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DOE/RL-90-04
Revision 2A

UC-630,721

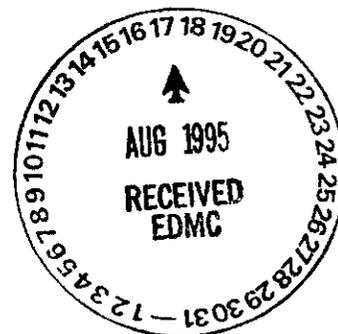
303-K Storage Facility Closure Plan

Date Published
June 1995



United States
Department of Energy

P.O. Box 550
Richland, Washington 99352



Approved for Public Release

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STATE ENVIRONMENTAL POLICY ACT (SEPA)

ENVIRONMENTAL CHECKLIST FORMS

FOR

303-K RADIOACTIVE MIXED-WASTE STORAGE FACILITY

RCRA CLOSURE PLAN

REVISION 2A

JULY, 1995

**WASHINGTON ADMINISTRATIVE CODE
ENVIRONMENTAL CHECKLIST FORMS
[WAC 197-11-960]**

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A. BACKGROUND

1. Name of proposed project, if applicable:

RCRA Closure of the 303-K Storage Facility.

Information contained in this State Environmental Policy Act (SEPA) Checklist pertains only to the portion of the Hanford Site 300 Area which contains the 303-K Storage Facility.

2. Name of applicants:

U.S. Department of Energy, Richland Operations Office (DOE-RL); and Westinghouse Hanford Company (WHC)

3. Address and phone number of applicants and contact persons:

U.S. Department of Energy	Westinghouse Hanford Company
Richland Operations Office	P.O. Box 1970
P.O. Box 550	Richland, Washington 99352
Richland, Washington 99352	

Contact Persons:

J. E. Rasmussen, Division Director	W. T. Dixon
Office of Environmental Assurance,	Environmental Services
Permits, and Policy Division	Westinghouse Hanford Company
(509) 376-5441	(509) 376-0428

4. Date checklist prepared:

July, 1995

5. Agency requesting checklist:

State of Washington
Department of Ecology
Mail Stop PV-11
Olympia, Washington 98504-8711

6. Proposed timing or schedule (including phasing, if applicable):

A closure plan (DOE/RL-90-04 Revision 2A) is being submitted for the closure of the 303-K Storage Facility. The schedule for closure has not been determined at this time.

Closure of the facility would begin upon notification by The State of Washington Department of Ecology, (Ecology) and by the United States Environmental Protection Agency, (EPA) of approval of the closure plan. The closure activities would be completed in accordance with the closure

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1 plan in approximately 52 weeks after approval of the plan by Ecology and
2 the EPA.
3

- 4 **7. Do you have any plans for future additions, expansion, or further**
5 **activity related to or connected with this proposal?**
6

7 It is intended that the facility would be clean closed in accordance with
8 the closure plan. Once the facility is clean closed, it would be
9 demolished. If clean closure is not practical, final disposition of the
10 site would be determined through the Remedial Investigation and
11 Feasibility Study (RI/FS) process in conjunction with the 300 Area
12 Operable Units, 300-FF-3 and 300-FF-5, under the Comprehensive
13 Environmental Response, Compensation and Liability Act of 1980, (CERCLA)
14 and the Hanford Federal Facility Agreement and Consent Order.
15

- 16 **8. List any environmental information you know about that has been prepared,**
17 **or will be prepared, directly related to this proposal.**
18

19 A revised RCRA Part A Permit Application for the facility was submitted
20 to Ecology and EPA on November 17, 1987.
21

22 This SEPA Checklist is being submitted to the Washington State Department
23 of Ecology (Ecology) concurrently with the RCRA Closure Plan (DOE/RL-90-
24 04 Revision 2A) for the 303-K Storage Facility. A RI/FS and National
25 Environmental Policy Act (NEPA) documentation are planned for the 300-FF-
26 3 Operable Unit.
27

28 ERDA-1538 contains environmental information on radioactive waste
29 operations at the Hanford Site, including the 300 Area.
30

- 31 **9. Do you know whether applications are pending for government approvals of**
32 **other proposals directly affecting property covered by your proposal? If**
33 **yes, explain.**
34

35 No applications are known to be pending.
36

- 37 **10. List any government approvals or permits that will be needed for your**
38 **proposal, if known.**
39

40 Ecology and the EPA must approve the closure plan for the 303-K Storage
41 Facility. No other permits are known to be required at this time.
42

- 43 **11. Give brief, complete description of your proposal, including the proposed**
44 **uses and the size of the project and site. There are several questions**
45 **later in this checklist that ask you to describe certain aspects of your**
46 **proposal. You do not need to repeat those answers on this page.**
47

48 The 303-K Radioactive Facility would be closed as a dangerous waste
49 storage facility regulated under WAC 173-303. Clean closure of the 303-K
50 Building and associated waste storage pads is proposed for final closure.
51 Once the facility is clean closed, it would be demolished.
52

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1 The site consists of a cinder-block building and fenced outside storage
2 pads of concrete, asphalt and gravel covering an area of approximately
3 620 square meters. Only the north half of the building is included within
4 the storage area and is separated from the south half by a cinder-block
5 wall. The site also contains a process sewer system.
6

7 Following removal of any dangerous waste inventory, the building and the
8 storage pads would be decontaminated to appropriate action levels with
9 one or more of the following methods:

- 10 • Damp wipe downs
- 11 • Vacuum assisted mechanical removal
- 12 • Sandblasting
- 13 • High-pressure steam and suction

14
15
16 The building, floor, outside storage pads, and underlying soils would be
17 sampled to determine effectiveness of decontamination procedures and
18 presence of contaminants. Decontamination would proceed until acceptable
19 action levels are reached. When these levels are achieved, clean closure
20 would be complete.
21

22 If these action levels cannot be achieved, those portions of the
23 building, floor, and pads that exceed action levels would be removed. If
24 dangerous constituents are determined to exist in the soil above action
25 levels, the soil would be remediated as part of the CERCLA RI/FS process
26 for the 300-FF-3 operable unit. The process sewer system is scheduled to
27 be addressed under the 300-FF-3 operable unit RI/FS process and is not
28 included in the closure plan.
29

30 Details of the proposed sampling and closure activities are found in the
31 accompanying closure plan.
32

- 33 12. Location of the proposal. Give sufficient information for a person to
34 understand the precise location of your proposed project, including a
35 street address, if any, and section, township, and range, if known. If a
36 proposal would occur over a range of area, provide the range or
37 boundaries of the site(s). Provide a legal description, site plan,
38 vicinity map, and topographic map, if reasonably available. While you
39 should submit any plans required by the agency, you are not required to
40 duplicate maps or detailed plans submitted with any permit applications
41 related to this checklist.
42

43 The 303-K Storage Facility is located in the northwest portion of the
44 Hanford Site 300 Area approximately one mile north of the City of
45 Richland, Washington. The facility is located in Section 11, T 10 N, R
46 28 E. A location map and site plans are included in the closure plan.
47
48
49

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B. ENVIRONMENTAL ELEMENTS

1. Earth

- a. General description of the site (circle one): Flat, rolling, hilly, steep slopes, mountainous, other _____.

Flat.

- b. What is the steepest slope on the site (approximate percent slope)?

The approximate slope of the land at the site of the 303-K RM-WSF is less than two percent.

- c. What general types of soils are found on the site (for example, clay, sandy gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

The soil at the site consists of compacted sand and gravel fill material underlain by sandy gravel with excellent drainage characteristics. No farming is permitted on the Hanford Site.

- d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

No.

- e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.

No additional fill would be required.

- f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Erosion is not expected.

- g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Approximately 80% of the surface is covered at the existing facility. No change would be made.

- h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

None.

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1 2. Air
2

- 3 a. What types of emissions to the air would result from the proposal
-
- 4 (i.e., dust, automobile, odors, industrial wood smoke) during
-
- 5 construction and when the project is completed? If any, generally
-
- 6 describe and give approximate quantities, if known.
-
- 7

8 Minor amounts of exhaust fumes would be generated by vehicles used
9 to gain access to the site. Small quantities of dust and vapors
10 could be generated by decontamination and sampling activities.
11

- 12 b. Are there any off-site sources of emissions or odors that may affect
-
- 13 your proposal? If so, generally describe.
-
- 14

15 No.

- 16 c. Proposed measures to reduce or control emissions or other impacts to
-
- 17 the air, if any?
-
- 18

19 None at this time.
20
2122 3. Water
2324 a. Surface
25

- 26 1) Is there any surface water body on or in the immediate vicinity
-
- 27 of the site (including year-round and seasonal streams,
-
- 28 saltwater, lakes, ponds, wetlands)? If yes, describe type and
-
- 29 provide names. If appropriate, state what stream or river it
-
- 30 flows into.
-
- 31

32 No. The closest body of water is the Columbia River
33 approximately one-half mile from the 303-K Storage Facility.
34

- 35 2) Will the project require any work over, in, or adjacent to
-
- 36 (within 200 feet) the described waters? If yes, please
-
- 37 describe and attach available plans.
-
- 38

39 No.
40

- 41 3) Estimate the amount of fill and dredge material that would be
-
- 42 placed in or removed from surface water or wetlands and
-
- 43 indicate the area of the site that would be affected. Indicate
-
- 44 the source of fill material.
-
- 45

46 None.
47

- 48 4) Will the proposal require surface water withdrawals or
-
- 49 diversions? Give general description, purpose, and approximate
-
- 50 quantities if known.
-
- 51

52 No.
53

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1 5) Does the proposal lie within a 100-year floodplain? If so,
2 note location on the site plan.

3
4 No.

5
6 6) Does the proposal involve any discharges of waste materials to
7 surface waters? If so, describe the type of waste and
8 anticipated volume of discharge.

9
10 No.

11
12 **b. Ground**

13
14 1) Will ground water be withdrawn, or will water be discharged to
15 ground water? Give general description, purpose, and
16 approximate quantities if known.

17
18 Insignificant amounts of water would be discharged to the soil
19 by steam cleaning and concrete coring activities.

20
21 2) Describe waste material that will be discharged into the ground
22 from septic tanks or other sources, if any (for example:
23 Domestic sewage; industrial, containing the following
24 chemicals; agricultural....; etc.). Describe the general size
25 of the system, the number of such systems, the number of houses
26 to be served (if applicable), or the number of animals or
27 humans the system(s) are expected to serve.

28
29 Does not apply.

30
31 **c. Water Run-off (including storm water)**

32
33 1) Describe the source of run-off (including storm water) and
34 method of collection and disposal, if any (include quantities,
35 if known). Where will this water flow? Will this water flow
36 into other waters? If so, describe.

37
38 The Hanford Site receives 6 inches to 8 inches of annual
39 precipitation. Any precipitation that occurs at the site will
40 run off the building and pads and seep into the soil on and
41 near the site. No run-off would enter surface waters.

42
43 2) Could waste materials enter ground or surface waters? If so,
44 generally describe.

45
46 Slightly contaminated runoff from the pads could enter the
47 soil during closure and reach the groundwater. The
48 quantity would be very minor because of the dry climate and
49 evapotranspiration from the soil. No materials would enter
50 surface waters.
51
52

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1 d. Proposed measures to reduce or control surface, ground, and run-off
2 water impacts, if any:

3
4 None are proposed at this time.

5
6 **4. Plants**

7
8 a. Check or circle types of vegetation found on the site.

- 9
10 deciduous tree: alder, maple, aspen, other
11 evergreen tree: fir, cedar, pine, other
12 shrubs
13 grass
14 pasture
15 crop or grain
16 wet soil plants: cattail, buttercup, bulrush, skunk cabbage,
17 other
18 water plants: water lily, reedgrass, milfoil, other
19 other types of vegetation

20
21 Small amounts of forbes and grasses may be seasonally present.

22
23 b. What kind and amount of vegetation will be removed or altered?

24
25 Small amounts of forbes and grasses.

