATORY SECTION (Amending Order 93-07, filed 10/29/93, effective 12/10/93)

**WAC 296-155-17621 Medical surveillance.** (1) General.

(a) The employer shall make available initial medical surveillance to employees occupationally exposed on any day to lead at or above the action level. Initial medical surveillance consists of biological monitoring in the form of blood sampling and analysis for lead and zinc protoporphyrin levels.

(b) The employer shall institute a medical surveillance program in accordance with subsections (2) and (3) of this section for all employees who are or may be exposed by the employer at or above the action level for more than thirty days in any consecutive twelve months;

(c) The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician.

(d) The employer shall make available the required medical surveillance including multiple physician review under subsection (3)(c) without cost to employees and at a reasonable time and place.

(2) Biological monitoring.

(a) Blood lead and ZPP level sampling and analysis. The employer shall make available biological monitoring in the form of blood sampling and analysis for lead and zinc protoporphyrin levels to each employee covered by subsection (1)(a) and (b) of this section on the following schedule:

(i) For each employee covered by subsection (1)(b) of this section, at least every two months for the first six months and every six months thereafter;

(ii) For each employee covered by subsection (1)(a) or (b) of this section whose last blood sampling and analysis indicated a blood lead level at or above 40 µg/dl, at least every two months. This frequency shall continue until two consecutive blood samples and analyses indicate a blood lead level below 40 µg/dl; and

(iii) For each employee who is removed from exposure to lead due to an elevated blood lead level at least monthly during the removal period.

(b) Follow-up blood sampling tests. Whenever the results of a blood lead level test indicate that an employee's blood lead level (~~exceeds~~) is at or above the numerical criterion for medical removal under WAC 296-155-17623 (1)(a), the employer shall provide a second (follow-up) blood sampling test within two weeks after the employer receives the results of the first blood sampling test.

(c) Accuracy of blood lead level sampling and analysis. Blood lead level sampling and analysis provided pursuant to this WAC 296-155-176 shall have an accuracy (to a confidence level of ninety-

five percent) within plus or minus fifteen percent or 6 µg/dl, whichever is greater, and shall be conducted by a laboratory approved by OSHA.

(d) Employee notification.

(i) Within five working days after the receipt of biological monitoring results, the employer shall notify each employee in writing of their blood lead level; and

(ii) The employer shall notify each employee whose blood lead level (~~exceeds~~) is at or above 40 µg/dl that the standard requires temporary medical removal with Medical Removal Protection benefits when an employee's blood lead level exceeds the numerical criterion for medical removal under WAC 296-155-17623 (1)(a).

(3) Medical examinations and consultations.

(a) Frequency. The employer shall make available medical examinations and consultations to each employee covered by subsection (1)(b) of this section on the following schedule:

(i) At least annually for each employee for whom a blood sampling test conducted at any time during the preceding twelve months indicated a blood lead level at or above 40 µg/dl;

(ii) As soon as possible, upon notification by an employee either that the employee has developed signs or symptoms commonly associated with lead intoxication, that the employee desires medical advice concerning the effects of current or past exposure to lead on the employee's ability to procreate a healthy child, that the employee is pregnant, or that the employee has demonstrated difficulty in breathing during a respirator fitting test or during use; and

(iii) As medically appropriate for each employee either removed from exposure to lead due to a risk of sustaining material impairment to health, or otherwise limited pursuant to a final medical determination.

(b) Content. The content of medical examinations made available pursuant to subdivision (a)(ii) and (iii) of this subsection shall be determined by an examining physician and, if requested by an employee, shall include pregnancy testing or laboratory evaluation of male fertility. Medical examinations made available pursuant to subdivision (a)(i) of this subsection shall include the following elements:

(i) A detailed work history and a medical history, with particular attention to past lead exposure (occupational and nonoccupational), personal habits (smoking, hygiene), and past gastrointestinal, hematologic, renal, cardiovascular, reproductive and neurological problems;

(ii) A thorough physical examination, with particular attention to teeth, gums, hematologic, gastrointestinal, renal, cardiovascular, and neurological systems. Pulmonary status should be evaluated if respiratory protection will be used;

(iii) A blood pressure measurement;

(iv) A blood sample and analysis which determines:

(A) Blood lead level;

(B) Hemoglobin and hematocrit determinations, red cell indices, and examination of peripheral smear morphology;

(C) Zinc protoporphyrin;

(D) Blood urea nitrogen; and,  
(E) Serum creatinine;  
(v) A routine urinalysis with microscopic examination; and  
(vi) Any laboratory or other test relevant to lead exposure which the examining physician deems necessary by sound medical practice.

(c) Multiple physician review mechanism.

(i) If the employer selects the initial physician who conducts any medical examination or consultation provided to an employee by WAC 296-155-176, the employee may designate a second physician:

(A) To review any findings, determinations or recommendations of the initial physician; and

(B) To conduct such examinations, consultations, and laboratory tests as the second physician deems necessary to facilitate this review.

(ii) The employer shall promptly notify an employee of the right to seek a second medical opinion after each occasion that an initial physician conducts a medical examination or consultation pursuant to WAC 296-155-176. The employer may condition its participation in, and payment for, the multiple physician review mechanism upon the employee doing the following within fifteen days after receipt of the foregoing notification, or receipt of the initial physician's written opinion, whichever is later:

(A) The employee informing the employer that they intend to seek a second medical opinion; and

(B) The employee initiating steps to make an appointment with a second physician.

(iii) If the findings, determinations or recommendations of the second physician differ from those of the initial physician, then the employer and the employee shall assure that efforts are made for the two physicians to resolve any disagreement.

(iv) If the two physicians have been unable to quickly resolve their disagreement, then the employer and the employee through their respective physicians shall designate a third physician:

(A) To review any findings, determinations or recommendations of the prior physicians; and

(B) To conduct such examinations, consultations, laboratory tests and discussions with the prior physicians as the third physician deems necessary to resolve the disagreement of the prior physicians.

(v) The employer shall act consistent with the findings, determinations and recommendations of the third physician, unless the employer and the employee reach an agreement which is otherwise consistent with the recommendations of at least one of the three physicians.

(d) Information provided to examining and consulting physicians.

(i) The employer shall provide an initial physician conducting a medical examination or consultation under WAC 296-155-176 with the following information:

(A) A copy of this regulation for lead including all Appendices;

(B) A description of the affected employee's duties as they

relate to the employee's exposure;

(C) The employee's exposure level or anticipated exposure level to lead and to any other toxic substance (if applicable);

(D) A description of any personal protective equipment used or to be used;

(E) Prior blood lead determinations; and

(F) All prior written medical opinions concerning the employee in the employer's possession or control.

(ii) The employer shall provide the foregoing information to a second or third physician conducting a medical examination or consultation under WAC 296-155-176 upon request either by the second or third physician, or by the employee.

(e) Written medical opinions.

(i) The employer shall obtain and furnish the employee with a copy of a written medical opinion from each examining or consulting physician which contains only the following information:

(A) The physician's opinion as to whether the employee has any detected medical condition which would place the employee at increased risk of material impairment of the employee's health from exposure to lead;

(B) Any recommended special protective measures to be provided to the employee, or limitations to be placed upon the employee's exposure to lead;

(C) Any recommended limitation upon the employee's use of respirators, including a determination of whether the employee can wear a powered air purifying respirator if a physician determines that the employee cannot wear a negative pressure respirator; and

(D) The results of the blood lead determinations.

(ii) The employer shall instruct each examining and consulting physician to:

(A) Not reveal either in the written opinion or orally, or in any other means of communication with the employer, findings, including laboratory results, or diagnoses unrelated to an employee's occupational exposure to lead; and

(B) Advise the employee of any medical condition, occupational or nonoccupational, which dictates further medical examination or treatment.

(f) Alternate physician determination mechanisms. The employer and an employee or authorized employee representative may agree upon the use of any alternate physician determination mechanism in lieu of the multiple physician review mechanism provided by subdivision (c) of this subsection so long as the alternate mechanism is as expeditious and protective as the requirements contained in this section.

(4) Chelation.

(a) The employer shall assure that any person whom he retains, employs, supervises or controls does not engage in prophylactic chelation of any employee at any time.

(b) If therapeutic or diagnostic chelation is to be performed by any person in subdivision (a) of this subsection, the employer shall assure that it be done under the supervision of a licensed physician in a clinical setting with thorough and appropriate medical monitoring and that the employee is notified in writing

prior to its occurrence.

AMENDATORY SECTION (Amending Order 93-07, filed 10/29/93, effective 12/10/93)

**WAC 296-155-17623 Medical removal protection.** (1) Temporary medical removal and return of an employee.

(a) Temporary removal due to elevated blood lead level. The employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that a periodic and a follow-up blood sampling test conducted pursuant to WAC 296-155-176 indicate that the employee's blood lead level is at or above 50 µg/dl; and

(b) Temporary removal due to a final medical determination.

(i) The employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that a final medical determination results in a medical finding, determination, or opinion that the employee has a detected medical condition which places the employee at increased risk of material impairment to health from exposure to lead.

(ii) For the purposes of WAC 296-155-176, the phrase "final medical determination" means the written medical opinion on the employees' health status by the examining physician or, where relevant, the outcome of the multiple physician review mechanism or alternate medical determination mechanism used pursuant to the medical surveillance provisions of WAC 296-155-176.

(iii) Where a final medical determination results in any recommended special protective measures for an employee, or limitations on an employee's exposure to lead, the employer shall implement and act consistent with the recommendation.

(c) Return of the employee to former job status.

(i) The employer shall return an employee to their former job status:

(A) For an employee removed due to a blood lead level at or above 50 µg/dl when two consecutive blood sampling tests indicate that the employee's blood lead level is (~~at or~~) below 40 µg/dl;

(B) For an employee removed due to a final medical determination, when a subsequent final medical determination results in a medical finding, determination, or opinion that the employee no longer has a detected medical condition which places the employee at increased risk of material impairment to health from exposure to lead.

(ii) For the purposes of WAC 296-155-176, the requirement that an employer return an employee to their former job status is not intended to expand upon or restrict any rights an employee has or would have had, absent temporary medical removal, to a specific job classification or position under the terms of a collective bargaining agreement.

(d) Removal of other employee special protective measure or

limitations. The employer shall remove any limitations placed on an employee or end any special protective measures provided to an employee pursuant to a final medical determination when a subsequent final medical determination indicates that the limitations or special protective measures are no longer necessary.

(e) Employer options pending a final medical determination. Where the multiple physician review mechanism, or alternate medical determination mechanism used pursuant to the medical surveillance provisions of WAC 296-155-176, has not yet resulted in a final medical determination with respect to an employee, the employer shall act as follows:

(i) Removal. The employer may remove the employee from exposure to lead, provide special protective measures to the employee, or place limitations upon the employee, consistent with the medical findings, determinations, or recommendations of any of the physicians who have reviewed the employee's health status.

(ii) Return. The employer may return the employee to their former job status, end any special protective measures provided to the employee, and remove any limitations placed upon the employee, consistent with the medical findings, determinations, or recommendations of any of the physicians who have reviewed the employee's health status, with two exceptions.

(A) If the initial removal, special protection, or limitation of the employee resulted from a final medical determination which differed from the findings, determinations, or recommendations of the initial physician or;

(B) If the employee has been on removal status for the preceding eighteen months due to an elevated blood lead level, then the employer shall await a final medical determination.

(2) Medical removal protection benefits.

(a) Provision of medical removal protection benefits. The employer shall provide an employee up to eighteen months of medical removal protection benefits on each occasion that an employee is removed from exposure to lead or otherwise limited pursuant to WAC 296-155-176.

(b) Definition of medical removal protection benefits. For the purposes of WAC 296-155-176, the requirement that an employer provide medical removal protection benefits means that, as long as the job the employee was removed from continues, the employer shall maintain the total normal earnings, seniority and other employment rights and benefits of an employee, including the employee's right to their former job status as though the employee had not been medically removed from the employee's job or otherwise medically limited.

(c) Follow-up medical surveillance during the period of employee removal or limitation. During the period of time that an employee is medically removed from their job or otherwise medically limited, the employer may condition the provision of medical removal protection benefits upon the employee's participation in follow-up medical surveillance made available pursuant to WAC 296-155-176.

(d) Workers' compensation claims. If a removed employee files a claim for workers' compensation payments for a lead-related

disability, then the employer shall continue to provide medical removal protection benefits pending disposition of the claim. To the extent that an award is made to the employee for earnings lost during the period of removal, the employer's medical removal protection obligation shall be reduced by such amount. The employer shall receive no credit for workers' compensation payments received by the employee for treatment-related expenses.

(e) Other credits. The employer's obligation to provide medical removal protection benefits to a removed employee shall be reduced to the extent that the employee receives compensation for earnings lost during the period of removal either from a publicly or employer-funded compensation program, or receives income from employment with another employer made possible by virtue of the employee's removal.

(f) Voluntary removal or restriction of an employee. Where an employer, although not required by WAC 296-155-176 to do so, removes an employee from exposure to lead or otherwise places limitations on an employee due to the effects of lead exposure on the employee's medical condition, the employer shall provide medical removal protection benefits to the employee equal to that required by subdivisions (a) and (b) of this subsection.

AMENDATORY SECTION (Amending Order 93-07, filed 10/29/93, effective 12/10/93)

**WAC 296-155-17629 Recordkeeping.** (1) Exposure assessment.

(a) The employer shall establish and maintain an accurate record of all monitoring and other data used in conducting employee exposure assessments as required in WAC 296-155-17609.