26
27 c. List threatened or endangered species known to be on or near the
28 site.

29
30 None. Additional information on the Hanford Site environment can be
31 found in the environmental document referred to in the answer to
32 checklist question A.8.

33
34 d. Proposed landscaping, use of native plants, or other measures to
35 preserve or enhance vegetation on the site, if any:

36
37 None at this time.

38
39 **5. Animals**

40
41 a. Circle any birds and animals which have been observed on or near the
42 site or are known to be on or near the site:

- 43
44 birds: hawk, heron, eagle, songbirds, other
45 mammals: deer, bear, elk, beaver, other
46 fish: bass, salmon, trout, herring, shellfish, other

47
48 Starlings, lagomorphs and pigeons have been observed on the site.
49 Additional information on the Hanford Site environment can be found
50 in the environmental document referenced in the answer to checklist
51 question A.8.
52

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b. List any threatened or endangered species known to be on or near the site.

The Bald Eagle and the White Pelican are sometimes seen on the Hanford Site and possibly may be seen near the 300 area.

The site of the 303-K Storage Facility is not known to be used by any threatened or endangered species. However, additional information concerning endangered and threatened species on the Hanford Site can be found in the environmental document referred to in the answer to checklist question A.8.

c. Is the site part of a migration route? If so, explain.

No: however, the adjacent Columbia River is part of the broad Pacific Flyway for waterfowl migration and other birds also migrate along the river.

d. Proposed measures to preserve or enhance wildlife, if any:

None at this time.

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electricity for lighting.
Water for washdown.
Fuel for vehicles.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

None.

7. Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

The 303-K Facility would be clean closed by removing or decontaminating all dangerous waste and waste residues to appropriate action levels. All proper procedures would be followed

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1 during these operations to minimize exposure to hazardous waste.
2 The potential exists for exposure to hazardous waste during sampling
3 of the building and storage pads. Procedures to prevent and manage
4 hazards are presented in the closure plan.
5

6 **1) Describe special emergency services that might be required.**

7
8 Hanford Site security, fire response, and ambulance services
9 are on call at all times in the event of an onsite emergency.
10

11 **2) Proposed measures to reduce or control environmental health**
12 **hazards, if any:**

13
14 Environmental health hazards are expected to be minimal.
15 Procedures to prevent and manage potential hazards are
16 presented in the closure plan.
17

18 **b. Noise**

19
20 **1) What type of noise exists in the area which may affect your**
21 **project (for example: traffic, equipment, operation, other)?**

22
23 None.
24

25 **2) What types and levels of noise would be created by or**
26 **associated with the project on a short-term or a long-term**
27 **basis (for example: traffic, construction, operation, other)?**
28 **Indicate what hours noise would come from the site.**

29
30 Minor amounts of noise from traffic and equipment are expected
31 on a short term basis during day shift hours.
32

33
34 **3) Proposed measures to reduce or control noise impacts, if any:**

35
36 Vehicles and equipment will meet manufacturer's requirements
37 for noise suppression.
38

39 **8. Land and Shoreline Use**

40
41 **a. What is the current use of the site and adjacent properties?**

42
43 The Hanford Site houses reactors, chemical separation systems, waste
44 management facilities, and related facilities used for the
45 production of special nuclear materials. Other scientific and
46 engineering programs are carried out.
47

48 The 303-K Storage Facility is currently used to store DOT-
49 specification containers of radioactive and mixed-wastes generated
50 at other buildings in the 300 Area. Detailed descriptions of these
51 wastes can be found in the closure plan.
52

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- 1 **b. Has the site been used for agriculture? If so, describe.**
2

3 No portion of the Hanford Site, including the site 303-K facility,
4 has been used for agricultural purposes since 1943.
5

- 6 **c. Describe any structures on the site.**
7

8 The site, consists of a cinder-block building and outside storage
9 pads consisting of two concrete pads, two asphalted areas, and a
10 gravel area. The facility is surrounded by a fence.
11

12 The cinder-block building is divided into two sections by a cinder-
13 block wall. The north half of the building was used for mixed waste
14 storage and the closure plan applies to the north half only. The
15 north end of the building is approximately 8.5m by 8.5m in floor
16 plan and 3.5m high.
17

- 18 **d. Will any structures be demolished? If so, what?**
19

20 Following clean closure, the building would be demolished.
21

- 22 **e. What is the current zoning classification of the site?**
23

24 The Hanford Site is zoned by Benton County as an Unclassified Use
25 (U) district.
26

- 27 **f. What is the current comprehensive plan designation of the site?**
28

29 The 1985 Benton County Comprehensive Land Use Plan designates the
30 Hanford Site as the "Hanford Reservation." Under this designation,
31 land on the Site may be used for "activities nuclear in nature."
32 Non-nuclear activities are authorized "if and when DOE approval for
33 such activities is obtained."
34

- 35 **g. If applicable, what is the current shoreline master program**
36 **designation of the site?**
37

38 Does not apply.
39

- 40 **h. Has any part of the site been classified as an "environmentally**
41 **sensitive" area? If so, specify.**
42

43 No.
44

- 45 **i. Approximately how many people would reside or work in the completed**
46 **project?**
47

48 No people would reside or have office space in the facility. A
49 small number of personnel would be working intermittently at the
50 facility if it is used for less than 90 day mixed waste storage.
51

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j. Approximately how many people would the completed project displace?

None.

k. Proposed measures to avoid or reduce displacement impacts, if any:

Does not apply.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

See answer to checklist question B.8.f.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

None.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

None.

c. Proposed measures to reduce or control housing impacts, if any:

Does not apply.

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

Existing building is approximately 3.5m high and no change in exterior materials would be made.

b. What views in the immediate vicinity would be altered or obstructed?

None.

c. Proposed measures to reduce or control aesthetic impacts, if any:

None.

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

None.

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1 b. Could light or glare from the finished project be a safety hazard or
2 interfere with views?
3

4 No.
5

6 c. What existing off-site sources of light or glare may affect your
7 proposal?
8

9 None.
10

11 d. Proposed measures to reduce or control light and glare impacts, if
12 any:
13

14 Does not apply.
15

16 **12. Recreation**
17

18 a. What designated and informal recreational opportunities are in the
19 immediate vicinity?
20

21 None.
22

23 b. Would the proposed project displace any existing recreational uses?
24 If so, describe.
25

26 No.
27

28 c. Proposed measures to reduce or control impacts on recreation,
29 including recreation opportunities to be provided by the project or
30 applicant, if any?
31

32 Does not apply.
33

34 **13. Historic and Cultural Preservation**
35

36 a. Are there any places or objects listed on, or proposed for,
37 national, state, or local preservation registers known to be on or
38 next to the site? If so, generally describe.
39

40 No places or objects listed on, or proposed for, national, state, or
41 local preservation registers are known to be on or next to the site.
42 Additional information on the Hanford Site environment can be found
43 in the environmental document referred to in the answer to checklist
44 question A.8.
45

46 b. Generally describe any landmarks or evidence of historic,
47 archaeological, scientific, or cultural importance known to be on or
48 next to the site.
49

50 There are no known archaeological, historical, or Native American
51 religious sites on or next to the facility. Additional information
52 on the Hanford Site environment can be found in the environmental
53 document referenced in the answer to Checklist question A.8.

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1 c. Proposed measures to reduce or control impacts, if any:

2 Does not apply.

3
4
5 14. Transportation

6
7 a. Identify public streets and highways serving the site, and describe
8 proposed access to the existing street system. Show on site plans,
9 if any.

10 Does not apply.

11
12
13 b. Is site currently served by public transit? If not, what is the
14 approximate distance to the nearest transit stop?

15
16 The facility is not publicly accessible and, therefore, is not
17 served by public transit.

18
19 c. How many parking spaces would the completed project have? How many
20 would the project eliminate?

21 None.

22
23
24 d. Will the proposal require any new roads or streets, or improvements
25 to existing roads or streets, not including driveways? If so,
26 generally describe (indicate whether public or private).

27 No.

28
29
30 e. Will the project use (or occur in the immediate vicinity of) water,
31 rail, or air transportation? If so, generally describe.

32 No.

33
34
35 f. How many vehicular trips per day would be generated by the completed
36 project? If known, indicate when peak volumes would occur.

37 Vehicular traffic would not be required if the facility is clean
38 closed.

39
40
41 g. Proposed measures to reduce or control transportation impacts, if
42 any:

43 None.

44
45
46 15. Public Services

47
48 a. Would the project result in an increased need for public services
49 (for example: fire protection, police protection, health care,
50 schools, other)? If so, generally describe.

51 No.

52
53

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SIGNATURES

The above answers are true and complete to the best of my knowledge. We understand that the lead agency is relying on them to make its decision.

J. E. Rasmussen, Division Director	Date
Office of Environmental Assurance,	
Permits, and Policy	
U.S. Department of Energy	
Richland Operations Office	

W. T. Dixon	Date
Environmental Services	
Westinghouse Hanford Company	

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1 THE 303-K STORAGE FACILITY CLOSURE PLAN

2
3
4 FOREWORD

5
6
7 The Hanford Facility is owned by the U.S. Government and operated by the
8 U.S. Department of Energy, Richland Operations Office. Dangerous waste and
9 mixed waste (containing both radioactive and dangerous components) are
10 produced and managed on the Hanford Facility. The dangerous waste is
11 regulated in accordance with the *Resource Conservation and Recovery Act of*
12 *1976* and the *State of Washington Hazardous Waste Management Act of 1976* (as
13 administered through the Washington State Department of Ecology *Dangerous*
14 *Waste Regulations*, Washington Administrative Code 173-303). The radioactive
15 component of mixed waste is interpreted by the U.S. Department of Energy to be
16 regulated under the *Atomic Energy Act of 1954*; the nonradioactive dangerous
17 component of mixed waste is interpreted to be regulated under the *Resource*
18 *Conservation and Recovery Act* and Washington Administrative Code 173-303.
19

20 For purposes of the *Resource Conservation and Recovery Act* and the
21 Washington State Department of Ecology *Dangerous Waste Regulations*, the
22 Hanford Facility is considered to be a single facility. The single dangerous
23 waste permit identification number issued to the Hanford Facility by
24 the U.S. Environmental Protection Agency and the Washington State Department
25 of Ecology is U.S. Environmental Protection Agency/State Identification
26 Number WA7890008967. This identification number encompasses over
27 60 treatment, storage, and/or disposal units within the Hanford Facility,
28 hereinafter referred to as the Hanford Facility when cited in the context of
29 the *Resource Conservation and Recovery Act* and the Washington State Department
30 of Ecology *Dangerous Waste Regulations*.
31

32 Westinghouse Hanford Company is a major contractor to the U.S. Department
33 of Energy, Richland Operations Office and serves as co-operator of the
34 303-K Storage Facility, the treatment and storage unit addressed in this
35 closure plan.
36

37 Westinghouse Hanford Company is identified in the permit application as a
38 'co-operator' and signs in that capacity. Any identification of Westinghouse
39 Hanford Company as an 'operator' elsewhere in this application is not meant to
40 conflict with Westinghouse Hanford Company's designation as a co-operator but
41 rather is based on Westinghouse Hanford Company's contractual status (i.e., as
42 an operations and engineering contractor) for the U.S. Department of Energy.