(b) Exposure monitoring records shall include:

(i) The date(s), number, duration, location and results of each of the samples taken if any, including a description of the sampling procedure used to determine representative employee exposure where applicable;

(ii) A description of the sampling and analytical methods used and evidence of their accuracy;

(iii) The type of respiratory protective devices worn, if any;

(iv) Name, Social Security number, and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent; and

(v) The environmental variables that could affect the measurement of employee exposure.

(c) The employer shall maintain monitoring and other exposure assessment records in accordance with the provisions of part B, chapter 296-62 WAC.

(2) Medical surveillance.

(a) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance as required by WAC 296-155-17621.

(b) This record shall include:

(i) The name, Social Security number, and description of the duties of the employee;

(ii) A copy of the physician's written opinions;

(iii) Results of any airborne exposure monitoring done on or for that employee and provided to the physician; and

(iv) Any employee medical complaints related to exposure to lead.

(c) The employer shall keep, or assure that the examining physician keeps, the following medical records:

(i) A copy of the medical examination results including medical and work history required by WAC 296-155-17621;

(ii) A description of the laboratory procedures and a copy of any standards or guidelines used to interpret the test results or references to that information;

(iii) A copy of the results of biological monitoring.

(d) The employer shall maintain or assure that the physician maintains medical records in accordance with the provisions of part B, chapter 296-62 WAC.

(3) Medical removals.

(a) The employer shall establish and maintain an accurate record for each employee removed from current exposure to lead pursuant to WAC 296-155-17623.

(b) Each record shall include:

(i) The name and Social Security number of the employee;

(ii) The date of each occasion that the employee was removed from current exposure to lead as well as the corresponding date on which the employee was returned to their former job status;

(iii) A brief explanation of how each removal was or is being accomplished; and

(iv) A statement with respect to each removal indicating whether or not the reason for the removal was an elevated blood lead level.

(c) The employer shall maintain each medical removal record for at least the duration of an employee's employment.

(4) Objective data for exemption from requirement for initial monitoring.

(a) For purposes of WAC 296-155-176, objective data are information demonstrating that a particular product or material containing lead or a specific process, operation, or activity involving lead cannot release dust or fumes in concentrations at or above the action level under any expected conditions of use. Objective data can be obtained from an industry-wide study or from laboratory product test results from manufacturers of lead containing products or materials. The data the employer uses from an industry-wide survey must be obtained under workplace conditions closely resembling the processes, types of material, control methods, work practices and environmental conditions in the employer's current operations.

(b) The employer shall maintain the record of the objective data relied upon for at least thirty years.

(5) Availability. The employer shall make available upon request all records required to be maintained by this section to

affected employees, former employees, and their designated representatives, and to the director for examination and copying.

~~(6) Transfer of records. ((a) Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by this section.~~

~~(b) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records required to be maintained by WAC 296-155-176 for the prescribed period, these records shall be transmitted to the director.~~

~~(c) At the expiration of the retention period for the records required to be maintained by WAC 296-155-176, the employer shall notify the director at least three months prior to the disposal of such records and shall transmit those records to the director if requested within the period.~~

~~(d)) The employer shall ((also)) comply with ((any additional)) requirements involving the transfer of records set forth in WAC ((296-62-05215)) 296-800-6005.~~

AMENDATORY SECTION (Amending WSR 07-17-034, filed 8/7/07, effective 12/1/07)

**WAC 296-304-02013 Appendix B--Compliance assistance guidelines for confined and enclosed spaces and other dangerous atmospheres.** This appendix is a nonmandatory set of guidelines provided to assist employers in complying with the requirements of WAC 296-304-020 through 296-304-02011. This appendix neither creates additional obligations nor detracts from obligations otherwise contained in this chapter. It is intended to provide explanatory information and educational material to employers and employees to foster understanding of, and compliance with, this chapter.

WAC 296-304-020 through 296-304-02011. These standards are minimum safety standards for entering and working safely in vessel tanks and compartments.

WAC 296-304-020(2) Definition of "Hot work." There are several instances in which circumstances do not necessitate that grinding, drilling, abrasive blasting be regarded as hot work. Some examples are:

(1) Abrasive blasting of the external surface of the vessel (the hull) for paint preparation does not necessitate pumping and cleaning the tanks of a vessel.

(2) Prior to hot work on any hollow structure, the void space should be tested and appropriate precautions taken.

WAC 296-304-020(2) Definition of "Lower explosive limit." The terms lower flammable limit (LFL) and lower explosive limit (LEL) are used interchangeably in fire science literature.

WAC 296-304-020(2) Definition of "Upper explosive limit." The terms upper flammable limit (UFL) and upper explosive limit (UEL) are used interchangeably in fire science literature.

WAC 296-304-02003(1) After a tank has been properly washed and ventilated, the tank should contain 20.8 percent oxygen by volume. This is the same amount found in our normal atmosphere at sea level. However, it is possible that the oxygen content will be lower. When this is the case, the reasons for this deficiency should be determined and corrective action taken.

An oxygen content of 19.5 percent can support life and is adequate for entry. However, any oxygen level less than 20.8 percent and greater than 19.5 percent level should also alert the competent person to look for the causes of the oxygen deficiency and to correct them prior to entry.

WAC 296-304-02003(2) Flammable atmospheres. Atmospheres with a concentration of flammable vapors at or above 10 percent of the lower explosive limit (LEL) are considered hazardous when located in confined spaces. However, atmospheres with flammable vapors below 10 percent of the LEL are not necessarily safe.

Such atmospheres are too lean to burn. Nevertheless, when a space contains or produces measurable flammable vapors below the 10 percent LEL, it might indicate that flammable vapors are being released or introduced into the space and could present a hazard in time. Therefore, the cause of the vapors should be investigated and, if possible, eliminated prior to entry.

Some situations that have produced measurable concentrations of flammable vapors that could exceed 10 percent of the LEL in time are:

(1) Pipelines that should have been blanked or disconnected have opened, allowing product into the space.

(2) The vessel may have shifted, allowing product not previously cleaned and removed during washing to move into other areas of the vessel.

(3) Residues may be producing the atmosphere by releasing flammable vapor.

WAC 296-304-02003(2) Flammable atmospheres that are toxic. An atmosphere with a measurable concentration of a flammable substance below 10 percent of the LEL may be above the WISHA permissible exposure limit for that substance. In that case, refer to WAC 296-304-02003 (3)(b), (c), and (d).

WAC 296-304-02005 (2)(d), 296-304-02009(3), and 296-304-02009(5). The frequency with which a tank is monitored to determine if atmospheric conditions are being maintained is a function of several factors that are discussed below:

(1) Temperature. Higher temperatures will cause a combustible or flammable liquid to vaporize at a faster rate than lower temperatures. This is important since hotter days may cause tank residues to produce more vapors and that may result in the vapors exceeding 10 percent of the LEL or an overexposure to toxic contaminants.

(2) Work in the tank. Any activity in the tank could change the atmospheric conditions in that tank. Oxygen from a leaking oxyfuel hose or torch could result in an oxygen-enriched atmosphere that would more easily propagate a flame. Some welding operations use inert gas, and leaks can result in an oxygen-deficient atmosphere. Manual tank cleaning with high pressure spray devices can stir up residues and result in exposures to toxic contaminants. Simple cleaning or mucking out, where employees walk through and shovel residues and sludge, can create a change in atmospheric conditions.

(3) Period of time elapsed. If a period of time has elapsed since a marine chemist or Coast Guard authorized person has certified a tank as safe, the atmospheric condition should be rechecked by the competent person prior to entry and starting work.

(4) Unattended tanks or spaces. When a tank or space has been tested and declared safe, then subsequently left unattended for a period of time, it should be retested prior to entry and starting work. For example, when barges are left unattended at night, unidentified products from another barge are sometimes dumped into their empty tanks. Since this would result in a changed atmosphere, the tanks should be retested prior to entry and starting work.

(5) Work break. When workers take a break or leave at the end of the shift, equipment sometimes is inadvertently left in the tanks. At lunch or work breaks and at the end of the shift are the times when it is most likely someone will leave a burning or cutting torch in the tank, perhaps turned on and leaking oxygen or an inert gas. Since the former can produce an oxygen-enriched atmosphere, and the latter an oxygen-deficient atmosphere, tanks should be checked for equipment left behind, and atmosphere, monitored if necessary prior to reentering and resuming work. In an oxygen-enriched atmosphere, the flammable range is severely broadened. This means that an oxygen-enriched atmosphere can promote very rapid burning.

(6) Ballasting or trimming. Changing the position of the ballast, or trimming or in any way moving the vessel so as to expose cargo that had been previously trapped, can produce a change in the atmosphere of the tank. The atmosphere should be retested after any such move and prior to entry or work.

WAC 296-304-02007 (1) and (2) hot work. This is a reminder that other sections of the WISHA shipyard safety and health standards in chapter 296-304 WAC should be reviewed prior to starting any hot work. Most notably, WAC 296-304-040 through 296-304-04013, welding, cutting and heating, places additional restrictions on hot work: The requirements of WAC 296-304-04001 and 296-304-04005 must be met before hot work is begun on any metal that is toxic or is covered by a preservative coating respectively; the requirements of WAC 296-304-04007 must be met before welding, cutting, or heating is begun on any structural voids.

WAC 296-304-02003 (1)(b). During hot work, more than 20.8 percent oxygen by volume can be unsafe since it extends the normal flammable range. The standard permits the oxygen level to reach 22.0 percent by volume in order to account for instrument error. However, the cause of excess oxygen should be investigated and the source removed.

WAC 296-304-02011(2). If the entire vessel has been found to be in the same condition, then employers shall be considered to be in compliance with this requirement when signs using appropriate warning language in accordance with WAC 296-304-02011(1) are posted at the gangway and at all other means of access to the vessel.

AMENDATORY SECTION (Amending Order 76-7, filed 3/1/76)

**WAC 296-304-07003 Ropes, chains and slings.** (1) Manila rope and manila rope slings. (~~((a) Table G-1 in WAC 296-304-07011 shall be used to determine the safe working load of various sizes of manila rope and manila rope slings at various angles, except that higher safe working loads are permissible when recommended by the manufacturer for specific, identifiable products: Provided, That a safety factor of not less than five is maintained.))~~ Employers must ensure that manila rope and manila-rope slings:

(a) Have permanently affixed and legible identification markings as prescribed by the manufacturer that indicate the recommended safe working load for the type(s) of hitch(es) used, the angle upon which it is based, and the number of legs if more than one;

(b) Not be loaded in excess of its recommended safe working load as prescribed on the identification markings by the manufacturer; and

(c) Not be used without affixed and legible identification markings as required by (a) of this subsection.

(2) Wire rope and wire rope slings.

~~((Tables G-2 through G-5 in WAC 296-304-07011 shall be used to determine the safe working loads of various sizes and classifications of improved plow steel wire rope and wire rope slings with various types of terminals. For sizes, classifications and grades not included in these tables, the safe working load recommended by the manufacturer for specific, identifiable products shall be followed: Provided, That a safety factor of not less than five is maintained.))~~ Employers must ensure that wire rope and wire rope slings:

(i) Have permanently affixed and legible identification markings as prescribed by the manufacturer that indicate the recommended safe working load for the type(s) of hitch(es) used, the angle upon which it is based, and the number of legs if more than one;

(ii) Not be loaded in excess of its recommended safe working load as prescribed on the identification markings by the manufacturer; and

(iii) Not be used without affixed and legible identification markings as required by (a)(i) of this subsection.

(b) Protruding ends of strands in splices on slings and bridles shall be covered or blunted.

(c) Where U-bolt wire rope clips are used to form eyes, (~~(Table G-6 in WAC 296-304-07011 shall be used to determine the number and spacing of clips. The U-bolt shall be applied))~~ employers must use Table G-1 in WAC 296-304-07011 to determine the number and spacing of clips. Employers must apply the U-bolt so that the "U" section is in contact with the dead end of the rope.

(d) Wire rope shall not be secured by knots.

(3) Chains and chain slings.

(a) (~~Tables G-7 and G-8 in WAC 296-304-07011 shall be used to determine the working load limit of various sizes of wrought iron and alloy steel chains and chain slings, except that higher safe working loads are permissible when recommended by the manufacturer for specific, identifiable products.~~) Employers must ensure that chain and chain slings:

(i) Have permanently affixed and legible identification markings as prescribed by the manufacturer that indicate the recommended safe working load for the type(s) of hitch(es) used, the angle upon which it is based, and the number of legs if more than one;

(ii) Not be loaded in excess of its recommended safe working load as prescribed on the identification markings by the manufacturer; and

(iii) Not be used without affixed and legible identification markings as required by (a)(i) of this subsection.

(b) All sling chains, including end fastenings, shall be given a visual inspection before being used on the job. A thorough inspection of all chains in use shall be made every 3 months. Each chain shall bear an indication of the month in which it was thoroughly inspected. The thorough inspection shall include inspection for wear, defective welds, deformation and increase in length or stretch.

(c) Employers must note interlink wear, not accompanied by stretch in excess of 5 percent, (~~shall be noted~~) and remove the chain (~~removed~~) from service when maximum allowable wear at any point of link, as indicated in Table (~~G-9~~) G-2 in WAC 296-304-07011, has been reached.

(d) Chain slings shall be removed from service when, due to stretch, the increase in length of a measured section exceeds five percent; when a link is bent, twisted or otherwise damaged; or when raised scarfs or defective welds appear.