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CONTENTS

1	
2	
3	
4	FOREWORD
5	
6	ACRONYMS AND ABBREVIATIONS
7	
8	PART A
9	
10	1.0 INTRODUCTION
11	
12	2.0 FACILITY DESCRIPTION
13	
14	3.0 PROCESS INFORMATION
15	
16	4.0 WASTE CHARACTERISTICS
17	
18	5.0 GROUNDWATER
19	
20	6.0 CLOSURE STRATEGY AND PERFORMANCE STANDARDS
21	
22	7.0 CLOSURE ACTIVITIES
23	
24	8.0 POSTCLOSURE
25	
26	9.0 REFERENCES

APPENDICES

27	
28	
29	
30	
31	
32	
33	A PHOTOGRAPHS
34	
35	B RANDOM SAMPLING LOCATIONS
36	
37	C BILLET FIRE OCCURRENCE REPORT
38	
39	D MATERIAL SAFETY DATA SHEETS
40	
41	E PERSONNEL TRAINING
42	
43	F QUALITY ASSURANCE PROJECT PLAN FOR SAMPLING AND ANALYSIS FOR
44	THE 303-K STORAGE FACILITY

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GLOSSARY

1		
2		
3		
4	303-K Facility	303-K Storage Facility
5		
6	ALARA	as low as reasonably achievable
7		
8	CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
9		
10	CPR	cardio-pulmonary resuscitation
11		
12	DOE	U.S. Department of Energy
13	DOE-RL	U.S. Department of Energy, Richland Operations Office
14	DOT	U.S. Department of Transportation
15		
16	Ecology	Washington State Department of Ecology
17	EII	environmental investigation instruction
18	EPA	U.S. Environmental Protection Agency
19		
20	GC/MS	gas chromatography/mass spectroscopy
21		
22	HASP	health and safety plan
23	HBL	health-based action levels
24	HEPA	high-efficiency particulate air
25	HVAC	heating, ventilation, and air conditioning
26		
27	ICP-AES	Inductively Coupled Plasma Atomic Emission Spectroscopy
28	IRIS	Integrated Risk Information System
29		
30	LLRW	low-level radioactive waste
31	LOQ	limit of quantitation
32		
33	MSDS	Material Safety Data Sheet
34		
35	OD	outside diameter
36		
37	PAPR	powered, air purifying respirator
38		
39	QA	quality assurance
40	QAPjP	quality assurance project plan
41	QC	quality control
42		
43	RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
44	RI/FS	remedial investigation/feasibility study
45		
46	SCBA	self-contained breathing apparatus
47		
48	TCLP	toxicity characteristic leaching procedure
49	Tri-Party Agreement	Hanford Federal Facility Agreement and Consent Order
50		
51	TSD	treatment, storage, and/or disposal

GLOSSARY (continued)

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VOA
WAC

volatile organics analysis
Washington Administrative Code

1 **DEFINITION OF TERMS**

2
3 Action Level. Refers to the chemical concentration levels that will
4 prompt an action. Action level values commonly will be Hanford Facility wide
5 background threshold concentrations, health and environmental based
6 concentrations, toxicity characteristic leaching procedure (TCLP) regulatory
7 levels, and limits of quantitation (LOQ). If action levels are exceeded,
8 actions could include additional decontamination, additional evaluation,
9 building and pad removal, or deferral of soil remediation to the CERCLA
10 remedial action process.

11
12 Facility. For purposes of the *Resource Conservation and Recovery Act of*
13 *1976*, the Hanford Facility is considered to be a single facility consisting of
14 a number of waste management units. The term 'facility' also is commonly used
15 in building nomenclature throughout the Hanford Facility (e.g., 303-K Storage
16 Facility).

METRIC CONVERSION CHART

The following conversion chart is provided to aid in conversion.

Into metric units

Out of metric units

If you know	Multiply by	To get	If you know	Multiply by	To get
Length			Length		
inches	25.40	millimeters	millimeters	0.0393	inches
inches	2.54	centimeters	centimeters	0.393	inches
feet	0.3048	meters	meters	3.2808	feet
yards	0.914	meters	meters	1.09	yards
miles	1.609	kilometers	kilometers	0.62	miles
Area			Area		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.092	square meters	square meters	10.7639	square feet
square yards	0.836	square meters	square meters	1.20	square yards
square miles	2.59	square kilometers	square kilometers	0.39	square miles
acres	0.404	hectares	hectares	2.471	acres
Mass (weight)			Mass (weight)		
ounces	28.35	grams	grams	0.0352	ounces
pounds	0.453	kilograms	kilograms	2.2046	pounds
short ton	0.907	metric ton	metric ton	1.10	short ton
Volume			Volume		
fluid ounces	29.57	milliliters	milliliters	0.03	fluid ounces
quarts	0.95	liters	liters	1.057	quarts
gallons	3.79	liters	liters	0.26	gallons
cubic feet	0.03	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.76	cubic meters	cubic meters	1.308	cubic yards
Temperature			Temperature		
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit

Source: *Engineering Unit Conversions*, M. R. Lindeburg, PE., Second Ed., 1990, Professional Publications, Inc., Belmont, California.

PART A

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The Part A, Form 1, "Dangerous Waste Permit General Information" was originally submitted to the Washington State Department of Ecology in May 1988 and a revised Part A, Form 1 was submitted in January 1995. The revised Part A, Form 1, now consists of four pages.

The original Part A, Form 3, Revision 0, "Dangerous Waste Permit Application" was submitted to Ecology in August 1987. Revision 0 included the treatment design capacity, facility description, dangerous waste codes, and dangerous waste description. Revision 1 of the Part A, Form 3, was prepared to include Westinghouse Hanford Company as co-operator of the 303-K Storage Facility. Revision 2 of the Part A, Form 3, was prepared to add dangerous waste code D002 and related estimated annual quantity of dangerous waste for the addition of copper-fluorozirconate crystals. Revision 3 of the Part A, Form 3, was prepared to add 23 dangerous waste codes and their related estimated annual quantity of dangerous waste.

Revision 4 of the Part A, Form 3, was prepared to add waste codes D029, D035, D037, D039, D040, F002, F005, and WC02. These new waste codes are from the analysis of current waste, the analysis of a previously unknown waste, and from regulatory changes that added new waste codes.

The Part A, Form 3, Revision 4, included in this closure plan consists of 9 pages, 1 figure, and 1 photograph.

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UNCLASSIFIED
DATE 12/15/93

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Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 character/inch).

FORM 3	DANGEROUS WASTE PERMIT APPLICATION	1. EPA/STATE I.D. NUMBER
		W A 7 8 9 0 0 0 8 9 6 7

FOR OFFICIAL USE ONLY	
APPLICATION APPROVED	DATE RECEIVED <i>(mo., day, & yr.)</i>
COMMENTS	

II. FIRST OR REVISED APPLICATION
Place an "X" in the appropriate box in A or B below (mark one box only) to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA/STATE I.D. Number, or if this is a revised application, enter your facility's EPA/STATE I.D. Number in Section I above.

A. FIRST APPLICATION (place an "X" below and provide the appropriate date)

<input type="checkbox"/> 1. EXISTING FACILITY (See instructions for definition of "existing" facility. Complete item below.)	<input type="checkbox"/> 2. NEW FACILITY (Complete item below)
------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------

<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th style="width:10%;">MO.</th> <th style="width:10%;">DAY</th> <th style="width:10%;">YR.</th> </tr> <tr> <td style="text-align: center;">01</td> <td></td> <td style="text-align: center;">72</td> </tr> </table> <p>FOR EXISTING FACILITIES, PROVIDE THE DATE (mo., day, & yr.) OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED (use the boxes to the left)</p>	MO.	DAY	YR.	01		72	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th style="width:10%;">MO.</th> <th style="width:10%;">DAY</th> <th style="width:10%;">YR.</th> </tr> <tr> <td></td> <td></td> <td></td> </tr> </table> <p>FOR NEW FACILITIES, PROVIDE THE DATE (mo., day, & yr.) OPERATION BEGAN OR IS EXPECTED TO BEGIN</p>	MO.	DAY	YR.			
MO.	DAY	YR.											
01		72											
MO.	DAY	YR.											

B. REVISED APPLICATION (place an "X" below and complete Section I above)

<input checked="" type="checkbox"/> 1. FACILITY HAS AN INTERIM STATUS PERMIT	<input type="checkbox"/> 2. FACILITY HAS A FINAL PERMIT
------------------------------------------------------------------------------	---------------------------------------------------------

III. PROCESSES - CODES AND CAPACITIES

A. PROCESS CODE - Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process (including its design capacity) in the space provided on the (Section III-C).

B. PROCESS DESIGN CAPACITY - For each code entered in column A enter the capacity of the process.

1. AMOUNT - Enter the amount.

2. UNIT OF MEASURE - For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PRO-CESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY	PROCESS	PRO-CESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:			Treatment:		
CONTAINER (barrel, drum, etc)	S01	GALLONS OR LITERS	TANK	T01	GALLONS PER DAY OR LITERS PER DAY
TANK	S02	GALLONS OR LITERS	SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS	INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS			
Disposal:			OTHER (Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Section III-C.)		
INJECTION WELL	D80	GALLONS OR LITERS		T04	GALLONS PER DAY OR LITERS PER DAY
LANDFILL	D81	ACRE-FEET (the volume that would cover one acre to a depth of one foot) OR HECTARE-METER			
LAND APPLICATION	D82	ACRES OR HECTARES			
OCEAN DISPOSAL	D83	GALLONS PER DAY OR LITERS PER DAY			
SURFACE IMPOUNDMENT	D84	GALLONS OR LITERS			

<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th style="width:10%;">UNIT OF MEASURE</th> <th style="width:10%;">UNIT OF MEASURE CODE</th> </tr> <tr> <td>GALLONS</td> <td>G</td> </tr> <tr> <td>LITERS</td> <td>L</td> </tr> <tr> <td>CUBIC YARDS</td> <td>Y</td> </tr> <tr> <td>CUBIC METERS</td> <td>C</td> </tr> <tr> <td>GALLONS PER DAY</td> <td>U</td> </tr> </table>	UNIT OF MEASURE	UNIT OF MEASURE CODE	GALLONS	G	LITERS	L	CUBIC YARDS	Y	CUBIC METERS	C	GALLONS PER DAY	U	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th style="width:10%;">UNIT OF MEASURE</th> <th style="width:10%;">UNIT OF MEASURE CODE</th> </tr> <tr> <td>LITERS PER DAY</td> <td>V</td> </tr> <tr> <td>TONS PER HOUR</td> <td>D</td> </tr> <tr> <td>METRIC TONS PER HOUR</td> <td>W</td> </tr> <tr> <td>GALLONS PER HOUR</td> <td>E</td> </tr> <tr> <td>LITERS PER HOUR</td> <td>H</td> </tr> </table>	UNIT OF MEASURE	UNIT OF MEASURE CODE	LITERS PER DAY	V	TONS PER HOUR	D	METRIC TONS PER HOUR	W	GALLONS PER HOUR	E	LITERS PER HOUR	H	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th style="width:10%;">UNIT OF MEASURE</th> <th style="width:10%;">UNIT OF MEASURE CODE</th> </tr> <tr> <td>ACRE-FEET</td> <td>A</td> </tr> <tr> <td>HECTARE-METER</td> <td>F</td> </tr> <tr> <td>ACRES</td> <td>B</td> </tr> <tr> <td>HECTARES</td> <td>Q</td> </tr> </table>	UNIT OF MEASURE	UNIT OF MEASURE CODE	ACRE-FEET	A	HECTARE-METER	F	ACRES	B	HECTARES	Q
UNIT OF MEASURE	UNIT OF MEASURE CODE																																			
GALLONS	G																																			
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ACRES	B																																			
HECTARES	Q																																			

EXAMPLE FOR COMPLETING SECTION III (shown in line numbers X-1 and X-2 below): A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

LINE NUMBER	A. PRO-CESS CODE (from list above)	B. PROCESS DESIGN CAPACITY		FOR OFFICIAL USE ONLY	LINE NUMBER	A. PRO-CESS CODE (from list above)	B. PROCESS DESIGN CAPACITY		FOR OFFICIAL USE ONLY
		1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)				1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	
X-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
1	S 0 1	11,000	G		7				
2					8				
3					9				
4					10				

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PROCESSES (continued)
SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESS (code "T04"). FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

S01

The 303-K Storage Facility is used for the storage of mixed waste in Department of Transportation-specification containers. Both liquid and solid waste is stored in the 303-K Storage Facility. The liquid waste is stored on a 610 square foot (57 square meter) pad within the building. The building provides secondary containment for the contents of the containers. The solid waste is stored outside the building on a 4,590 square foot (426 square meter) asphalt, concrete, and gravel pad. The storage area is surrounded by a chain link fence. Approximately 200 55-gallon (208-liter) containers (or more smaller-sized containers) can be stored at the 303-K Storage Facility.

IV. DESCRIPTION OF DANGEROUS WASTES

- A. DANGEROUS WASTE NUMBER - Enter the four digit number from Chapter 173-303 WAC for each listed dangerous waste you will handle. If you handle dangerous wastes which are not listed in Chapter 173-303 WAC, enter the four digit number(s) that describes the characteristics and/or the toxic contaminants of those dangerous wastes.
- B. ESTIMATED ANNUAL QUANTITY - For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.
- C. UNIT OF MEASURE - For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:

For listed dangerous waste: For each listed dangerous waste entered in column A select the code(s) from the list of process codes contained in Section III to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non-listed dangerous wastes: For each characteristic or toxic contaminant entered in Column A, select the code(s) from the list of process codes contained in Section III to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed dangerous wastes that possess that characteristic or toxic contaminant.

Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code(s).

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: DANGEROUS WASTES DESCRIBED BY MORE THAN ONE DANGEROUS WASTE NUMBER - Dangerous wastes that can be described by more than one Waste Number shall be described on the form as follows:

1. Select one of the Dangerous Waste Numbers and enter it in column A. On the same line complete columns B, C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other Dangerous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other Dangerous Waste Number that can be used to describe the dangerous waste.

EXAMPLE FOR COMPLETING SECTION IV (shown in line numbers X-1, X-2, X-3, and X-4 below) - A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE	A. DANGEROUS WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES	
				1. PROCESS CODES (enter)	2. PROCESS DESCRIPTION (if a code is not entered in D(1))
X-1	K 0 5 4	900	P	T 0 3 D 8 0	
X-2	D 0 0 2	400	P	T 0 3 D 8 0	
X-3	D 0 0 1	100	P	T 0 3 D 8 0	
X-4	D 0 0 2			T 0 3 D 8 0	included with above

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 NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

D. NUMBER (entered from page 1)

WA 7 8 9 0 0 0 8 9 8 7

IV. DESCRIPTION OF DANGEROUS WASTES (continued)

LINE NO.	A. DANGEROUS WASTE NO. (enter code)				B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES	
							1. PROCESS CODES (enter)	2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	F	0	0	1	15,000	P	S01	Storage - Container (See IV.E.1)
2	W	C	0	1				
3	W	P	0	1				
4	W	T	0	1				
5	D	0	0	1				
6	F	0	0	3				
7	W	T	0	2				
8	F	0	0	2				
9	F	0	0	5				
10	W	C	0	2				
11	D	0	0	2				
12	D	0	0	6				
13	D	0	2	9				
14	D	0	3	5				
15	D	0	3	9				
16	D	0	4	0				included with above
17	W	T	0	2	40,000	P	S01	Storage - Container (See IV.E.2)
18	D	0	0	7				included with above
19	W	T	0	1	40,000	P	S01	Storage - Container (See IV.E.2)
20	D	0	0	1				
21	D	0	0	5				
22	D	0	0	6				included with above
23	D	0	0	2	1,700	P	S01	Storage - Container (See IV.E.3)
24	D	0	0	1	5,100	P	S01	Storage - Container (See IV.E.4)
25	D	0	0	8	5,500	P	S01	Storage - Container (See IV.E.5)
26								

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NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

D. NUMBER (entered from page 1)

W	A	7	8	9	0	0	0	8	9	6	7
---	---	---	---	---	---	---	---	---	---	---	---

LINE NO.	A. DANGEROUS WASTE NO. (enter code)				B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES								
							1. PROCESS CODES (enter)				2. PROCESS DESCRIPTION (if a code is not entered in D(1))				
1	W	T	0	2	300,000	P	S01					Storage - Container (See IV.E.6)			
2	D	0	0	1											
3	D	0	0	4											
4	D	0	0	5											
5	D	0	0	6											
6	D	0	0	7											
7	D	0	0	9											
8	D	0	1	1											included with above
9	D	0	0	2	1,500	P	S01					Storage - Container (See IV.E.7)			
10	D	0	0	7								included with above			
11	D	0	0	2	60	P	S01					Storage - Container (See IV.E.8)			
12	D	0	0	4											
13	D	0	0	7											
14	D	0	1	1											included with above
15	W	P	0	2	200	P	S01					Storage - Container (See IV.E.9)			
16	D	0	3	7	44	P	S01					Storage - Container (See IV.E.10)			
17															
18															
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IV. DESCRIPTION OF DANGEROUS WASTES (continued)

USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM SECTION D(1) ON PAGE 3.

SEE FOLLOWING PAGE

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility (see instructions for more detail).

VI. PHOTOGRAPHS

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas (see instructions for more detail).

VII. FACILITY GEOGRAPHIC LOCATION

This information is provided on the attached drawings and photos.

LATITUDE (degrees, minutes, & seconds)

LONGITUDE (degrees, minutes, & seconds)

VIII. FACILITY OWNER

A. If the facility owner is also the facility operator as listed in Section VII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER

2. PHONE NO. (area code & no.)

3. STREET OR P.O. BOX

4. CITY OR TOWN

5. ST.

6. ZIP CODE

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME (print or type)

SIGNATURE

DATE SIGNED

John D. Wagoner, Manager
U.S. Department of Energy
Richland Operations Office

12/16/93

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME (print or type)

SIGNATURE

DATE SIGNED

SEE ATTACHMENT

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Section IV.E. Description of Dangerous Wastes

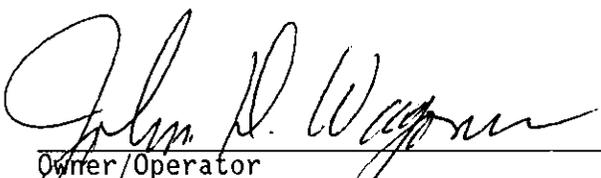
The 303-K Storage Facility is used for the storage of mixed waste in U.S. Department of Transportation-specification containers. This waste consists of the following:

1. Approximately 15,000 pounds (6,800 kilograms) per year of spent solvents [This includes spent degreasing solvents (F001, WC01, WP01, and WT01) that were occasionally mixed with ethyl acetate (D001, F003, and WT02). This also includes spent halogenated and nonhalogenated solvents (F002 and F005) as well as waste with low concentrations of carcinogenic solvents (WC02). Waste solvents are corrosive (D002) and contain cadmium (D006), 1,1-dichloroethylene (D029), methyl ethyl ketone (D035), tetrachloroethylene (D039), and trichloroethylene (D040)].
2. Approximately 80,000 pounds (36,300 kilograms) per year of heat treat salts contaminated with naturally occurring radioactive potassium-40 [The heat treat salts were generated from both beta bath [40,000 pounds (18,200 kilograms) per year] and quench bath [40,000 pounds (18,000 kilograms) per year]. The beta bath salts consist of potassium chloride and sodium chloride (WT02) and chromium (D007). The quench bath salts consist of potassium nitrate, sodium nitrate, sodium nitrite, potassium chloride, and sodium chloride. The quench bath salts are toxic extremely hazardous waste (WT01) and are ignitable (D001) because of the presence of oxidizers (solid nitrates and nitrites). The quench bath salts also contain barium (D005) and cadmium (D006).
3. Approximately 1,700 pounds (770 kilograms) of corrosive (D002) copper fluoro-zirconate acid crystals from the bottom of the waste acid tanks in the 334-A Building
4. Approximately 5,100 pounds (2,300 kilograms) per year of Zircaloy-2 and beryllium/Zircaloy-2 chips and fines before and after concreting the waste in the 304 Building (This material is designated ignitable (D001) because of its pyrophoric properties.)
5. Approximately 5,500 pounds (2,500 kilograms) per year of metallic lead (D008)
6. Approximately 300,000 pounds (136,100 kilograms) per year of centrifuge and filter press sludge designated as a toxic dangerous waste (WT02) by the mixture rule and ignitable (D001) because of the presence of solid nitrates [The waste may also contain the following ions introduced into the 300 Area Waste Acid Treatment System: arsenic (D004), barium (D005), cadmium (D006), chromium (D007), mercury (D009), and silver (D011)].
7. Approximately 1,500 pounds (680 kilograms) per year of corrosive (D002) waste acid absorbed by sedimentary opal clay [This waste also contains chromium (D007)].
8. Approximately 60 pounds (27 kilograms) per year of waste acids contaminated with oil [The waste acids are designated as corrosive (D002) and contain arsenic (D004), chromium (D007), and silver (D011)].
9. Approximately 200 pounds (91 kilograms) per year of waste hydraulic oil containing halogenated hydrocarbons (WP02)
10. Approximately 44 pounds (20 kilograms) of a mixed waste that contains pentachlorophenol (D037)

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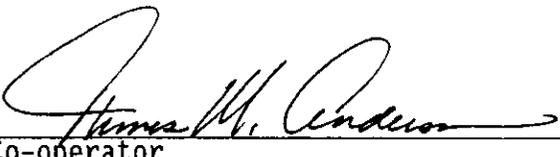
X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.



Owner/Operator
John D. Wagoner, Manager
U.S. Department of Energy
Richland Operations Office