(e) All repairs to chains shall be made under qualified supervision. Links or portions of the chain found to be defective as described in (d) of this section shall be replaced by links having proper dimensions and made of material similar to that of the chain. Before repaired chains are returned to service, they shall be proof tested to the proof test load recommended by the manufacturer.

(f) Wrought iron chains in constant use shall be annealed or normalized at intervals not exceeding six months when recommended by the manufacturer. The chain manufacturer shall be consulted for recommended procedures for annealing or normalizing. Alloy chains shall never be annealed.

(g) A load shall not be lifted with a chain having a kink or knot in it. A chain shall not be shortened by bolting, wiring or knotting.

AMENDATORY SECTION (Amending Order 76-7, filed 3/1/76)

**WAC 296-304-07005 Shackles and hooks.** (1) Shackles. (~~((a)~~ Table G-10 in WAC 296-304-07011 shall be used to determine the safe working loads of various sizes of shackles, except that higher safe working loads are permissible when recommended by the manufacturer for specific, identifiable products: ~~Provided, That a safety factor of not less than five is maintained.~~)) Employers must ensure that shackles:

(a) Have permanently affixed and legible identification markings as prescribed by the manufacturer that indicate the recommended safe working load;

(b) Not be loaded in excess of its recommended safe working load as prescribed on the identification markings by the manufacturer; and

(c) Not be used without affixed and legible identification markings as required by (a) of this subsection.

(2) Hooks.

(a) The manufacturer's recommendations shall be followed in determining the safe working loads of the various sizes and types of specific and identifiable hooks. All hooks for which no applicable manufacturer's recommendations are available shall be tested to twice the intended safe working load before they are initially put into use. The employer shall maintain a record of the dates and results of such tests.

(b) Loads shall be applied to the throat of the hook since loading the point overstresses and bends or springs the hook.

(c) Hooks shall be inspected periodically to see that they have not been bent by overloading. Bent or sprung hooks shall not be used.

AMENDATORY SECTION (Amending WSR 03-04-099, filed 2/4/03, effective 8/1/03)

**WAC 296-304-07011 Use of gear.** (1) Loads shall be safely rigged before being hoisted.

(2) Plates shall be handled on and off hulls by means of shackles whenever possible. Clips or pads of ample size shall be welded to the plate to receive the shackle pins whenever there are no holes in the plate. When it is not possible to make holes in or to weld pads to the plate, alligator tongs, grab hooks, grab clamps or screw clamps may be used. In such cases special precautions shall be taken to keep employees from under such lifts.

(3) Tag lines shall be provided on loads likely to swing or to need guidance.

(4) When slings are secured to eyebolts, the slings shall be so arranged, using spreaders if necessary, that the pull is within 20 degrees of the axis of the bolt.

(5) Slings shall be padded by means of wood blocks or other suitable material where they pass over sharp edges or corners of loads so as to prevent cutting or kinking.

(6) Skips shall be rigged to be handled by not less than 3 legged bridles, and all legs shall always be used. When open end skips are used, means shall be taken to prevent the contents from falling.

(7) Loose ends of idle legs of slings in use shall be hung on the hook.

(8) Employees shall not be permitted to ride the hook or the load.

(9) Loads (tools, equipment or other materials) shall not be swung or suspended over the heads of employees.

(10) Pieces of equipment or structure susceptible to falling or dislodgement shall be secured or removed as early as possible.

(11) An individual who is familiar with the signal code in use shall be assigned to act as a signalman when the hoist operator cannot see the load being handled. Communications shall be made by means of clear and distinct visual or auditory signals except that verbal signals shall not be permitted.

(12) Pallets, when used, shall be of such material and construction and so maintained as to safely support and carry the loads being handled on them.

(13) A section of hatch through which materials or equipment are being raised, lowered, moved, or otherwise shifted manually or by a crane, winch, hoist, or derrick, shall be completely opened. The beam or pontoon left in place adjacent to an opening shall be sufficiently lashed, locked or otherwise secured to prevent it from moving so that it cannot be displaced by accident.

(14) Hatches shall not be opened or closed while employees are in the square of the hatch below.

(15) Before loads or empty lifting gear are raised, lowered, or swung, clear and sufficient advance warning shall be given to employees in the vicinity of such operations.

(16) At no time shall an employee be permitted to place himself in hazardous position between a swinging load and a fixed object.

**TABLE E-1**  
**DIMENSIONS AND SPACING OF WOOD**  
**INDEPENDENT-POLE SCAFFOLD MEMBERS**

Structural Members	Light duty (Up to 25 pounds per square foot)			Heavy duty (25 to 75 pounds per square foot)		
	Height in feet			Height in feet		
	< 24	>24<40	40<60	<24	>24<40	40<60
Poles or uprights (in inches) .....	2x4	3x4 or 2x6	4x4	3x4	4x4	4x6
Bearers (in inches) .....	2x4	2x6	2x6	2x8	2x8	2x10
Ledgers (in inches) .....	2x6	2x6	2x6	2x8	2x8	2x8

Structural Members	Light duty (Up to 25 pounds per square foot)			Heavy duty (25 to 75 pounds per square foot)		
	Height in feet			Height in feet		
	< 24	>24<40	40<60	<24	>24<40	40<60
Stringer (not supporting bearers) (in inches) . . . . .	1x6	1x6	1x6	1x6	1x6	1x6
Braces (in inches) . . . . .	1x4	1x6	1x6	1x6	1x6	1x6
Pole spacing—longitudinally (in feet) . . . . .	7 1/2	7 1/2	7 1/2	7	7	7
Pole spacing—transversely (in feet) . . . . .	6 1/2 min	7 1/2 min	8 1/2 min	6 1/2	10	10
Ledger spacing—vertically (in feet) . . . . .	7	7	7	4 1/2	4 1/2	4 1/2

**TABLE E-2**

**SPECIFICATIONS FOR SIDE RAILS OF LADDERS**

Length (in feet)	Cross section (in inches)	
	At ends	At center
15 . . . . .	1 7/8 x 2 3/4	1 7/8 x 3 3/4
16 . . . . .	1 7/8 x 2 3/4	1 7/8 x 3 3/4
17 . . . . .	1 7/8 x 3	1 7/8 x 4
18 . . . . .	1 7/8 x 3	1 7/8 x 4
20 . . . . .	1 7/8 x 3	1 7/8 x 4 1/2
24 . . . . .	1 7/8 x 3	1 7/8 x 4 1/2

**TABLE E-3**

**SPECIFICATIONS FOR THE CONSTRUCTION OF HORSES**

Structural Members	Height in feet		
	<10	>10<16	16<20
	Inches	Inches	Inches
Legs . . . . .	2x4	3x4	4x6
Bearers or headers	2x6	2x8	4x6
Crossbraces . . . . .	2x4 or 1x8	2x4	2x6
Longitudinal braces . . . . .	2x4	2x6	2x6

**TABLE E-4**

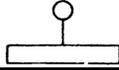
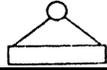
**SAFE CENTER LOADS FOR SCAFFOLD PLANK OF 1,100 POUNDS FIBRE STRESS**

[Codification note: The graphic presentation of this table has been varied in order that it would fall within the printing specifications for the Washington Administrative Code. The following table had lumber dimensions in the table heading typed in vertically across the page while the remainder of the table was typed horizontally on the page. The "Span in Feet" materials (6 through 16) which ran top to bottom has been switched to run left to right on the page. The "Lumber dimensions in inches" which ran left to right on the page has been switched to run top to bottom on the page.]

Lumber dimensions in inches	Span in Feet					
	6	8	10	12	14	16
A-2 x 10						
B-1 5/8 x 9 1/2	256	192	153	128	110	—
A-2 x 12						
B-1 5/8 x 11 1/2	309	232	186	155	133	116
A-3 x 8						
B-2 5/8 x 7 1/2	526	395	316	263	225	197
A-3 x 10						
B-2 5/8 x 9 1/2	667	600	400	333	286	250
A-3 x 12						
B-2 5/8 x 11 1/2	807	605	484	404	346	303

(A)—Rough lumber.  
(B)—Dressed lumber.

**(TABLE G-1)**  
**MANILA ROPE**  
(in pounds or tons of 2000 pounds)

Cir- cum- fer- ence	Dia- meter in Inches	Single Leg	60°	45°	30°
					
3/4	1/4	120 lbs.	204 lbs.	170 lbs.	120 lbs.
1	5/16	200	346	282	200
1-1/8	3/8	270	467	380	270
1-1/4	7/16	350	605	493	350
1-3/8	15/32	450	775	635	450
1-1/2	1/2	530	915	798	530
1-3/4	9/16	690	1190	973	690
2	5/8	880	1520	1240	880
2-1/4	3/4	1080	1870	1520	1080
2-1/2	13/16	1300	2250	1830	1300
2-3/4	7/8	1540	2660	2170	1540
3	1	1800	3120	2540	1800
3-1/4	1-1/16	1.0 tons	1.7 tons	1.4 tons	1.0 tons
3-1/2	1-1/8	1.2	2.1	1.7	1.2
3-3/4	1-1/4	1.35	2.3	1.9	1.35
4	1-5/16	1.5	2.6	2.1	1.5
4-1/2	1-1/2	1.8	3.1	2.5	1.8
5	1-5/8	2.25	3.9	3.2	2.25
5-1/2	1-3/4	2.6	4.5	3.7	2.6
6	2	3.1	5.4	4.4	3.1
6-1/2	2-1/8	3.6	6.2	5.1	3.6

**TABLE G-2**  
**RATED CAPACITIES FOR IMPROVED PLOW**  
**STEEL, INDEPENDENT WIRE ROPE CORE,**  
**WIRE ROPE AND WIRE ROPE SLINGS**  
(in tons of 2000 pounds)

Rope Dia: Inches	SINGLE LEG					
	Vertical			Choker		
	A	B	C	A	B	C
6X19 CLASSIFICATION						
1/4"	.59	.56	.53	.44	.42	.40
3/8"	1.3	1.2	1.1	.98	.93	.86
1/2"	2.3	2.2	2.0	1.7	1.6	1.5
5/8"	3.6	3.4	3.0	2.7	2.5	2.2
3/4"	5.1	4.9	4.2	3.8	3.6	3.1
7/8"	6.9	6.6	5.5	5.2	4.9	4.1
1"	9.0	8.5	7.2	6.7	6.4	5.4
1-1/8"	11.0	10.0	9.0	8.5	7.8	6.8
6X37 CLASSIFICATION						
1-1/4"	13.	12.	10.	9.9	9.2	7.9
1-3/8"	16.	15.	13.	12.	11.	9.6
1-1/2"	19.	17.	15.	14.	13.	11.
1-3/4"	26.	24.	20.	19.	18.	15.
2"	33.	30.	26.	25.	23.	20.
2-1/4"	41.	38.	33.	31.	29.	25.

(A) - Socket or swaged terminal attachment  
(B) - Mechanical sleeve attachment  
(C) - Hand tucked splice attachment

**TABLE G-3**  
**RATED CAPACITIES FOR**  
**IMPROVED FLOW STEEL,**  
**INDEPENDENT WIRE ROPE CORE,**  
**WIRE ROPE SLINGS**  
(in tons of 2000 pounds)

{Codification note: The graphic presentation of this table has been varied slightly in order that it would fall within the printing specifications for the Washington Administrative Code. The following table was too wide to be accommodated in the width of the WAC column. The table as codified has been divided into two tables covering the "TWO LEG BRIDLE OR BASKET HITCH" for 6x19 Classification and for 6x37 Classification. Part One has Rope Diameter in Inches for Vertical and 60° within the two classifications. Part Two has Rope Diameter in Inches for 45° and 30° within the two classifications.}

**TWO - LEG BRIDLE OR BASKET HITCH**  
**(TABLE G-3: Part 1--Vertical and 60° Positions)**

Rope Dia: Inches	Vertical			60° 		
	A	B	C	A	B	C
6X19 CLASSIFICATION						
1/4"	1.2	1.1	1.0	1.0	.97	.92
3/8"	2.6	2.5	2.3	2.3	2.1	2.0
1/2"	4.6	4.4	3.9	4.0	3.8	3.4
5/8"	7.2	6.8	6.0	6.2	5.9	5.2
3/4"	10.	9.7	8.4	8.9	8.4	7.3
7/8"	14.	13.	11.	12.	11.	9.6
1"	18.	17.	14.	15.	15.	12.

Rope Dia: Inches	Vertical			60°		
	A	B	C	A	B	C
1-1/8"	23:	21:	18:	19:	18:	16:
<b>6X37 CLASSIFICATION</b>						
1-1/4"	26:	24:	21:	23:	21:	18:
1-3/8"	32:	29:	25:	28:	25:	22:
1-1/2"	38:	35:	30:	33:	30:	26:
1-3/4"	51:	47:	41:	44:	41:	35:
2"	66:	61:	53:	57:	53:	46:
2-1/4"	83:	76:	66:	72:	66:	57:

**TWO-LEG BRIDLE OR BASKET HITCH  
(TABLE G-3: Part 2--45° and 30° Positions)**

Rope Dia: Inches	45°			30°		
	A	B	C	A	B	C
1/4"	.83	.79	.75	.59	.56	.53
3/8"	1.8	1.8	1.6	1.3	1.2	1.1
1/2"	3.2	3.1	2.8	2.3	2.2	2.0
5/8"	5.1	4.8	4.2	3.6	3.4	3.0
3/4"	7.2	6.9	5.9	5.1	4.9	4.2
7/8"	9.8	9.3	7.8	6.9	6.6	5.5
1"	13:	12:	10:	9.0	8.5	7.2
1-1/8"	16:	15:	13:	11:	10:	9.0
<b>6X37 CLASSIFICATION</b>						
1-1/4"	19:	17:	15:	13:	12:	10:
1-3/8"	22:	21:	18:	16:	15:	13:
1-1/2"	27:	25:	21:	19:	17:	15:
1-3/4"	36:	33:	29:	26:	24:	20:
2"	47:	43:	37:	33:	30:	26:
2-1/4"	58:	54:	47:	41:	38:	33:

(A) - Socket or swaged terminal attachment.