12/16/93
Date

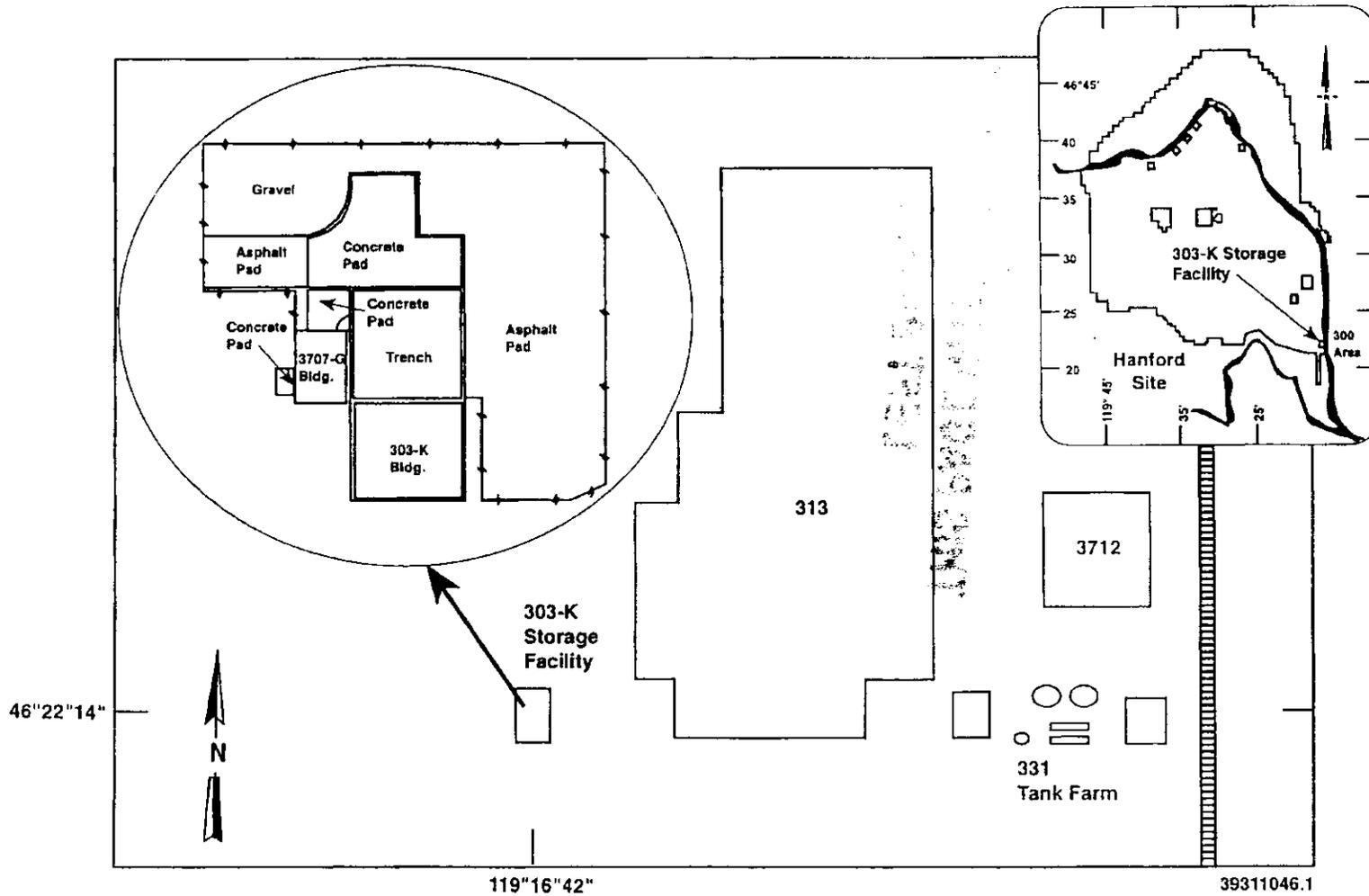


Co-operator
Thomas M. Anderson, President
Westinghouse Hanford Company

12/1/93
Date

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303-K Storage Facility

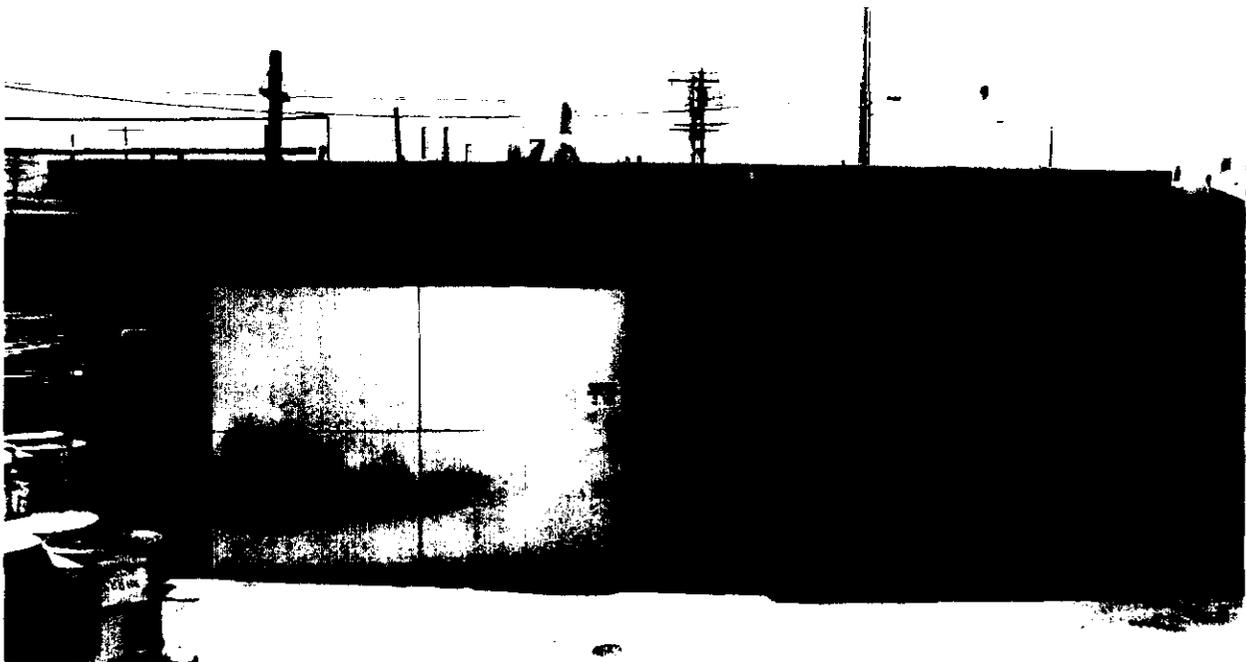


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303-K Storage Facility



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CONTENTS

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8
9
10
11
12
13
14
15
16

1.0 INTRODUCTION 1-1

1.1 SUMMARY 1-1

1.2 THE 303-K STORAGE FACILITY 1-1

1.2.1 Facility Description 1-2

1.2.2 Process Information 1-2

1.2.3 Waste Characteristics 1-2

1.2.4 Groundwater 1-2

1.2.5 Closure Strategy and Performance Standards 1-2

1.2.6 Closure Activities 1-2

1.2.7 Postclosure 1-2

1.2.8 References 1-3

1
2
3
4
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1.0 INTRODUCTION

This chapter provides background information for the 303-K Storage Facility and provides an overview of the contents of the 303-K Storage Facility closure plan.

1.1 SUMMARY

Recyclable scrap uranium with zircaloy-2 and copper silicon alloy, uranium-titanium alloy, beryllium/zircaloy-2 alloy, and zircaloy-2 chips and fines were secured in concrete billets (7.5-gallon containers) in the 303-K Storage Facility, located in the 300 Area. The beryllium/zircaloy-2 alloy and zircaloy-2 chips and fines are designated as mixed waste with the characteristic of ignitability. The concretion process reduced the ignitability of the fines and chips for safe storage and shipment. This process has been discontinued and the 303-K Storage Facility is now undergoing closure as defined in the *Resource Conservation and Recovery Act (RCRA) of 1976* and the Washington Administrative Code (WAC) *Dangerous Waste Regulations*, WAC 173-303-040.

This closure plan presents a description of the 303-K Storage Facility, the history of materials and waste managed, and the procedures that will be followed to close the 303-K Storage Facility. The 303-K Storage Facility is located within the 300-FF-3 (source) and 300-FF-5 (groundwater) operable units, as designated in the *Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement)* (Ecology et al. 1992). Contamination in the operable units 300-FF-3 and 300-FF-5 is scheduled to be addressed through the *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980* remedial action process. Therefore, all soil remedial action at the 303-K Storage Facility will be conducted as part of the CERCLA remedial action of operable units 300-FF-3 and 300-FF-5.

The 303-K Storage Facility is subject to requirements for the storage and treatment of dangerous waste. The 303-K Storage Facility will be closed pursuant to the requirements of WAC 173-303-610.

1.2 THE 303-K STORAGE FACILITY

The 303-K Storage Facility Closure Plan consists of nine chapters as follows:

- Introduction (Chapter 1.0)
- Facility Description (Chapter 2.0)
- Process Information (Chapter 3.0)
- Waste Characteristics (Chapter 4.0)
- Groundwater (Chapter 5.0)
- Closure Performance Standards (Chapter 6.0)

- 1 • Closure Activities (Chapter 7.0)
- 2 • Postclosure (Chapter 8.0)
- 3 • References (Chapter 9.0).

4
5 A brief description of each chapter is provided in the following
6 sections.

7
8
9 **1.2.1 Facility Description (Chapter 2.0)**

10
11 This chapter provides a general description of the 303-K Storage
12 Facility. A brief description and history of the Hanford Facility also are
13 provided.

14
15
16 **1.2.2 Process Information (Chapter 3.0)**

17
18 This chapter covers the detailed operation of the 303-K Storage Facility.
19 Additional information is given concerning the waste stored at the
20 303-K Storage Facility.

21
22
23 **1.2.3 Waste Characteristics (Chapter 4.0)**

24
25 This chapter discusses the estimate of maximum inventory of waste and the
26 waste types stored at the 303-K Storage Facility.

27
28
29 **1.2.4 Groundwater (Chapter 5.0)**

30
31 This chapter explains that groundwater in the 300 Area will be included
32 in the 300-FF-5 operable unit and cleaned up by the CERCLA remedial action
33 process. Therefore, groundwater monitoring information is not included.

34
35
36 **1.2.5 Closure Strategy and Performance Standards (Chapter 6.0)**

37
38 This chapter outlines the closure strategy and the general closure
39 procedure for the 303-K Storage Facility.

40
41
42 **1.2.6 Closure Activities (Chapter 7.0)**

43
44 This chapter contains a sampling plan and describes how the
45 303-K Storage Facility will be decontaminated and closed. A closure schedule
46 is provided.

47
48
49 **1.2.7 Postclosure (Chapter 8.0)**

50
51 This chapter outlines provision for postclosure care if required.
52

1 1.2.8 References (Chapter 9.0)

2
3 References used throughout this closure plan are listed in this chapter.
4 All references listed here, which are not available from other sources, will
5 be made available for review, upon request, to any regulatory agency or public
6 commentor. References can be obtained by contacting the following:

7
8 Administrative Records Specialist
9 Public Access Room H6-08
10 Westinghouse Hanford Company
11 P.O. Box 1970
12 Richland, Washington 99352

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CONTENTS

2.0 FACILITY DESCRIPTION 2-1

2.1 FACILITY DESCRIPTION AND OPERATIONS 2-1

2.2 SECURITY 2-3

FIGURES

2-1. Hanford Facility F2-1

2-2. 300 Area F2-2

2-3. Plan View of the 303-K Storage Facility Surrounding Area F2-3

2-4. 303-K Storage Facility Site Plan F2-4

2-5. Plan View of the 303-K Storage Facility Showing the Year that
Additional Storage Areas were Added F2-5

2-6. Plan View of the 303-K Storage Facility F2-6

2-7. Section View of the 303-K Storage Facility F2-7

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2
3
4
5

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2.0 FACILITY DESCRIPTION

This chapter briefly describes the 303-K Storage Facility location (Figure 2-1), and provides information on the Hanford Facility security.

2.1 FACILITY DESCRIPTION AND OPERATIONS

The 303-K Storage Facility is located in the northwest portion of the 300 (Figure 2-2), near an asphalt roadway. Figure 2-3 shows the area around the 303-K Storage Facility in detail and indicates adjacent buildings. No 'legal' boundary exists for the 303-K Storage Facility. However, the boundary on the west side of the 303-K Storage Facility is Montana Street, the east side is Nevada Street, and the south side is Gingko Street. The boundary on the north side is 3.66 meters (12 feet) outside the 303-K Storage Facility fence (Figure 2-3). Operations began at the 303-K Storage Facility in 1943, and continue today. Detailed drawings of the 303-K Storage Facility are shown in Figures 2-4 through 2-7.

The 3707-G Building is a changeroom and not part of the 303-K Storage Facility or this closure plan. An aboveground drain from a sink and water fountain emptied into the west end of the 303-K Storage Facility trench until 1982.

The 303-K Storage Facility was designed and constructed in 1943. There is a sliding door on the north wall, a personnel door on the west wall, and there are no windows in the building. The cinder-block building has a poured concrete ceiling and no interior insulation or wallboard. The interior cinder-block walls were painted in 1977. The dimensions of the north end of the building are approximately 7.47 meters (24.5 feet) by 7.62 meters (25 feet) on the ground and 3.05 meters (10 feet) high. An H-shaped drainage trench was added to the north end of the building in 1953, at the same time the cinder-block wall was built dividing the building into northern and southern halves.

The outside storage areas consist of two concrete pads, two asphalt pads, and a graveled area. Figure 2-5 shows the dates the storage areas were added to the 303-K Storage Facility.

The north room of the 303-K Storage Facility originally had one electric-powered roof fan (size unknown). The fan might have been used from 1953 to 1977 while decontaminating aluminum spacers and equipment. However, weather permitting, the north room sliding door generally was open for material transfer during the decontamination of spacers and equipment.

The roof vent fan was replaced with a high-efficiency particulate air (HEPA) exhaust system in 1977 and was used until the fall of 1982 (Figure 2-7). The HEPA exhaust system was turned on only at the end of the curing operation for the concreted billets of recyclable scrap uranium chips and fines or if hydrogen levels indicated a billet fire had occurred. Air was discharged horizontally from the exhaust system approximately 4 meters

1 | (13 feet) above ground (0.6 meters (2 feet) above the roof). The flow rate of
2 | the exhaust system is unknown and there are no records of the HEPA filter
3 | efficiency tests. The HEPA exhaust system has not been used since the
4 | concrete curing operation was discontinued in 1982.
5 |

6 | During the aluminum spacer decontamination operation from 1953 to 1971,
7 | the chemicals and contaminants were removed via the process sewer
8 | (Figure 2-4). Discharges were from two sinks, a wash table, and the floor
9 | trench. Flow rates are unknown.
10 |

11 | During the concretion curing operation from 1977 to 1982, steam
12 | condensate, sink and water fountain drainage from the 3707-G Building, and any
13 | cleanup water would have entered the process sewer via the floor trench drain.
14 | Flow rates are unknown.
15 |

16 | After 1982, the only known liquid discharge was steam condensate. In
17 | 1988, the steam was shut off and the floor trench drain was sealed.
18 |

19 | Surface run-off from precipitation entered the process sewer through the
20 | drain on the north concrete pad from 1953 until the drain was sealed in 1989.
21 |

22 | There are no radiation detectors or sampling stations on the process
23 | sewer from the 303-K Storage Facility. Sampling was done at the outflow from
24 | the combined 300 Area process sewer system.
25 |

26 | Various uses of the 303-K Storage Facility have been made (Chapter 3.0).
27 | At the present time, liquid waste is stored in DOT-approved containers
28 | (49 CFR 178) throughout the north room of the building.
29 |

30 | A detailed description of the waste materials presently stored in the
31 | 303-K Storage Facility is presented in Chapter 4.0.
32 |

33 | The outdoor concrete, gravel, and asphalt storage pads associated with
34 | the 303-K Storage Facility have been used since 1953 for storage of
35 | radioactive and mixed waste. The outside storage area is approximately
36 | 462 square meters (4,590 square feet). In 1978, a fence was constructed
37 | around the perimeter of the 303-K Storage Facility to control access into the
38 | area. At the present time, solid waste is stored on the outside storage areas
39 | in DOT-approved containers.
40 |

41 | The 303-K Storage Facility has a drainage trench designed to remove or
42 | collect liquids resulting from spills, leaks, and/or daily operations.
43 | Standard spill-response procedures inside the building during the curing of
44 | concreated billets of recyclable scrap uranium chips and fines (1977 to 1982)
45 | included washing the spilled waste to the trench, where particulates settled
46 | out. The waste water drained into the 300 Area process sewer and the fines
47 | were shoveled from the trench and transferred to the 304 Concretion Facility
48 | to be reconcreted. The trench drain to the process sewer was sealed in 1988.
49 | The trench can hold 867 liters (229 gallons) of liquid.

1 **2.2 SECURITY**

2
3 The following describes the 24-hour surveillance system, warning signs,
4 and barriers used to provide security and control access to the
5 303-K Storage Facility.
6

7 The entire Hanford Facility is a controlled access area. The Hanford
8 Facility maintains around-the-clock surveillance for protection of government
9 property, classified information, and special nuclear materials. The Hanford
10 Patrol maintains a continuous presence of protective force personnel to
11 provide additional security.
12

13 Within the Hanford Facility are operational areas to which access is
14 restricted. One such operational area, the 300 Area, is the location of the
15 303-K Storage Facility. Access to the 300 Area is gained through one of three
16 access points. All personnel accessing the 300 Area must display a DOE-issued
17 security identification badge indicating appropriate authorization. Personnel
18 also may be subjected to a search of items carried into and out of the area.
19 Currently, there are no physical barriers (e.g., manned barriers, locked
20 gates) limiting access to the 300 Area.
21

22 Signs are posted at area boundaries within the Hanford Facility stating
23 "NO TRESPASSING. SECURITY BADGES REQUIRED BEYOND THIS POINT. GOVERNMENT
24 VEHICLES ONLY. PUBLIC ACCESS PROHIBITED" (or an equivalent legend).
25

26 In addition, warning signs stating "DANGER--UNAUTHORIZED PERSONNEL KEEP
27 OUT" (or equivalent legend) are posted at the 303-K Storage Facility. The
28 signs are in English, legible from a distance of 7.6 meters (25 feet), and are
29 visible from all angles of approach. The 303-K Storage Facility is locked
30 around the clock and only authorized personnel have access.

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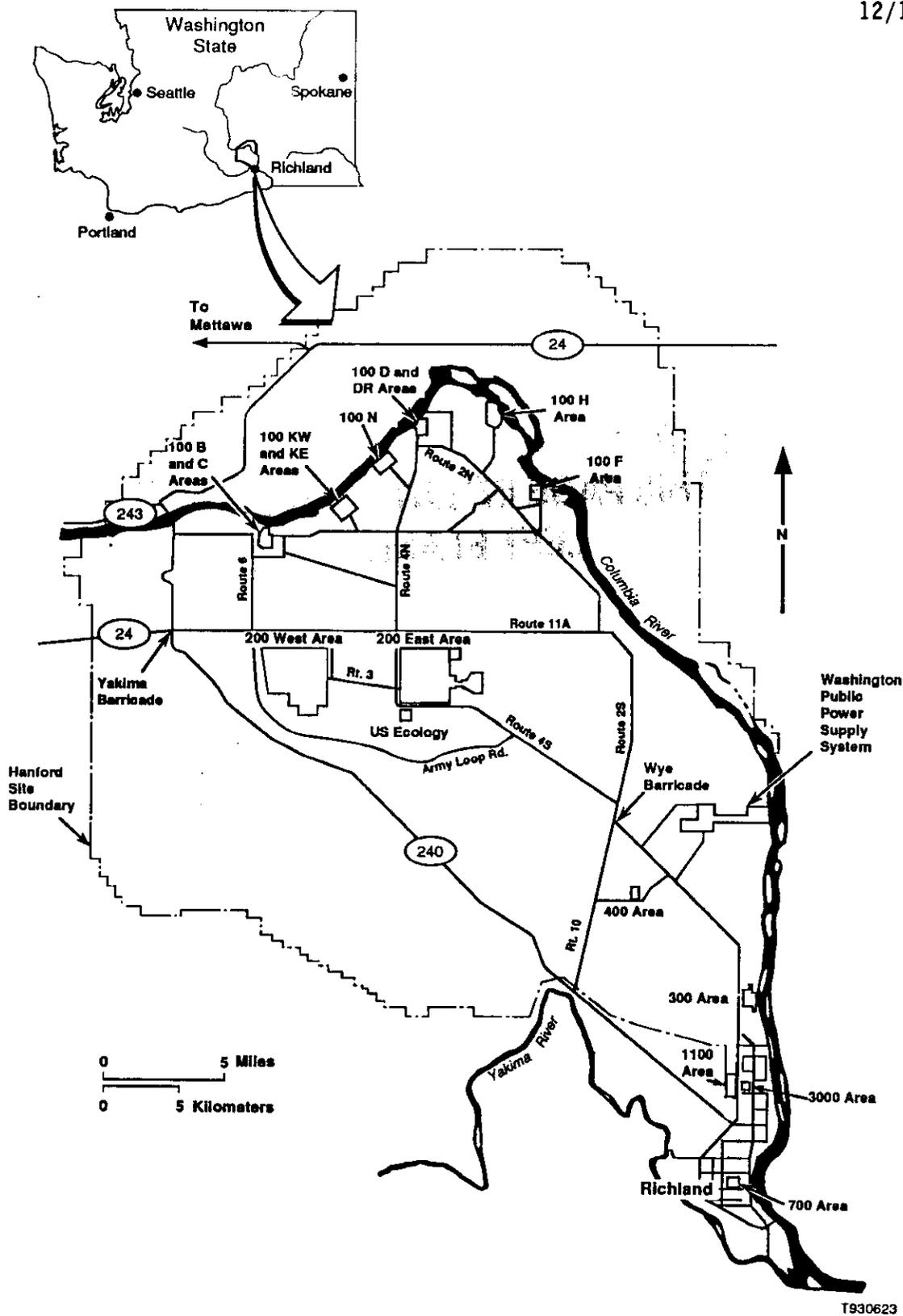