(B) - Mechanical sleeve attachment.

(C) - Hand tucked splice attachment.

**TABLE G-4  
RATED CAPACITIES FOR  
IMPROVED PLOW STEEL,  
FIBER CORE, WIRE ROPE AND  
WIRE ROPE SLINGS  
(in tons of 2000 pounds)**

Rope Dia: Inches	-SINGLE LEG-					
	Vertical			Choker		
	A	B	C	A	B	C
<b>6X19 CLASSIFICATION</b>						
1/4	.55	.51	.49	.41	.38	.37
3/8	1.2	1.1	1.1	.91	.85	.80

SINGLE LEG						
Rope Dia: Inches	Vertical			Choker		
	A	B	C	A	B	C
1/2	2.1	2.0	1.8	1.6	1.5	1.4
5/8	3.3	3.1	2.8	2.5	2.3	2.1
3/4	4.8	4.4	3.9	3.6	3.3	2.9
7/8	6.4	5.9	5.1	4.8	4.5	3.9
1	8.4	7.7	6.7	6.3	5.8	5.0
1-1/8	10.	9.5	8.4	7.9	7.1	6.3

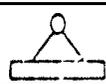
  

6X37 CLASSIFICATION						
1-1/4	12.	11.	9.8	9.2	8.3	7.4
1-3/8	15.	13.	12.	11.	10.	8.9
1-1/2	17.	16.	14.	13.	12.	10.
1-3/4	24.	21.	19.	18.	16.	14.
2	31.	28.	25.	23.	21.	18.

(A) - Socket or swaged terminal attachment.  
(B) - Mechanical sleeve attachment.  
(C) - Hand tucked splice attachment.

**TABLE G-5**  
**RATED CAPACITIES FOR IMPROVED FLOW**  
**STEEL, FIBER-CORE, WIRE ROPE SLINGS**  
(in tons of 2000 pounds)

[Codification note: The graphic presentation of this table has been varied slightly in order that it would fall within the printing specifications for the Washington Administrative Code. The following table was too wide to be accommodated in the width of the WAC column. The table as codified has been divided into two tables covering the "TWO-LEG BRIDLE OR BASKET HITCH" for 6x19 Classification and for 6x37 Classification. Part One has Rope Diameter in Inches for Vertical and 60° within the two classifications. Part Two has Rope Diameter in Inches for 45° and 30° within the two classifications.]

TWO-LEG BRIDLE OR BASKET HITCH (TABLE G-5: Part 1--Vertical and 60° Positions)						
Rope Dia: Inches	Vertical			60° 		
	A	B	C	A	B	C
6X19 CLASSIFICATION						
1/4	1.1	1.0	.99	.95	.88	.85
3/8	2.4	2.2	1.9	2.1	1.9	1.8
1/2	4.3	3.9	3.7	3.7	3.4	3.2
5/8	6.7	6.2	5.6	5.8	5.3	4.8
3/4	9.5	8.8	7.8	8.2	7.6	6.8
7/8	13.	12.	10.	11.	10.	8.9
1	17.	15.	13.	14.	13.	11.
1-1/8	21.	19.	17.	18.	16.	14.
6X37 CLASSIFICATION						
1-1/4	25.	22.	20.	21.	19.	17.
1-3/8	30.	27.	24.	26.	23.	20.
1-1/2	35.	33.	28.	30.	27.	24.

Rope Dia: Inches	Vertical			60°		
	A	B	C	A	B	C
1-3/4	48:	43:	38:	41:	37:	33:
2	62:	55:	49:	53:	48:	43:



**TWO-LEG BRIDLE OR BASKET HITCH**  
(TABLE G-5: Part 2--45° and 30° Positions)

Rope Dia: Inches	45°			30°		
	A	B	C	A	B	C

6X19 CLASSIFICATION

1/4	.77	.72	.70	.55	.51	.49
3/8	1.7	1.6	1.5	1.2	1.1	1.1
1/2	3.0	2.8	2.6	2.1	2.0	1.8
5/8	4.7	4.4	4.0	3.3	3.1	2.8
3/4	6.7	6.2	5.5	4.8	4.4	3.9
7/8	9.1	8.4	7.3	6.4	5.9	5.1
1	12:	11:	9.4	8.4	7.7	6.7
1-1/8	15:	13:	12:	10:	9.5	8.4

6X37 CLASSIFICATION

1-1/4	17:	16:	14:	12:	11:	9.8
1-3/8	21:	19:	17:	15:	13:	12:
1-1/2	25:	22:	20:	17:	16:	14:
1-3/4	34:	30:	27:	24:	21:	19:
2	43:	39:	35:	31:	28:	25:

- (A) - Socket or swaged terminal attachment.
- (B) - Mechanical sleeve attachment.
- (C) - Hand tucked splice attachment.)

**TABLE ((G-6)) G-1**  
NUMBER AND SPACING OF U-BOLT WIRE  
ROPE CLIPS

Improved plow steel rope diameter inches	Number of Clips		Minimum spacing (inches)
	Drop forged	Other material	
*	...	...	
1/2	3	4	3
5/8	3	4	3 3/4
3/4	4	5	4 1/2
7/8	4	5	5 1/4
1	4	6	6
1 1/8	5	6	6 3/4
1 1/4	5	7	7 1/2
1 3/8	6	7	8 1/4
1 1/2	6	8	9

\*Three clips shall be used on wire size less than 1/2-inch diameter.

((TABLE G-7

**WROUGHT IRON CHAIN**  
(in pounds or tons of 2000 pounds)

Nominal Size	Single Leg	60°	45°	30°
Chain Stock Inch				
- 1/4	1060	1835	1500	1060
5/16	1655	2865	2340	1655
3/8	2385	21	3370	2385
7/16	3250	2.8	2.3	3250
1/2	421	43.7	43.0	421
9/16	42.7	44.6	43.8	42.7
5/8	43.3	45.7	44.7	43.3
3/4	44.8	48.3	46.7	44.8
7/8	46.5	41.2	49.2	46.5
+	48.5	44.7	42.0	48.5
1-1/8	40.0	47.3	44.2	40.0
1-1/4	42.4	21.4	17.5	42.4
1-3/8	45.0	25.9	21.1	45.0
1-1/2	47.8	30.8	25.2	47.8
1-5/8	20.9	36.2	29.5	20.9
1-3/4	24.2	42.0	34.3	24.2
1-7/8	27.6	47.9	39.1	27.6
2	31.6	54.8	44.8	31.6

\*These sizes of wrought iron chain are no longer manufactured in the United States.

**TABLE G-8**

**ALLOY STEEL CHAIN**  
(in tons of 2000 pounds)

Nominal Size	Single Leg	60°	45°	30°
Chain Stock Inch				
1/4	1.62	2.82	2.27	1.62
3/8	3.30	5.70	4.65	3.30
1/2	5.62	9.75	7.90	5.62
5/8	8.25	14.25	11.65	8.25
3/4	11.5	19.9	16.2	11.5
7/8	14.3	24.9	20.3	14.3
+	19.3	33.4	27.3	19.8
1-1/8	22.2	38.5	31.5	22.2
1-1/4	28.7	49.7	40.5	28.7
1-3/8	33.5	58.0	47.0	33.5
1-1/2	39.7	68.5	56.0	39.7
1-5/8	42.5	73.5	59.5	42.5
1-3/4	47.0	81.5	62.0	47.0))

**TABLE ((G-9)) G-2**

**MAXIMUM ALLOWABLE WEAR AT ANY POINT OF LINK**

Chain size in inches	Maximum allowable wear in fraction of inches
1/4 (9/32) .....	3/64
3/8 .....	5/64
1/2 .....	7/64
5/8 .....	9/64
3/4 .....	5/32
7/8 .....	1/64
1 .....	3/16
1 1/8 .....	7/32
1 1/4 .....	1/4
1 3/8 .....	9/32
1 1/2 .....	5/16
1 3/4 .....	1/32

((TABLE G-10

SAFE WORKING LOADS FOR SHACKLES  
(in tons of 2,000 pounds)

Material size (inches)	Pin diameter (inches)	Safe working load
1/2 .....	5/8	1.4
5/8 .....	3/4	2.2
3/4 .....	7/8	3.2
7/8 .....	1	4.3
1 .....	1 1/8	5.6
1 1/8 .....	1 1/4	6.7
1 1/4 .....	1 3/8	8.2
1 3/8 .....	1 1/2	10.0
1 1/2 .....	1 5/8	11.9
1 3/4 .....	2	16.2
2 .....	2 1/4	21.2))

AMENDATORY SECTION (Amending WSR 98-24-096, filed 12/1/98, effective 3/1/99)

**WAC 296-307-09506 What definitions apply to this section?**

"Accessible" means a maximum of one-quarter mile or five minutes travel time from the worksite.

"Hand-labor operations" means agricultural operations performed by hand or with hand tools.

For example: The hand cultivation, weeding, planting or harvesting of vegetables, nuts, fruit, seedlings or other crops, including mushrooms, and hand packing into containers.

EXCEPTION: Hand-labor does not include logging operations, the care or feeding of livestock, or hand-labor operations in permanent structures (e.g., canning facilities or packing houses).

"Handwashing facility" means a facility that meets the requirements of WAC 296-307-09515 and is approved by the local health authority.

"Potable water" means water that is suitable for drinking by the public and meets the requirements of chapter 246-290 or 246-291 WAC.

"Toilet" means a fixed or portable facility designed for the purpose of adequate collection and containment of both defecation and urination. "Toilet" includes biological, chemical, flush, and combustion toilets, or sanitary outhouses.

AMENDATORY SECTION (Amending WSR 03-18-090, filed 9/2/03, effective 11/1/03)

**WAC 296-800-23025 Provide convenient and clean washing facilities.**

**Exemption:** You do **not** have to provide washing facilities for:  
● Mobile crews or work locations not normally attended by employees, if there is immediately available transportation to nearby washing facilities that meet the requirements of this rule.

**You must:**

- Provide convenient and clean washing facilities for employees including:
  - Sinks or basins for personal washing
  - Hot and cold water, or lukewarm (tepid), running water in each sink and basin
  - Hand soap or similar cleaning agents
  - One of the following:
    - Individual paper or cloth hand towels
    - Individual sections of clean continuous cloth toweling
    - ((Warm)) Air blowers for drying hands, located near the sinks and basins.

AMENDATORY SECTION (Amending WSR 08-18-056, filed 9/2/08, effective 11/2/08)

**WAC 296-800-310 Summary.** Your responsibility: To provide and maintain emergency exit routes and to install and maintain adequate employee alarm systems.

**IMPORTANT:**

An employer who demonstrates compliance with the exit route provisions of NFPA ((~~101-2000~~) 101-2009, the Life Safety Code, will be in compliance with the corresponding requirements of this section.

Exit routes:

You must:

Provide an adequate number of exit routes.

WAC 296-800-31005.

Make sure that exit routes are large enough.

WAC 296-800-31010.

Make sure that exit routes meet their specific design and construction requirements.

WAC 296-800-31015.

Make sure that each exit route leads outside.

WAC 296-800-31020.

Provide unobstructed access to exit routes.  
WAC 296-800-31025.  
Exit doors must be readily opened from the inside.  
WAC 296-800-31030.  
Use side-hinged doors to connect rooms to exit routes.  
WAC 296-800-31035.  
Provide outdoor exit routes that meet requirements.  
WAC 296-800-31040.  
Minimize danger to employees while they are using emergency exit routes.  
WAC 296-800-31045.  
Mark exits adequately.  
WAC 296-800-31050.  
Provide adequate lighting for exit routes and signs.  
WAC 296-800-31053.  
Maintain the fire retardant properties of paints or other coatings.  
WAC 296-800-31055.  
Maintain emergency safeguards.  
WAC 296-800-31060.  
Maintain exit routes during construction and repair.  
WAC 296-800-31065.  
Provide doors in freezer or refrigerated rooms that open from the inside.  
WAC 296-800-31067.  
Employee alarm systems:  
You must:  
Install and maintain an appropriate employee alarm system.  
WAC 296-800-31070.  
Establish procedures for sounding emergency alarms.  
WAC 296-800-31075.  
Test the employee alarm system.  
WAC 296-800-31080.

**Exemption:** This rule does not apply to vehicles, vessels, or other mobile structures.

**Note:** The introduction has important information about building, electrical and fire codes that may apply to you in addition to WISHA rules. See "How do the WISHA rules relate to building, fire, and electrical codes" in the introduction section of this book.

AMENDATORY SECTION (Amending WSR 09-01-158, filed 12/23/08, effective 3/1/09)

**WAC 296-800-370 Definitions.**

**Abatement action plans**

Refers to your written plans for correcting a WISHA violation.

**Abatement date**

The date on the citation when you must comply with specific safety and health standards listed on the citation and notice of assessment or the corrective notice of redetermination.

**Acceptable**

As used in **Electrical**, **WAC 296-800-280** means an installation or equipment is acceptable to the director of labor and industries, and approved:

- If it is accepted, or certified, or listed, or labeled, or otherwise determined to be safe by a nationally recognized testing laboratory; or

- With respect to an installation or equipment of a kind which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, if it is inspected or tested by another federal agency, or by a state, municipal, or other local authority responsible for enforcing occupational safety provisions of the National Electrical Code, and found in compliance with the provisions of the National Electrical Code as applied in this section;

**OR**

- With respect to custom-made equipment or related installations which are designed, fabricated for, and intended for use by a particular customer, if it is determined to be safe for its intended use by its manufacturer on the basis of test data which the employer keeps and makes available for inspection to the director and his/her authorized representatives. Refer to federal regulation 29 CFR 1910.7 for definition of nationally recognized testing laboratory.

**Accepted**

As used in **Electrical**, **WAC 296-800-280** means an installation is accepted if it has been inspected and found by a nationally recognized testing laboratory to conform to specified plans or to procedures of applicable codes.

**Access**

As used in material safety data sheets (MSDSs) as Exposure Records, **WAC 296-800-180** means the right and opportunity to examine and copy exposure records.

**Affected employees**

As used in WISHA appeals, penalties and other procedural rules, **WAC 296-800-350** means employees exposed to hazards identified as violations in a citation.

### **Analysis using exposure or medical records**

● An analysis using exposure records or medical records can be any collection of data or a statistical study. It can be based on either:

- Partial or complete information from individual employee exposure or medical records or

- Information collected from health insurance claim records

● The analysis is not final until it has been:

- Reported to the employer or

- Completed by the person responsible for the analysis

### **ANSI**

This is an acronym for the American National Standards Institute.

### **Approved means:**

● Approved by the director of the department of labor and industries or their authorized representative, or by an organization that is specifically named in a rule, such as Underwriters' Laboratories (UL), Mine Safety and Health Administration (MSHA), or the National Institute for Occupational Safety and Health (NIOSH).

● As used in Electrical, WAC 296-800-280 means acceptable to the authority enforcing this section. The authority enforcing this section is the director of labor and industries. The definition of acceptable indicates what is acceptable to the director and therefore approved.

### **Assistant director**

The assistant director for the WISHA services division at the department of labor and industries or his/her designated representative.

### **ASTM**

This is an acronym for American Society for Testing and Materials.

### **Attachment plug or plug**

As used in the basic electrical rules, WAC 296-800-280 means the attachment at the end of a flexible cord or cable that is part of a piece of electrical equipment. When it is inserted into an outlet or receptacle, it connects the conductors supplying electrical power from the outlet to the flexible cable.

### **Bare conductor**

A conductor that does not have any covering or insulation.

### **Bathroom**

A room maintained within or on the premises of any place of employment, containing toilets that flush for use by employees.

### **Biological agents**

Organisms or their by-products.

### **Board**

As used in WISHA appeals, penalties and other procedural rules, WAC 296-800-350 means the board of industrial insurance appeals.

### **Ceiling**

An exposure limit that must not be exceeded during any part of the employee's workday. The ceiling must be determined over the

shortest time period feasible and should not exceed fifteen minutes.

**Certification**

As used in WISHA appeals, penalties and other procedural rules, WAC 296-800-350 means refers to an employer's written statement describing when and how a citation violation was corrected.

**CFR**

This is an acronym for Code of Federal Regulations.

**Chemical**

Any element, chemical compound, or mixture of elements and/or compounds.

**Chemical agents (airborne or contact)**

A chemical agent is any of the following:

- Airborne chemical agent which is any of the following:
  - Dust - Solid particles suspended in air, that are created by actions such as:
    - Handling.
    - Drilling.
    - Crushing.
    - Grinding.
    - Rapid impact.
    - Detonation.
    - Decrepitation of organic or inorganic materials such as rock, ore, metal, coal, wood, and grain.
  - Fume - Solid particles suspended in air, that are created by condensation from the gaseous state.
  - Gas - A normally formless fluid, such as air, which can be changed to the liquid or solid state by the effect of increased pressure or decreased temperature or both.
  - Mist - Liquid droplets suspended in air. Mist is created by:
    - Condensation from the gaseous to the liquid state;
- OR
  - Converting a liquid into a dispersed state with actions such as splashing, foaming, spraying or atomizing.
    - Vapor - The gaseous form of a substance that is normally in the solid or liquid state.
  - Contact chemical agent which is any of the following:
    - Corrosive - A substance that, upon contact, causes destruction of living tissue by chemical action, including acids with a pH of 2.5 or below or caustics with a pH of 11.0 or above.
    - Irritant - A substance that will induce a local inflammatory reaction upon immediate, prolonged, or repeated contact with normal living tissue.
    - Toxicant - A substance that has the inherent capacity to produce personal injury or illness to individuals by absorption through any body surface.

**Chemical manufacturer**

An employer with a workplace where one or more chemicals are produced for use or distribution.

**Chemical name**

The scientific designation of a chemical in accordance with one of the following:

- The nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC)
- The Chemical Abstracts Service (CAS) rules of nomenclature
- A name which will clearly identify the chemical for the purpose of conducting a hazard evaluation.

**Circuit breaker**

● Is a device used to manually open or close a circuit. This device will also open the circuit automatically and without damage to the breaker when a predetermined overcurrent is applied. (600 volts nominal or less)

● Is a switching device capable of making, carrying, and breaking currents under normal circuit conditions, and also making, carrying for a specified time, and breaking currents under specified abnormal circuit conditions, such as those of short circuit. (Over 600 volts nominal)

**Citation**

Refers to the citation and notice issued to an employer for any violation of WISHA safety and health rules. A citation and notice may be referred to as a citation and notice of assessment but is more commonly referred to as a citation.

**Combustible liquid**

A combustible liquid has a flashpoint of at least 100°F (37.8°C) and below 200°F (93.3°C). Mixtures with at least 99% of their components having flashpoints of 200°F (93.3°C) or higher are not considered combustible liquids.

**Commercial account**

As used in Employer Chemical Hazard Communication, WAC 296-800-170 means an arrangement in which a retail distributor sells hazardous chemical(s) to an employer, generally in large quantities over time, and/or at costs that are below the regular retail price.

**Common name**

As used in Employer Chemical Hazard Communication, WAC 296-800-170 means any designation or identification such as:

- Code name
- Code number
- Trade name
- Brand name
- Generic name used to identify a chemical other than by its chemical name.

**Compressed gas**

A gas or mixture of gases that, when in a container, has an absolute pressure exceeding:

- 40 psi at 70°F (21.1°C)

OR

- 104 psi at 130°F (54.4°C) regardless of the pressure at 70°F (21.1°C)

Compressed gas can also mean a liquid with a vapor pressure that exceeds 40 psi at 100°F (37.8°C)

**Conductor**

A wire that transfers electric power.

**Container**

As used in Employer Chemical Hazard Communication, WAC 296-800-170 means any container, except for pipes or piping systems, that contains a hazardous chemical. It can be any of the following:

- Bag
- Barrel
- Bottle
- Box
- Can
- Cylinder
- Drum
- Reaction vessel
- Storage tank

**Correction date**

The date by which a violation must be corrected. Final orders or extensions that give additional time to make corrections establish correction dates. A correction date established by an order of the board of industrial insurance appeals remains in effect during any court appeal unless the court suspends the date.

**Corrective notice**

Refers to a notice changing a citation and is issued by the department after a citation has been appealed.

**Corrosive**

A substance that, upon contact, causes destruction of living tissue by chemical action, including acids with a pH of 2.5 or below or caustics with a pH of 11.0 or above.

**Covered conductor**

A conductor that is covered by something else besides electrical insulation.

**Damp location**

As used in basic electrical rules, WAC 296-800-280 means partially protected areas that are exposed to moderate moisture. Outdoor examples include roofed open porches and marquees. Interior examples include basements and barns.

**Department**

Those portions of the department of labor and industries responsible for enforcing the Washington Industrial Safety Act (WISHA).

**Designated representative**

- Any individual or organization to which an employee gives written authorization.
- A recognized or certified collective bargaining agent without regard to written authorization.
- The legal representative of a deceased or legally incapacitated employee.

**Director**

The director means the director of the department of labor and industries or their designee.

**Distributor**

A business, other than a chemical manufacturer or importer, that supplies hazardous chemicals to other distributors or to

employers.

**Documentation**

As used in WISHA appeals, penalties and other procedural rules, WAC 296-800-350 means material that you submit to prove that a correction is completed. Documentation includes, but is not limited to, photographs, receipts for materials and/or labor.

**Dry location**

As used in basic electrical rules, WAC 296-800-280 means areas not normally subjected to damp or wet conditions. Dry locations may become temporarily damp or wet, such as when constructing a building.

**Dust**

Solid particles suspended in air that are created by actions such as:

- Handling.
- Drilling.
- Crushing.
- Grinding.
- Rapid impact.
- Detonation.
- Decrepitation of organic or inorganic materials such as rock, ore, metal, coal, wood, and grain.

**Emergency washing facilities**

Emergency washing facilities are emergency showers, eyewashes, eye/face washes, hand-held drench hoses, or other similar units.

**Electrical outlets**

Places on an electric circuit where power is supplied to equipment through receptacles, sockets, and outlets for attachment plugs.

**Employee**

Based on chapter 49.17 RCW, the term employee and other terms of like meaning, unless the context of the provision containing such term indicates otherwise, means an employee of an employer who is employed in the business of his or her employer whether by way of manual labor or otherwise and every person in this state who is engaged in the employment of or who is working under an independent contract the essence of which is personal labor for an employer under this standard whether by way of manual labor or otherwise.

**Employee exposure record**

As used in material safety data sheets (MSDSs) as exposure records, WAC 296-800-180 means a record containing any of the following kinds of information:

- Environmental (workplace) monitoring or measuring of a toxic substance or harmful physical agent, including personal, area, grab, wipe, or other form of sampling, as well as related collection and analytical methodologies, calculations, and other background data relevant to interpretation of the results obtained;
- Biological monitoring results which directly assess the absorption of a toxic substance or harmful physical agent by body systems (e.g., the level of a chemical in the blood, urine, breath, hair, fingernails, etc.) but not including results which assess the biological effect of a substance or agent or which assess an

employee's use of alcohol or drugs;

- Material safety data sheets indicating that the material may pose a hazard to human health;

OR

- In the absence of the above, a chemical inventory or any other record which reveals where and when used and the identity (e.g., chemical, common or trade name) of a toxic substance or harmful physical agent.

**Employer**

Based on chapter 49.17 RCW, an employer is any person, firm, corporation, partnership, business trust, legal representative, or other business entity which engages in any business, industry, profession, or activity in this state and employs one or more employees or who contracts with one or more persons, the essence of which is the personal labor of such person or persons and includes the state, counties, cities, and all municipal corporations, public corporations, political subdivisions of the state, and charitable organizations: Provided, That any persons, partnership, or business entity not having employees, and who is covered by the Industrial Insurance Act must be considered both an employer and an employee.

**Exit**

Provides a way of travel out of the workplace.

**Exit route**

A continuous and unobstructed path of exit travel from any point within a workplace to safety outside.

**Explosive**

A chemical that causes a sudden, almost instant release of pressure, gas, and heat when exposed to a sudden shock, pressure, or high temperature.

**Exposed live parts**

Electrical parts that are:

- Not suitably guarded, isolated, or insulated

AND

- Capable of being accidentally touched or approached closer than a safe distance.

**Exposed wiring methods**

Involve working with electrical wires that are attached to surfaces or behind panels designed to allow access to the wires.

**Exposure or exposed**

As used in employer chemical hazard communication, WAC 296-800-170 and material safety data sheets (MSDSs) as exposure records, WAC 296-800-180. An employee has been, or may have possibly been, subjected to a hazardous chemical, toxic substance or harmful physical agent while working. An employee could have been exposed to hazardous chemicals, toxic substances, or harmful physical agents in any of the following ways:

- Inhalation
- Ingestion
- Skin contact
- Absorption
- Related means.

The terms exposure and exposed only cover workplace exposure involving a toxic substance or harmful physical agent in the workplace different from typical nonoccupational situations in the way it is:

- Used
- Handled
- Stored
- Generated
- Present

**Exposure record**

See definition for employee exposure record.

**Extension ladder**

A portable ladder with 2 or more sections and is not self-supporting. The 2 or more sections travel in guides or brackets that let you change the length. The size of a portable ladder is determined by adding together the length of each section.

**Failure-to-abate**

Any violation(s) resulting from not complying with an abatement date.

**Final order**

Any of the following (unless an employer or other party files a timely appeal):

- Citation and notice;
- Corrective notice;
- Decision and order from the board of industrial insurance appeals;
- Denial of petition for review from the board of industrial insurance appeals; or
- Decision from a Washington State superior court, court of appeals, or the state supreme court.

**Final order date**

The date a final order is issued.

**First aid**

The extent of treatment you would expect from a person trained in basic first aid, using supplies from a first-aid kit.

Tests, such as X rays, must not be confused with treatment.

**Flammable**

A chemical covered by one of the following categories:

- Aerosol flammable means an aerosol that, when tested by the method described in 16 CFR 1500.45 yields either a flame projection more than 18 inches at full valve opening or a flashback (a flame extending back to the valve) at any degree of valve opening;
- Gas, flammable means:
  - A gas that, at temperature and pressure of the surrounding area, forms a flammable mixture with air at a concentration of 13% by volume or less or
  - A gas that, at temperature and pressure of the surrounding area, forms a range of flammable mixtures with air wider than 12% by volume, regardless of the lower limit.
- Liquid, flammable means any liquid having a flashpoint below 100°F (37.8°C), except any mixture having components with flashpoints of 100°F (37.8°C) or higher, the total of which make up

99% or more of the total volume of the mixture.