Figure 2-1. Hanford Facility

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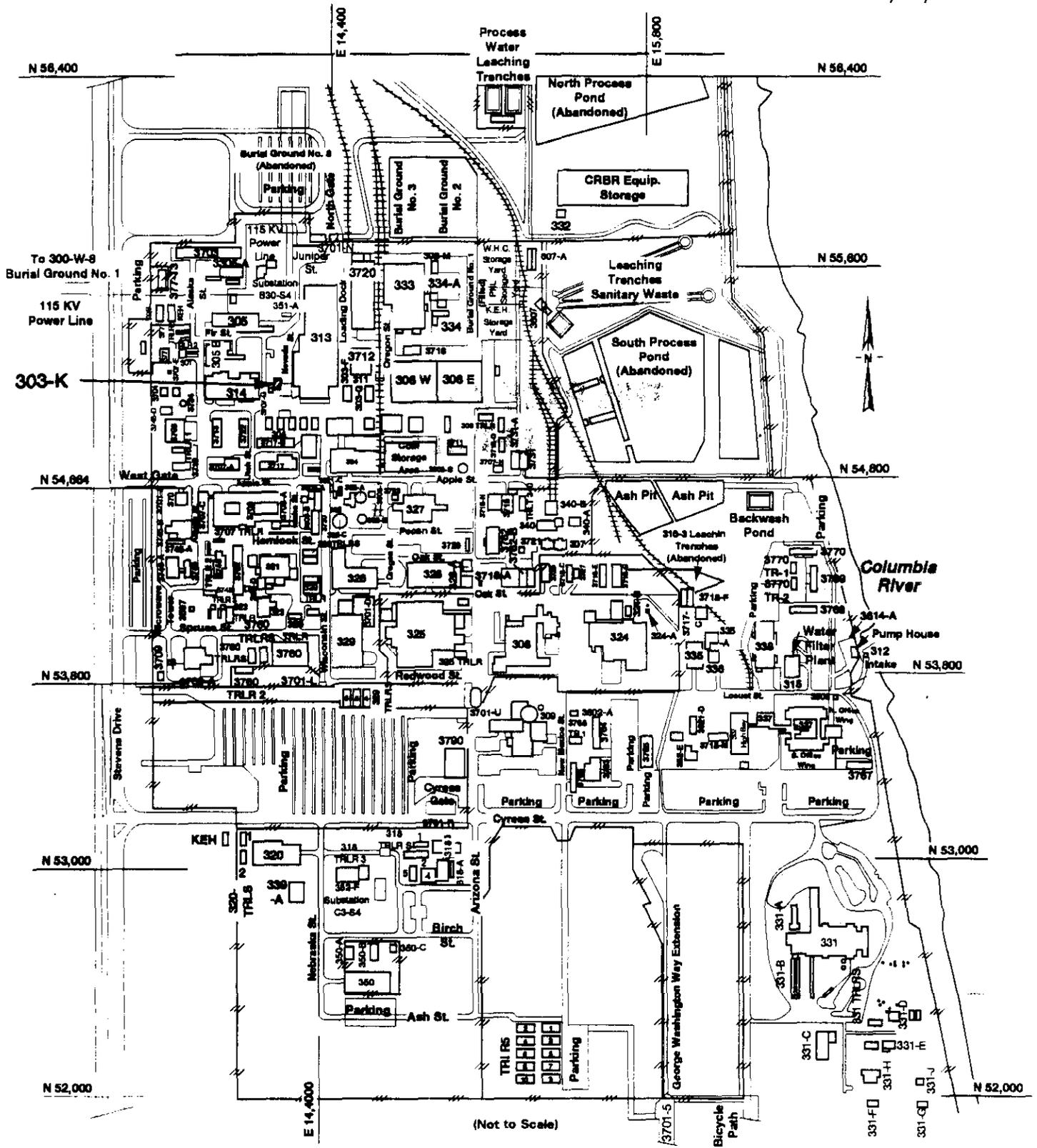
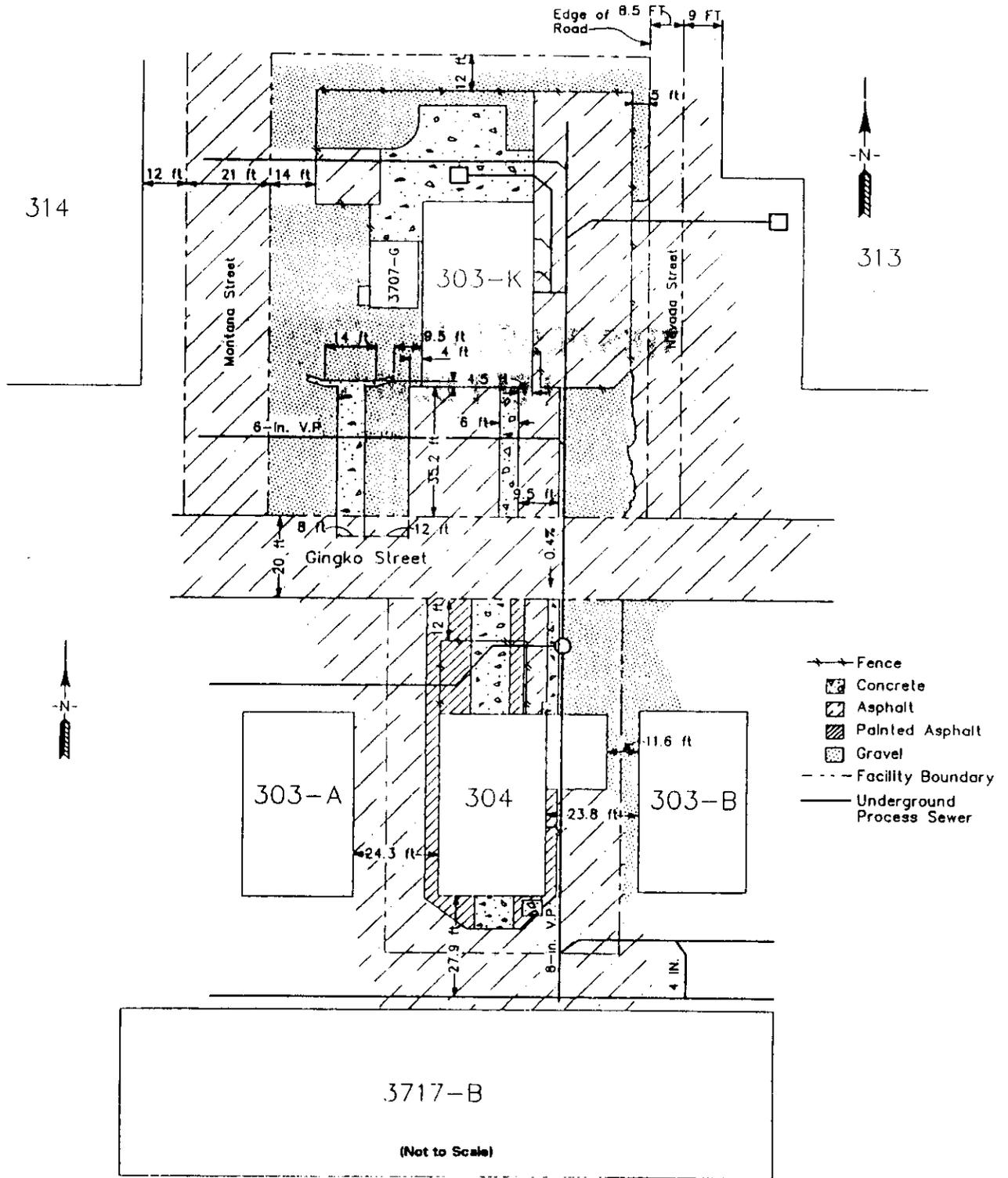


Figure 2-2. 300 Area.

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Figure 2-3. Plan View of the 303-K Storage Facility Surrounding Area.

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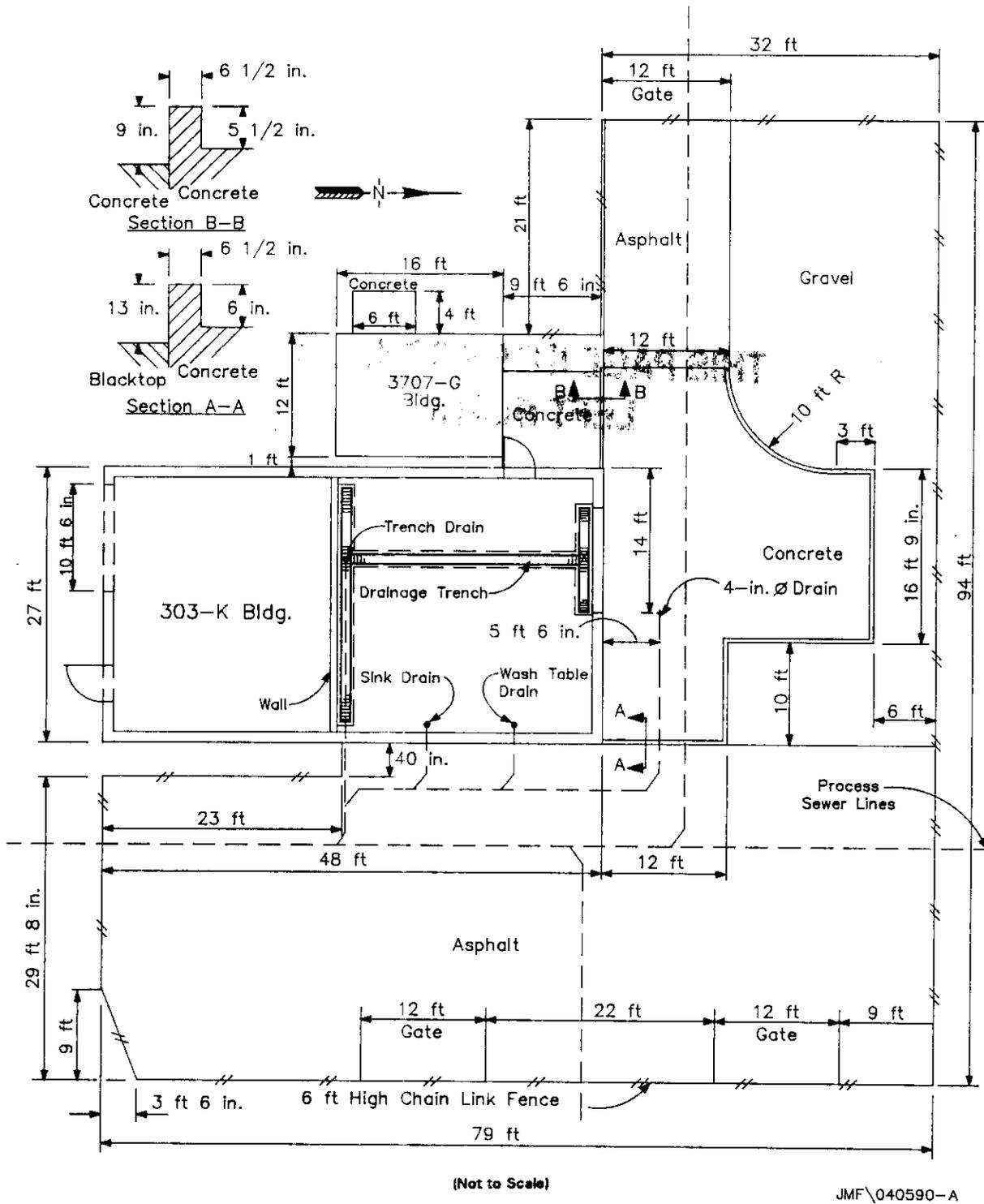
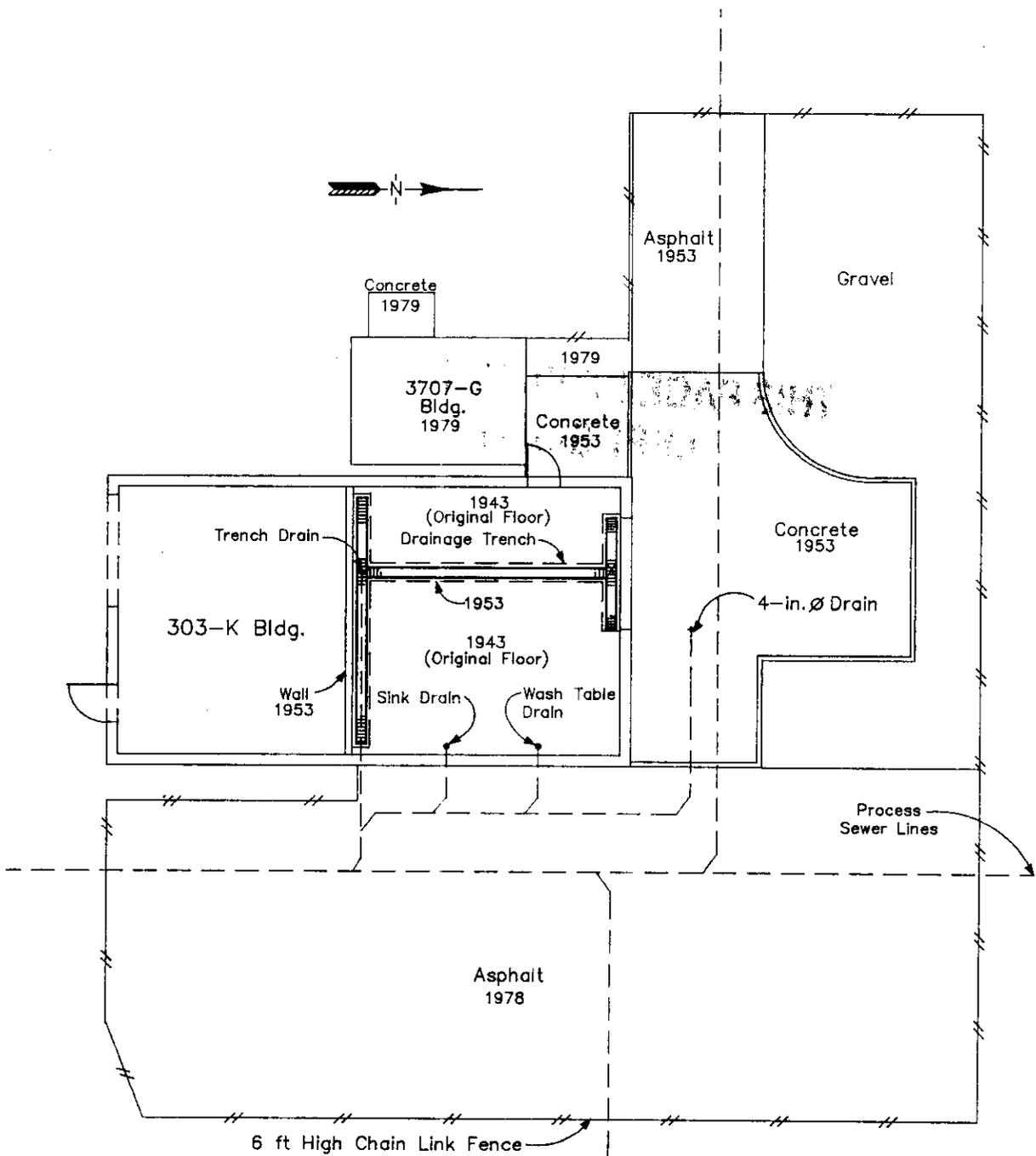


Figure 2-4. 303-K Storage Facility Site Plan.

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Date Indicate Year of Installation of Surface Materials.

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Figure 2-5. Plan View of the 303-K Storage Facility Showing the Year that Additional Storage Areas were Added.