● Solid, flammable means a solid, other than a blasting agent or explosive as defined in 29 CFR 1910.109(a), that is likely to cause fire through friction, moisture absorption, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily. Solid, inflammable also means that when the substance is ignited, it burns so powerfully and persistently that it creates a serious hazard. A chemical must be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

#### **Flashpoint**

● The minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested by any of the following measurement methods:

- Tagliabue closed tester: (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24-1979 (ASTM D 56-79)) for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100°F (37.8°C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or

- Pensky-Martens closed tester: (See American National Standard Method of Test for Flash Point by Pensky-Martens Closed Tester, Z11.7-1979 (ASTM D 93-79)) for liquids with a viscosity equal to or greater than 45 SUS at 100°F (37.8°C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

- Setaflash closed tester: (See American National Standard Method of Test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78).)

**Note:** Organic peroxides, which undergo auto accelerating thermal decomposition, are excluded from any of the flashpoint measurement methods specified above.

#### **Flexible cords and cables**

Typically used to connect electrical equipment to an outlet or receptacle. These cords can have an attachment plug to connect to a power source or can be permanently wired into the power source. Flexible cords, extension cords, cables and electrical cords are all examples of flexible cord.

#### **Floor hole**

An opening in any floor, platform, pavement, or yard that measures at least one inch but less than 12 inches at its smallest dimension and through which materials and tools (but not people) can fall.

Examples of floor holes are:

- Belt holes
- Pipe openings
- Slot openings

#### **Floor opening**

An opening in any floor, platform, pavement, or yard that measures at least 12 inches in its smallest dimension and through which a person can fall.

Examples of floor openings are:

- Hatchways
- Stair or ladder openings
- Pits
- Large manholes

The following are NOT considered floor openings:

- Openings occupied by elevators
- Dumbwaiters
- Conveyors
- Machinery
- Containers

**Foreseeable emergency**

As used in Employer Chemical Hazard Communication, WAC 296-800-170 means any potential event that could result in an uncontrolled release of a hazardous chemical into the workplace. Examples of foreseeable emergencies include equipment failure, rupture of containers, or failure of control equipment.

**Fume**

Solid particles suspended in air that are created by condensation from the gaseous state.

**Gas**

A normally formless fluid, such as air, which can be changed to the liquid or solid state by the effect of increased pressure or decreased temperature or both.

**Ground**

As used in Electrical, WAC 296-800-280, a connection between an electrical circuit or equipment and the earth or other conducting body besides the earth. This connection can be intentional or accidental.

**Grounded**

A connection has been made between an electrical circuit or equipment and the earth or another conducting body besides the earth.

**Grounded conductor**

A system or circuit conductor that is intentionally grounded.

**Ground-fault circuit-interrupter**

A device whose function is to interrupt the electric circuit to the load when a fault current to ground exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit.

**Grounding conductor**

Is used to connect equipment or the grounded circuit of a wiring system to a grounding electrode or electrodes.

**Grounding conductor, equipment**

A conductor used to connect noncurrent-carrying metal parts of equipment, raceways, and other enclosures to the system grounded conductor and/or the grounding electrode conductor at the service equipment or at the source of a separately derived system.

**Guarded**

Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of being accidentally touched

or approached closer than a safe distance.

**Hand-held drench hoses**

Hand-held drench hoses are single-headed emergency washing devices connected to a flexible hose that can be used to irrigate and flush the face or other body parts.

**Handrail**

A single bar or pipe supported on brackets from a wall or partition to provide a continuous handhold for persons using a stair.

**Harmful physical agent**

Any physical stress such as noise, vibration, repetitive motion, heat, cold, ionizing and nonionizing radiation, and hypo- or hyperbaric pressure which:

- Is listed in the latest edition of the National Institute for Occupational Safety and Health (NIOSH) *Registry of Toxic Effects of Chemical Substances* (RTECS); or

- Has shown positive evidence of an acute or chronic health hazard in testing conducted by, or known to, the employer;

OR

- Is the subject of a material safety data sheet kept by or known to the employer showing that the material may pose a hazard to human health.

**Hazard**

Any condition, potential or inherent, which can cause injury, death, or occupational disease.

**Hazard warning**

As used in Employer Chemical Hazard Communication, WAC 296-800-170 can be a combination of words, pictures, symbols, or combination appearing on a label or other appropriate form of warning which shows the specific physical and health hazard(s), including target organ effects, of the chemical(s) in the container(s).

**Note:** See definition for physical hazard and health hazard to determine which hazards must be covered.

**Hazardous chemical**

Any chemical that is a physical or health hazard.

**Health hazard**

A chemical, mixture, biological agent, or physical agent that may cause health effects in short- or long-term exposed employees. Based on statistically significant evidence from at least one study conducted using established scientific principles. Health hazards include:

- Carcinogens
- Toxic or highly toxic agents
- Reproductive toxins
- Irritants
- Corrosives
- Sensitizers
- Hepatotoxins (liver toxins)
- Nephrotoxins (kidney toxins)
- Neurotoxins (nervous system toxins)
- Substances that act on the hematopoietic system (blood or

blood-forming system)

- Substances that can damage the lungs, skin, eyes, or mucous membranes

- Hot or cold conditions.

**Hospitalization**

To be admitted to a hospital or an equivalent medical facility on an emergent in-patient basis requiring an overnight stay.

**Identity**

As used in Employer Chemical Hazard Communication, WAC 296-800-170 means any chemical or common name listed on the material safety data sheet (MSDS) for the specific chemical. Each identity used must allow cross-references among the:

- Required list of hazardous chemicals
- Chemical label
- MSDSs

**Imminent danger violation**

Any violation(s) resulting from conditions or practices in any place of employment, which are such that a danger exists which could reasonably be expected to cause death or serious physical harm, immediately or before such danger can be eliminated through the enforcement procedures otherwise provided by the Washington Industrial Safety and Health Act.

**Importer**

The first business within the Customs Territory of the USA that:

- Receives hazardous chemicals produced in other countries

**AND**

- Supplies them to distributors or employers within the USA

**Insulated**

A conductor has been completely covered by a material that is recognized as electrical insulation and is thick enough based on:

- The amount of voltage involved

**AND**

- The type of covering material

**Interim waiver**

An order granted by the department allowing an employer to vary from WISHA requirements until the department decides to grant a permanent or temporary waiver.

**Irritant**

A substance that will induce a local inflammatory reaction upon immediate, prolonged, or repeated contact with normal living tissue.

**Ladder**

Consists of 2 side rails joined at regular intervals by crosspieces called steps, rungs, or cleats. These steps are used to climb up or down.

**Listed**

Equipment is listed if it:

- Is listed in a publication by a nationally recognized laboratory (such as UL, underwriters laboratory) that inspects the production of that type of equipment,

**AND**

- States the equipment meets nationally recognized standards or has been tested and found safe to use in a specific manner.

**Material safety data sheet (MSDS)**

Written, printed, or electronic information (on paper, microfiche, or on-screen) that informs manufacturers, distributors, employers or employees about a hazardous chemical, its hazards, and protective measures as required by material safety data sheet and label preparation, chapter 296-839 WAC.

**Medical treatment**

Treatment provided by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first-aid treatment even if provided by a physician or registered professional personnel.

**Mist**

Liquid droplets suspended in air. Mist is created by:

- Condensation from the gaseous to the liquid state;

OR

- Converting a liquid into a dispersed state with actions such as splashing, foaming, spraying or atomizing.

**Mixture**

As used in Employer Chemical Hazard Communication, WAC 296-800-170, any combination of 2 or more chemicals (if that combination did not result from a chemical reaction).

**Movable equipment**

As used in WAC 296-800-35052, a hand-held or nonhand-held machine or device;

- That is powered or nonpowered;

AND

- Can be moved within or between worksites

**Must**

Must means mandatory.

**NEMA**

These initials stand for National Electrical Manufacturing Association.

**NFPA**

This is an acronym for National Fire Protection Association.

**Nose**

The portion of the stair tread that projects over the face of the riser below it.

**Occupational Safety and Health Administration (OSHA)**

Created in 1970 when the U.S. Congress passed the Occupational Safety and Health Act, the Occupational Safety and Health Administration (OSHA) provides safety on the job for workers. OSHA oversees state plans (such as WISHA in Washington) that have elected to administer the safety and health program for their state. OSHA requires WISHA rules to be at least as effective as OSHA rules.

**Office work environment**

An indoor or enclosed occupied space where clerical work, administration, or business is carried out.

In addition, it includes:

- Other workplace spaces controlled by the employer and used

by office workers, such as cafeterias, meeting rooms, and washrooms.

- Office areas of manufacturing and production facilities, not including process areas.

- Office areas of businesses such as food and beverage establishments, agricultural operations, construction, commercial trade, services, etc.

**Open riser**

A stair step with an air space between treads has an open riser.

**Organic peroxide**

This is an organic compound containing the bivalent-O-O-structure. It may be considered a structural derivative of hydrogen peroxide if one or both of the hydrogen atoms has been replaced by an organic radical.

**Outlet**

See definition for electrical outlets.

**Oxidizer**

A chemical other than a blasting agent or explosive as defined in WAC 296-52-60130 or CFR 1910.109(a), that starts or promotes combustion in other materials, causing fire either of itself or through the release of oxygen or other gases.

**Permissible exposure limits (PELs)**

Permissible exposure limits (PELs) are employee exposures to toxic substances or harmful physical agents that must not be exceeded. PELs are specified in applicable WISHA rules.

**Person**

Based on chapter 49.17 RCW, one or more individuals, partnerships, associations, corporations, business trusts, legal representatives, or any organized group of persons.

**Personal eyewash units**

Personal eyewash units are portable, supplementary units that support plumbed units or self-contained units, or both, by delivering immediate flushing for less than fifteen minutes.

**Personal service room**

Used for activities not directly connected with a business' production or service function such as:

- First aid
- Medical services
- Dressing
- Showering
- Bathrooms
- Washing
- Eating

**Personnel**

See the definition for employees.

**Physical hazard**

As used in Employer Chemical Hazard Communication, WAC 296-800-170 means a chemical that has scientifically valid evidence to show it is one of the following:

- Combustible liquid
- Compressed gas

- Explosive
- Flammable
- Organic peroxide
- Oxidizer
- Pyrophoric
- Unstable (reactive)
- Water reactive

**Platform**

Platform means an extended step or landing that breaks a continuous run of stairs.

**Plug**

See definition for attachment plug.

**Potable water**

Water that ~~((you can safely drink. It meets specific safety standards prescribed by the United States Environmental Protection Agency's National Interim Primary Drinking Water Regulations, published in 40 CFR Part 141, and 40 CFR 147.2400))~~ is suitable for drinking by the public and meets the requirements of chapter 246-290 or 246-291 WAC.

**Predictable and regular basis**

Employee functions such as, but not limited to, inspection, service, repair and maintenance which are performed

- At least once every 2 weeks

OR

● 4 man-hours or more during any sequential 4-week period (to calculate man-hours multiply the number of employees by the number of hours during a 4-week period).

**Produce**

As used in Employer Chemical Hazard Communication, WAC 296-800-170, any one of the following:

- Manufacture
- Process
- Formulate
- Blend
- Extract
- Generate
- Emit
- Repackage

**Purchaser**

As used in Employer Chemical Hazard Communication, WAC 296-800-170, an employer who buys one or more hazardous chemicals to use in their workplace.

**Pyrophoric**

A chemical is pyrophoric if it will ignite spontaneously in the air when the temperature is 130°F (54.4°C) or below.

**Qualified person**

A person who has successfully demonstrated the ability to solve problems relating to the subject matter, work, or project, either by:

- Possession of a recognized degree, certificate, or professional standing;

OR

- Extensive knowledge, training and experience.

**Railing or standard railing**

A vertical barrier erected along exposed edges of a floor opening, wall opening, ramp, platform, or runway to prevent falls of persons.

**Reassume jurisdiction**

The department has decided to take back its control over a citation and notice being appealed.

**Receptacle or receptacle outlet**

As used in basic electrical rules, WAC 296-800-280 means outlets that accept a plug to supply electric power to equipment through a cord or cable.

**Record**

A record is any item, collection, or grouping of information. Examples include:

- Paper document
- Microfiche
- Microfilm
- X-ray film
- Computer record

**Repeat violation**

A violation is a repeat violation if the employer has been cited one or more times previously for a substantially similar hazard.

~~((**Refuge area**~~

~~● A protected space along an exit route that is separated from other spaces inside the building by a barrier with at least a one-hour fire resistance rating;~~

~~OR~~

~~● A floor in a building with an automatic sprinkler system that has at least two spaces that are separated by smoke-resistant partitions. See WAC 296-24-607 for requirements for automatic sprinkler systems.]) **Refuge area**~~

● A protected space along an exit route that is separated from other spaces inside the building by a barrier with at least a one-hour fire resistance rating;

OR

● A floor in a building with an automatic sprinkler system that has at least two spaces that are separated by smoke-resistant partitions. See WAC 296-24-607 for requirements for automatic sprinkler systems.

**Responsible party**

As used in employer chemical hazard communication, WAC 296-800-170. Someone who can provide appropriate information about the hazardous chemical and emergency procedures.

**Rise**

The vertical distance from the top of a tread to the top of the next higher tread.

**Riser**

The vertical part of the step at the back of a tread that rises to the front of the tread above.

**Rungs**

Rungs are the cross pieces on ladders that are used to climb up and down the ladder.

**Runway**

An elevated walkway above the surrounding floor or ground level. Examples of runways are footwalks along shafting or walkways between buildings.

**Safety factor**

The term safety factor means the ratio of when something will break versus the actual working stress or safe load when it is used.

**Self-lighting or self-luminous**

A light source that:

● Is illuminated by a self-contained power source other than batteries;

**AND**

● Operates independently from external power sources.

**Serious violation**

Serious violation must be deemed to exist in a workplace if there is a substantial probability that death or serious physical harm could result from a condition which exists, or from one or more practices, means, methods, operations, or processes which have been adopted or are in use in such workplace, unless the employer did not, and could not with the exercise of reasonable diligence, know of the presence of the violation.

~~((**Self-lighting or self-luminous**~~

~~A light source that:~~

~~● Is illuminated by a self-contained power source other than batteries;~~

~~**AND**~~

~~● Operates independently from external power sources.))~~

**Short-term exposure limit (STEL)**

An exposure limit, averaged over a short time period (usually measured for 15 minutes) that must not be exceeded during any part of an employee's workday.

**Should**

Should means recommended.

**Single ladder**

A type of portable ladder with one section.

It is distinguished by all of the following:

- It has one section
- It cannot support itself
- Its length cannot be adjusted

**Smoking**

A person is smoking if they are:

- Lighting up
- Inhaling
- Exhaling
- Carrying a pipe, cigar or cigarette of any kind that is burning

**Specific chemical identity**

This term applies to chemical substances. It can mean the:

- Chemical name

- Chemical Abstracts Service (CAS) registry number
- Any other information that reveals the precise chemical designation of the substance.

**Stair railing**

A vertical barrier attached to a stairway with an open side to prevent falls. The top surface of the stair railing is used as a handrail

**Stairs or stairway**

A series of steps and landings:

- Leading from one level or floor to another,
- Leading to platforms, pits, boiler rooms, crossovers, or around machinery, tanks, and other equipment
- Used more or less continuously or routinely by employees, or only occasionally by specific individuals.
- With three or more risers

**Standard safeguard**

Safety devices that prevent hazards by their attachment to:

- Machinery
- Appliances
- Tools
- Buildings
- Equipment

These safeguards must be constructed of:

- Metal
- Wood
- Other suitable materials

The department makes the final determination about whether a safeguard is sufficient for its use.

**Step ladder**

A portable ladder with:

- Flat steps
- A hinge at the top allowing the ladder to fold out and support itself
- Its length that cannot be adjusted.

**Time weighted average (TWA<sub>8</sub>)**

An exposure limit, averaged over 8 hours, that must not be exceeded during an employee's work shift.

**Toeboard**

A barrier at floor level along exposed edges of a floor opening, wall opening, platform, runway, or ramp, to prevent falls of materials.

**Toxic chemical**

As used in first aid, WAC 296-800-150, is a chemical that produces serious injury or illness when absorbed through any body surface.

**Toxic substance**

Any chemical substance or biological agent, such as bacteria, virus, and fungus, which is any of the following:

- Listed in the latest edition of the National Institute for Occupational Safety and Health (NIOSH) *Registry of Toxic Effects of Chemical Substances* (RTECS)
- Shows positive evidence of an acute or chronic health hazard

in testing conducted by, or known to, the employer

- The subject of a material safety data sheet kept by or known to the employer showing the material may pose a hazard to human health.

**Toxicant**

A substance that has the inherent capacity to produce personal injury or illness to individuals by absorption through any body surface.

**Trade secret**

Any confidential:

- Formula
- Pattern
- Process
- Device
- Information
- Collection of information

The trade secret is used in an employer's business and gives an opportunity to gain an advantage over competitors who do not know or use it.

See WAC 296-62-053 for requirements dealing with trade secrets.

**Tread**

As used in stairs and stair railings, WAC 296-800-250 means the horizontal part of the stair step.

**Tread run**

As used in stairs and stair railings, WAC 296-800-250 means the distance from the front of one stair tread to the front of an adjacent tread.

**Tread width**

The distance from front to rear of the same tread including the nose, if used.

**UL (Underwriters' Laboratories, Inc.)**

You will find these initials on electrical cords and equipment. The initials mean the cord or equipment meets the standards set by the Underwriters' Laboratories, Inc.

**Unstable (reactive)**

As used in employer chemical hazard communication, WAC 296-800-170. An unstable or reactive chemical is one that in its pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

**Use**

As used in employer chemical hazard communication, WAC 296-800-170, means to:

- Package
- Handle
- React
- Emit
- Extract
- Generate as a by-product
- Transfer.

**Vapor**

The gaseous form of a substance that is normally in the solid or liquid state.

**Voltage of a circuit**

The greatest effective potential difference between any two conductors or between a conductor and ground.

**Voltage to ground**

The voltage between a conductor and the point or conductor of the grounded circuit. For undergrounded circuits, it is the greatest voltage between the conductor and any other conductor of the circuit.

**Voltage, nominal**

Nominal voltage is a value assigned to a circuit or system to designate its voltage class (120/240, 480Y/277, 600, etc.). The actual circuit voltage can vary from the value if it is within a range that permits the equipment to continue operating in a satisfactory manner.

**WAC**

This is an acronym for **Washington Administrative Code**, which are rules developed to address state law.

**Water-reactive**

As used in Employer Chemical Hazard Communication, WAC 296-800-170, a water-reactive chemical reacts with water to release a gas that is either flammable or presents a health hazard.

**Watertight**

Constructed so that moisture will not enter the enclosure or container.

**Weatherproof**

Constructed or protected so that exposure to the weather will not interfere with successful operation. Rainproof, raintight, or watertight equipment can fulfill the requirements for weatherproof where varying weather conditions other than wetness, such as snow, ice, dust, or temperature extremes, are not a factor.

**Wet location**

As used in basic electrical rules, WAC 296-800-280 means:

- Underground installations or in concrete slabs or masonry that are in direct contact with the earth
- Locations that can be saturated by water or other liquids
- Unprotected locations exposed to the weather (like vehicle washing areas)

**WISHA**

This is an acronym for the Washington Industrial Safety and Health Act.

**Work area**

As used in employer chemical hazard communication, WAC 296-800-170, a room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present.

**Working days**

Means a calendar day, except Saturdays, Sundays, and legal holidays. Legal holidays include:

- New Year's Day - January 1
- Martin Luther King, Jr. Day
- Presidents' Day

- Memorial Day
- Independence Day - July 4
- Labor Day
- Veterans' Day - November 11
- Thanksgiving Day
- The day after Thanksgiving Day; and
- Christmas Day - December 25

The number of working days must be calculated by not counting the first working day and counting the last working day.

**Worker**

See the definition for employee.

**Workplace**

- The term workplace means:

- Any plant, yard, premises, room, or other place where an employee or employees are employed for the performance of labor or service over which the employer has the right of access or control, and includes, but is not limited to, all workplaces covered by industrial insurance under Title 51 RCW, as now or hereafter amended.

- As used in Employer Chemical Hazard Communication, WAC 296-800-170 means an establishment, job site, or project, at one geographical location containing one or more work areas.

**You**

See definition of employer.

**Your representative**

Your representative is the person selected to act in your behalf.

AMENDATORY SECTION (Amending WSR 04-10-026, filed 4/27/04, effective 8/1/04)

**WAC 296-802-60005 Transfer or dispose of employee medical and exposure records when you go out of business.**

**You must:**

- Follow the requirements in Table 1 when transferring or disposing of records.

**Table 1  
Transfer or Disposal of Records**

<b>If</b>	<b>Then</b>
Another employer continues the business when you go out of business	Transfer all employee records to that employer
No other employer continues the business when you go out of business	<p><del>((Do the following:</del></p> <p>=)) Notify affected current employees of their rights of access to records at least three months prior to the termination of your business</p> <p><del>((AND EITHER:</del></p> <p>= Notify WISHA in writing of your impending decision to dispose of records at least three months prior to your planned disposal;</p> <p><b>OR</b></p> <p>= Transfer the records to WISHA, if required by a specific WISHA safety and health rule</p>
<p>You intend to dispose of records after the retention period has expired</p> <p>Note: If you dispose of records on a regular basis, you may notify WISHA once annually, at least</p>	<p>● Do the following:</p> <p>= Notify WISHA in writing of your impending decision to dispose of records at least three months prior to your planned disposal;</p>

If	Then
<p>three months before your first disposal, with the schedule of your planned disposals for the year</p>	<p><b>OR</b></p> <p>= Transfer the records to WISHA, if required by a specific WISHA safety and health rule</p>

**Note:** The address to notify WISHA in writing is:  
 Department of Labor & Industries/WISHA Services  
 Attention: Medical Records  
 P.O. Box 44610  
 Olympia, WA 98504-4610))

AMENDATORY SECTION (Amending WSR 04-12-070, filed 6/1/04, effective 9/1/04)

**WAC 296-823-200 Definitions.**

**Blood**

Human blood, human blood components and products made from human blood. Also included are medications derived from blood, such as immune globulins, albumin, and factors 8 and 9.

**Bloodborne pathogens**

Pathogenic microorganisms that are present in human blood and can cause disease in humans. Examples of these pathogens include:

- Human immunodeficiency virus (HIV)
- Hepatitis B virus (HBV)
- Hepatitis C virus, malaria
- Syphilis
- Babesiosis
- Brucellosis
- Leptospirosis
- Arboviral infections
- Relapsing fever
- Creutzfeld-Jakob Disease
- Human T-lymphotrophic virus Type I
- Viral Hemorrhagic Fever.

**Clinical laboratory**

A workplace where diagnostic or other screening procedures are performed on blood or other potentially infectious materials (OPIM).

**Contaminated**

The presence or the reasonably anticipated presence of blood or other potentially infectious materials (OPIM) on an item or surface.

**Contaminated laundry**

Laundry that has been soiled with blood or other potentially infectious materials (OPIM) or may contain contaminated sharps.

**Contaminated sharps**

Any contaminated object that can penetrate the skin including, but not limited to, needles, scalpels, broken glass, broken capillary tubes, and exposed ends of dental wires.

**Decontamination**

The use of physical or chemical means to remove, inactivate, or destroy bloodborne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use, or disposal.

**Exposure incident**

A specific eye, mouth, other mucous membrane, nonintact skin or parenteral contact with blood or other potentially infectious

materials (OPIM) that results from the performance of an employee's duties. Examples of nonintact skin include skin with dermatitis, hangnails, cuts, abrasions, chafing, or acne.

#### **Handwashing facilities**

A facility providing an adequate supply of running potable water, soap and single use towels or ((hot)) air drying machines.

#### **Licensed healthcare professional**

A person whose legally permitted scope of practice allows him or her to independently perform the activities required by this rule.

#### **Needleless systems**

A device that does not use needles for any of the following:

- The collection of bodily fluids or withdrawal of body fluids after initial venous or arterial access is established
- The administration of medication or fluids
- Any other procedure involving the potential for occupational exposure to bloodborne pathogens due to percutaneous injuries from contaminated sharps.

#### **Occupational exposure**

Reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or OPIM that may result from the performance of an employee's duties.

#### **Other potentially infectious materials (OPIM)**

Includes all of the following:

- Human body fluids: Semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids((†))
- Any unfixed tissue or organ (other than intact skin) from a human (living or dead)((†))
- HIV-containing cell or tissue cultures, organ cultures, and HIV- or HBV-containing culture medium or other solutions; and blood, organs, or other tissues from experimental animals infected with HIV or HBV
- Blood and tissues of experimental animals infected with bloodborne pathogens.

#### **Parenteral contact**

When mucous membranes or skin is pierced by needlesticks, human bites, cuts, or abrasions.

#### **Personal protective equipment (PPE)**

Specialized clothing or equipment worn by an employee for protection against a hazard. General work clothes (for example, uniforms, pants, shirts, or blouses) not intended to function as protection against a hazard are not considered to be PPE.

#### **Production facility**

A facility engaged in industrial-scale, large-volume or high concentration production of HIV or HBV.

#### **Regulated waste**

Regulated waste is any of the following:

- Liquid or semiliquid blood or other potentially infectious

materials (OPIM)

- Contaminated items that would release blood or OPIM in a liquid or semiliquid state, if compressed
- Items that are caked with dried blood or OPIM and are capable of releasing these materials during handling
- Contaminated sharps
- Pathological and microbiological wastes containing blood or OPIM.

#### **Research laboratory**

A laboratory producing or using research-laboratory-scale amounts of HIV or HBV. Research laboratories may produce high concentrations of HIV or HBV but not in the volume found in production facilities.

#### **Safer medical devices**

Medical devices that have been engineered to reduce the risk of needlesticks and other contaminated sharps injuries. These include not only sharps with engineered sharps injury protections and needleless systems but also other medical devices designed to reduce the risk of sharps injury exposures to bloodborne pathogens. Examples include blunt suture needles and plastic or mylar-wrapped glass capillary tubes.

#### **Secondary duty**

Any job expectation outside the primary job duties assigned to that position.

#### **Sharps with engineered sharps injury protections (SESIP)**

A nonneedle sharp or a needle device used for withdrawing body fluids, accessing a vein or artery, or administering medications or other fluids, with a built-in safety feature or mechanism that effectively reduces the risk of an exposure incident.

#### **Source person**

A person, living or dead, whose blood or other potentially infectious materials may be a source (OPIM) of occupational exposure to the employee. Examples include:

- Hospital and clinic patients
- Clients in institutions for the developmentally disabled
- Trauma victims
- Clients of drug and alcohol treatment facilities
- Residents of hospices and nursing homes
- Human remains
- Individuals who donate or sell blood or blood components.

#### **Standard microbiological practices**

Standard microbiological practices refer to procedures comparable to those outlined in the current edition of the Center for Disease Control "*Biosafety in Microbiological and Biomedical Laboratories.*"

#### **Sterilize**

The use of a physical or chemical procedure to destroy all microbial life including highly resistant bacterial endospores.

#### **Universal precautions**

An approach to infection control. According to the concept of universal precautions, all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and

other bloodborne pathogens.

**Note:** Universal Blood-Body Fluid Precautions, Body Substance Isolation, and Standard Precautions expand on the concept of universal precautions to include all body fluids and substances as infectious. These concepts are acceptable alternatives to universal precautions.

AMENDATORY SECTION (Amending WSR 09-19-119, filed 9/22/09, effective 12/1/09)

**WAC 296-842-13005 Select and provide appropriate respirators.**

**Exemption:** This section does NOT apply to respirator use that is voluntary. See WAC 296-842-11005 for voluntary use program requirements.

**IMPORTANT :**

See chapter 296-841 WAC, Airborne contaminants, for:

- Hazard evaluation requirements. Evaluation results are necessary for respirator selection.
- References to substance-specific rules that may also apply to you and have additional respirator selection requirements. These references are found in the permissible exposure limit (PEL) table.

A respirator shall be provided to each employee when such equipment is necessary to protect the health of the employee. Select and provide, at no cost to employees, appropriate respirators for routine use, infrequent use, and reasonably foreseeable emergencies (such as escape, emergency, and spill response situations) by completing the following process:

**Respirator Selection Process**

**Step 1:** If your only respirator use is for escape, skip to **Step 8** to select appropriate respirators.

**Step 2:** If the respiratory hazard is a biological aerosol, such as TB (tuberculosis), anthrax, psittacosis (parrot fever), or hanta virus, select a respirator appropriate for **nonemergency** activities recognized to present a health risk to workers AND skip to **Step 8**.

- If respirator use will occur during **emergencies**, skip to **Step 8** and document the analysis used to select the appropriate respirator.

- Use Centers for Disease Control (CDC) selection guidance for exposures to specific biological agents when this guidance exists. Visit <http://www.cdc.gov>.

**Step 3:** If the respiratory hazard is a pesticide, follow the respirator specification on the pesticide label AND skip to **Step 9**.

**Step 4:** Determine the expected exposure concentration for each respiratory hazard of concern. Use the results from the evaluation required by chapter 296-841 WAC, Airborne contaminants.

**Step 5:** Determine if the respiratory hazard is classified as IDLH; if it is NOT IDLH skip to **Step 7**.

- The respiratory hazard **is** classified as IDLH if:
  - The atmosphere is oxygen deficient or oxygen enriched;

OR

- You CANNOT measure or estimate your expected exposure concentration;

OR

- Your measured or estimated expected exposure concentration is greater or equal to the IDLH value in the NIOSH *Pocket Guide to Chemical Hazards*.

**Note:** DOSH uses the IDLH values in the 1990 edition of the NIOSH *Pocket Guide to Hazardous Chemicals* to determine the existence of IDLH conditions. You may use more recent editions of this guide. Visit [www.cdc.gov/niosh](http://www.cdc.gov/niosh) for more information.

**Step 6:** Select an appropriate respirator from one of the following respirators for IDLH conditions and skip to **Step 8:**

- Full-facepiece, pressure demand, self-contained breathing apparatus (SCBA) certified by NIOSH for a minimum service life of thirty minutes;

OR

- Full-facepiece, pressure demand air-line respirator equipped with an auxiliary self-contained air supply.

**Exception:** If the respiratory hazard is oxygen deficiency AND you can show oxygen concentrations can be controlled within the ranges listed in Table 4 under ALL foreseeable conditions, you are allowed to select ANY type of SCBA or air-line respirator:

**Table 4**  
**Concentration Ranges for Oxygen Deficiency**

<b>Altitude</b> (as ft. above sea level)	<b>Oxygen Concentration Range</b> (as percent oxygen)
Below 3,001	16.0 - 19.5
3,001 - 4,000	16.4 - 19.5
4,001 - 5,000	17.1 - 19.5
5,001 - 6,000	17.8 - 19.5
6,001 - 7,000	18.5 - 19.5
7,001 - 8,000	19.3 - 19.5
Above 8,000 feet the exception does not apply. Oxygen-enriched breathing air must be supplied above 14,000 feet.	

**Step 7:** Select respirator types with assigned protection factors (APFs) from Table 5 that are appropriate to protect employees from the expected exposure concentration.

**Note:**

- Appendix B, using assigned protection factors (APFs) for respirator selection, found in this chapter, uses the hazard-ratio approach established by ANSI Z88.2-1992 to determine which respirator types can provide a sufficient level of protection.
- If no permissible exposure limit (PEL) is established for an airborne contaminant, use relevant available information and informed professional judgment to determine an acceptable exposure limit value to use for calculating hazard ratios. For example, you may use exposure limit values established by the American Conference of Governmental Industrial Hygienists (ACGIH).

**Step 8:** Consider hazards that could require selection of specific respirator types. For example, select full-facepiece respirators to prevent eye irritation or abrasive blasting helmets to provide particle rebound protection.

**Note:** Rules for specific substances have additional selection specifications that apply to escape and other types of respirators. Make sure you follow those additional requirements before finalizing your selection.

**Step 9:** Evaluate user and workplace factors that might compromise respirator performance, reliability or safety.

Examples:

- High humidity or temperature extremes in the workplace.
- Necessary voice communication.
- High traffic areas and moving machinery.

● If respirator use is for escape only, follow this step and then skip to **Step 11**.

● If the respiratory hazard is a pesticide, follow the requirements on the pesticide label and skip to **Step 11**.

- Time or distance for escape.

**Step 10:** Follow Table 6 requirements to select an air-purifying respirator.

● If Table 6 requirements cannot be met, you must select an appropriate air-line respirator or an SCBA.

**Step 11:** Make sure respirators you select are certified by the National Institute for Occupational Safety and Health (NIOSH).

● Respirators provided exclusively for escape from IDLH atmospheres must be NIOSH-certified for escape from the atmosphere in which they will be used.

● To maintain certification, make sure the respirator is used according to cautions and limitations specified on the NIOSH approval label. This includes manufacturer restrictions on cartridges and canisters.

For SCBAs, use only the respirator manufacturer's NIOSH-approved breathing gas containers, marked and maintained in accordance with the Quality Assurance 68 provisions of the NIOSH approval for the SCBA as issued in accordance with the NIOSH respirator certification standard at 42 CFR Part 84.

**Note:** While selecting respirators, you will need to select a sufficient number of types, models or sizes to provide for fit testing. You can also consider other respirator use issues, such as accommodating facial hair with a loose fitting respirator.

Use Table 5 to identify the assigned protection factor for different types of respirators.

● These assigned protection factors are only effective when the employer implements a continuing, effective respirator program as required by this chapter, including training, fit testing, maintenance, and use requirements.

● You may select respirators assigned for use in higher workplace concentrations of a hazardous substance for use at lower concentrations of that substance, or when required use is independent of concentration.

**Table 5**  
**Assigned Protection Factors (APF) for Respirator Types**

<b>If the respirator is a(n) ...</b>	<b>Then the APF is ...</b>
Air-purifying respirator with a: ● Quarter-mask .....	5

If the respirator is a(n) . . .	Then the APF is . . .
<ul style="list-style-type: none"> <li>● Half-facepiece. This category includes filtering facepiece and elastomeric facepiece models . . . . . 10</li> <li>● Full-facepiece . . . . . 50</li> </ul> Powered air-purifying respirator (PAPR) with a: <ul style="list-style-type: none"> <li>● Loose-fitting facepiece . . . . . 25</li> <li>● Half-facepiece . . . . . 50</li> <li>● Full-facepiece . . . . . 1000</li> <li>● Hood or helmet . . . . . 25/1000 (see note)</li> </ul>	
<p><b>Note:</b> PAPRs with helmets/hoods may receive an APF of 1000 only when you have evidence that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater. Such evidence must be provided by the respirator manufacturer. This level of performance can best be demonstrated by performing a workplace protection factor (WPF) or simulated workplace protection factor (SWPF) study or equivalent testing.</p>	
Air-line respirator with a: <ul style="list-style-type: none"> <li>● Half-facepiece and designed to operate in demand mode . . . . . 10</li> <li>● Loose-fitting facepiece and designed to operate in continuous flow mode . . . . . 25</li> <li>● Half-facepiece and designed to operate in continuous-flow mode . . . . . 50</li> <li>● Half-facepiece and designed to operate in pressure-demand or other positive-pressure mode . . . . . 50</li> <li>● Full-facepiece and designed to operate in demand mode . . . . . 50</li> <li>● Full-facepiece and designed to operate in continuous-flow mode . . . . . 1000</li> <li>● Full-facepiece and designed to operate in pressure-demand or other positive-pressure mode . . . . . 1000</li> <li>● Helmet or hood and designed to operate in continuous-flow mode . . . . . 25/1000 (see note)</li> </ul>	

If the respirator is a(n) . . .	Then the APF is . . .
<p><b>Note:</b> Air-line respirators with helmets/hoods designed to operate in continuous-flow mode may receive an APF of 1000 when you have evidence that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater. Such evidence must be provided by the respirator manufacturer. This level of performance can best be demonstrated by performing a workplace protection factor (WPF) or simulated workplace protection factor (SWPF) study or equivalent testing.</p>	
<p>Self-contained breathing apparatus (SCBA) with a tight fitting:</p> <ul style="list-style-type: none"> <li>● Half-facepiece and designed to operate in demand mode . . . . .</li> <li>● Full-facepiece and designed to operate in demand mode . . . . .</li> <li>● Full-facepiece and designed to operate in pressure-demand or other positive pressure mode (e.g., open/closed circuit) . . . . .</li> <li>● Helmet or hood and designed to operate in demand mode . . . . .</li> <li>● Helmet or hood and designed to operate in pressure-demand or other positive-pressure mode (e.g., open/closed circuit) . . . . .</li> </ul>	<p>10</p> <p>50</p> <p>10,000</p> <p>50</p> <p>10,000</p>
<p>Combination respirators:</p> <ul style="list-style-type: none"> <li>● When using a combination respirator, such as an air-line respirator with an air-purifying filter, you must make sure the APF is appropriate to the mode of operation in which the respirator is used . . . . .</li> </ul>	
<p>Escape respirators:</p> <ul style="list-style-type: none"> <li>● APFs in this table do not apply to respirators used solely for escape. To select escape respirators, go to Step 8 of this section . . . . .</li> </ul>	

Use Table 6 to select air-purifying respirators for particle, vapor, or gas contaminants.

**Table 6**  
**Requirements for Selecting Any Air-purifying Respirator**

If the contaminant is a . .	Then . . .
<ul style="list-style-type: none"> <li>● Gas OR vapor</li> </ul>	<ul style="list-style-type: none"> <li>● Provide a respirator with canisters or cartridges equipped with a NIOSH-certified, end-of-service-life indicator (ESLI)</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>● If a canister or cartridge with an ESLI is NOT available, develop a cartridge change schedule to make sure the canisters or cartridges are replaced before they are no longer effective</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>● Select an atmosphere-supplying respirator</li> </ul>
<ul style="list-style-type: none"> <li>● Particle, such as a dust, spray, mist, fog, fume, or aerosol</li> </ul>	<ul style="list-style-type: none"> <li>● Select respirators with filters certified to be at least 95% efficient by NIOSH <ul style="list-style-type: none"> <li>– For example, N95s, R99s, P100s, or High Efficiency Particulate Air (HEPA) filters</li> </ul> </li> </ul>

AMENDATORY SECTION (Amending WSR 07-05-072, filed 2/20/07, effective 4/1/07)

**WAC 296-842-20010 Prevent conditions that could create a hazardous breathing air supply.** (1) Use SCBA and air-line respirators safely:

- **DO NOT** supply compressed oxygen to SCBAs or air-line respirators that previously used compressed air.

**Note:** Compressed air leaves residues containing hydrocarbons such as oil or grease. Fire or explosion can occur if compressed oxygen makes contact with these residues.

(2) Use breathing air couplings on air-line respirators that are **NOT** compatible with couplings for nonrespirable air or other gas systems, for example, utility air used for manufacturing purposes.

(3) **DO NOT** allow asphyxiating substances to enter breathing air lines; for example, do not flush nitrogen through worksite air lines also used for breathing air.

(4) Use equipment specifically designed for oxygen service or distribution **IF** oxygen concentrations greater than 23.5% are used.

**Note:** Respiratory equipment NOT designed for oxygen service or distribution can create fire or explosion hazards in oxygen concentrations higher than 23.5%.

(5) Make sure cylinders used to supply breathing air for SCBAs or air-line respirators are tested and maintained as described in the federal Department of Transportation's (DOT) Shipping Container Specification Regulations, Title 49 CFR Part 180.

**Note:**

- Use only cylinders marked (with serial number, cylinder pressure, DOT exemption number, and test dates) according to these DOT regulations
- To find any Code of Federal Regulations (CFR) visit: [www.access.gpo.gov](http://www.access.gpo.gov).