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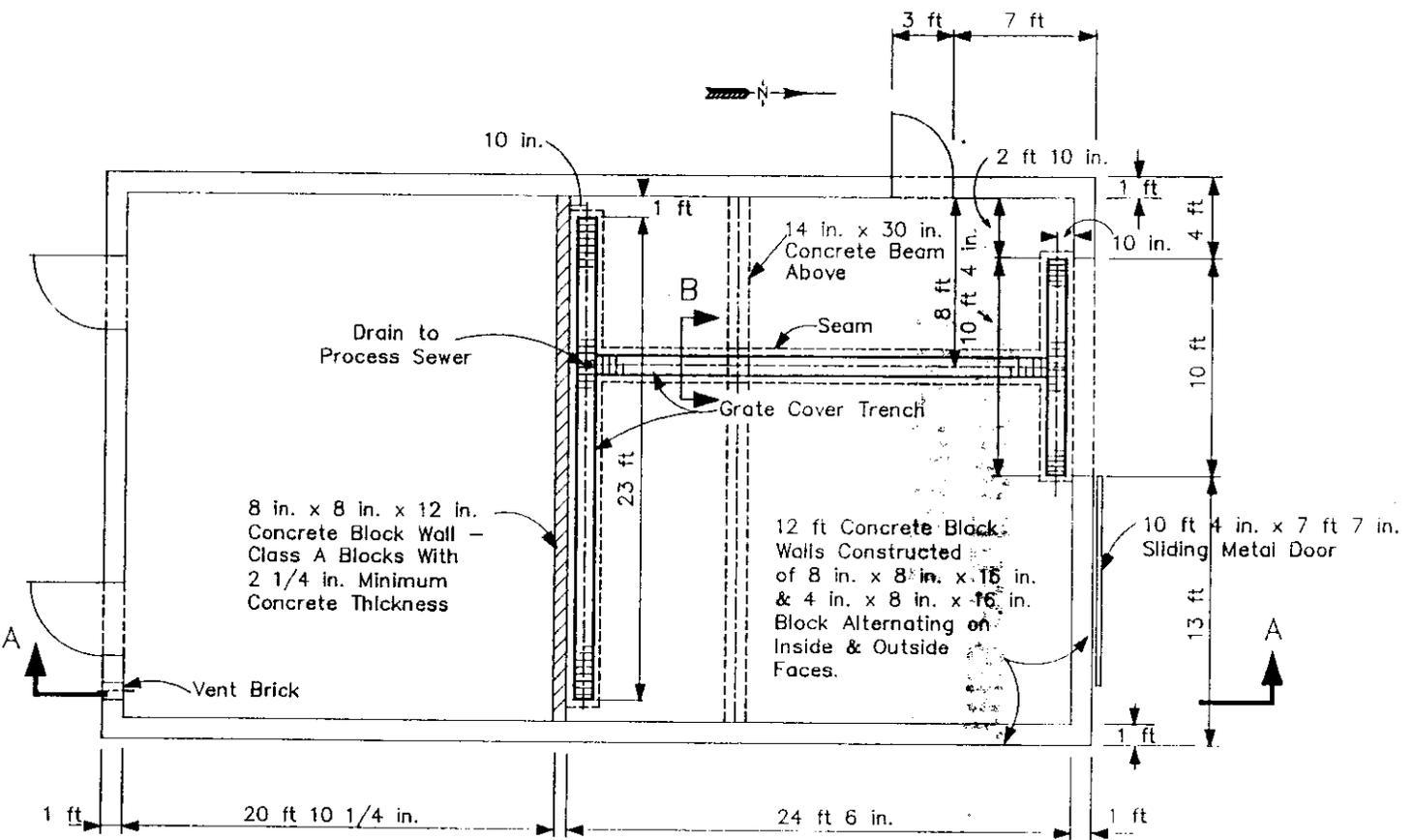
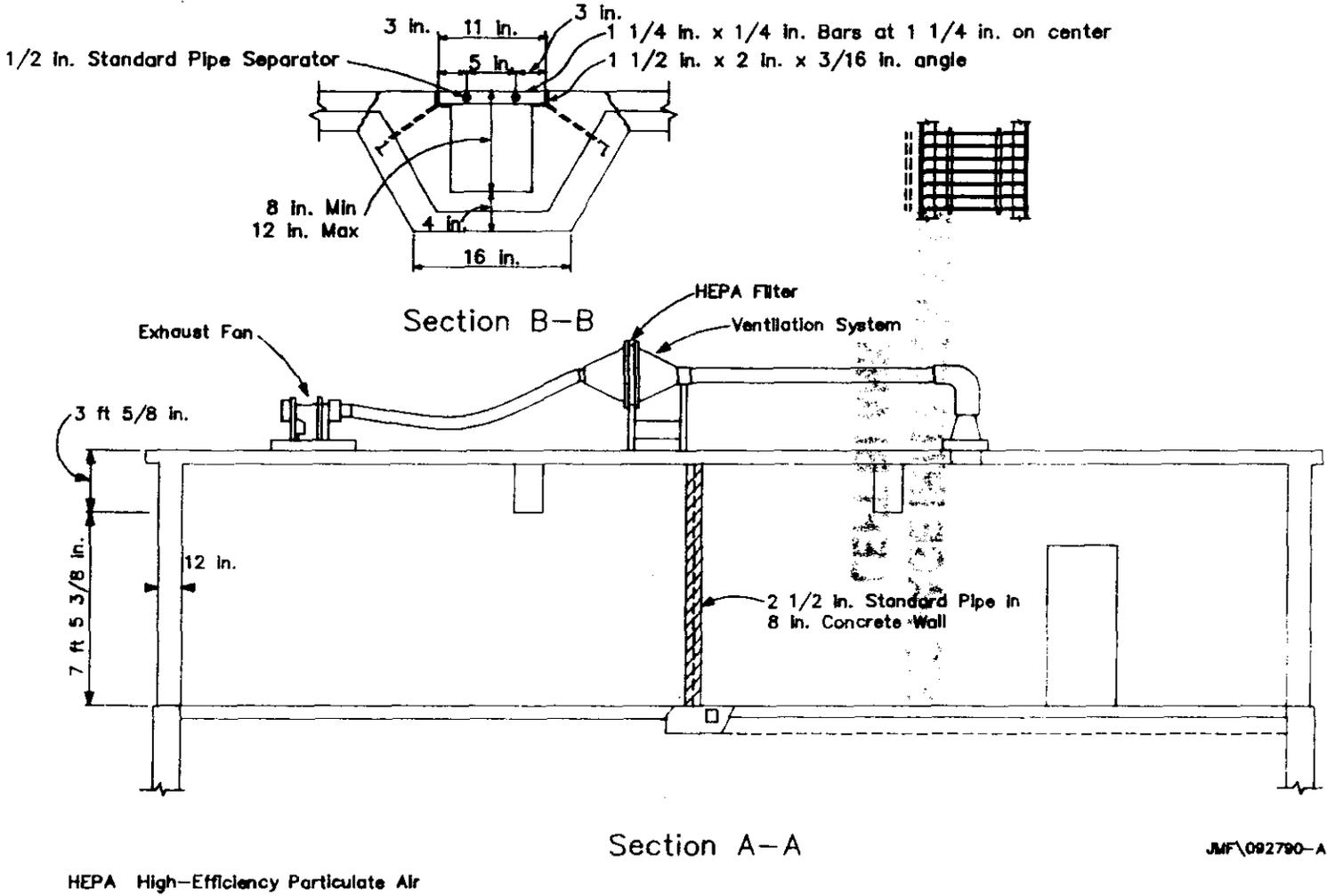


Figure 2-6. Plan View of the 303-K Storage Facility.

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Figure 2-7. Section View of the 303-K Storage Facility.



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CONTENTS

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3.0 PROCESS INFORMATION 3-1

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4 **3.0 PROCESS INFORMATION**

5 The 303-K Storage Facility was designed and constructed in 1943 primarily
6 for the storage of radioactive and mixed waste generated in the 300 Area.
7 Photographs of the 303-K Facility are shown in Appendix A. The following is a
8 summary of the operational history:

- 9 • 1943 to 1953--the building was used to store uranium metal (in various
10 shapes) and fuel elements (aluminum-canned uranium).
11
12 • August 1953--the building was remodeled to provide two rooms (north
13 and south), and drainage trenches were added in the north room.
14
15 • 1953 to 1971--the north end of the building was used to remove
16 radioactive contamination from aluminum spacers used in the reactors.
17
18 • 1953 to present--radioactive and mixed waste has been stored outside
19 the building on concrete, gravel, and asphalt pads.
20
21 • 1971 to 1977--the north room was used for storage and removal of
22 radioactive contamination from equipment.
23
24 • 1977--the north room was used to cure concreted billets (7.5-gallon
25 container of concreted material) of recyclable scrap uranium chips and
26 fines from the 304 Concretion Facility. The curing process was
27 discontinued in the fall of 1982.
28
29 • 1982 to 1986--equipment storage and the removal of radioactive
30 contamination, using alkaline solutions (Table 4-2), continued at the
31 303-K Storage Facility.
32
33 • January 1986 to present--used for storage of containers filled with
34 low-level radioactive waste and mixed waste.
35

36 The mixed waste stored after January 1986 is as follows (for a
37 constituent list refer to Chapter 4.0, Table 4-1):

- 38
39 • Neutralized solid waste from the nonrecoverable uranium stream of the
40 300 Area Waste Acid Treatment System
41
42 • Uranium contaminated metallic lead
43
44 • Salt and sludge containers from beta and quench metal heat treatment
45 furnaces
46
47 • Uranium contaminated perchloroethylene, 1,1,1 trichloroethane, and
48 ethyl acetate
49
50 • Beryllium/zircaloy-2 alloy chips and fines generated at the stepcut
51 lathe, before and after concreting at the 304 Concretion Facility
52

- 1 • Spent coolant from counterbore lathes in the 333 Building
- 2
- 3 • Waste oil and hydraulic fluids that are known, or strongly suspected
- 4 to be, contaminated with uranium
- 5
- 6 • Salt crystals (copper fluoro-zirconate) from the bottom of the waste
- 7 storage tanks in the 334-A Building
- 8
- 9 • Acids (HNO_3 , HF, and H_2SO_4 mixtures) as a solution and absorbed on
- 10 opal clay (Appendix D contains material safety data sheets [MSDS]).
- 11

12 The north room of the 303-K Storage Facility was used to run tests on
13 concreted recyclable scrap uranium chips and fines billets. Steam coils with
14 thermostat controls regulated the curing temperature of billets, and a
15 hydrogen detector was used to detect burning billets. The doors were sealed
16 with plastic during curing cycles.

17
18 It is recognized that several factors associated with serious operations
19 might have resulted in contamination of 303-K Storage Facility. These factors
20 include radioactive decontamination procedures, waste stored, and billet fires
21 that occurred in 1979, 1980, and 1982. However, there are no records of
22 spills or leaks. The evaluation of potential contamination at 303-K Storage
23 Facility is described in Chapter 7.0, Section 7.3.

CONTENTS

1
2
3
4 4.0 WASTE CHARACTERISTICS 4-1
5
6 4.1 ESTIMATE OF MAXIMUM INVENTORY OF WASTE 4-1
7
8 4.2 WASTE STORED AT THE 303-K STORAGE FACILITY 4-1
9

TABLES

10
11
12
13
14
15 4-1. Waste Stored at the 303-K Storage Facility Since 1986 T4-1
16 4-2. Materials Used or Stored in the 303-K Storage Facility
17 from 1953 to 1977 T4-3
18 4-3. Spectrochemical Analysis and pH of Material Stored in
19 303-K Storage Facility in 1976 T4-4

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8 **4.0 WASTE CHARACTERISTICS**

9
10 This chapter addresses the waste inventory and waste forms treated at the
11 303-K Storage Facility.
12

13
14
15
16
17 **4.1 ESTIMATE OF MAXIMUM INVENTORY OF WASTE**

18
19 The maximum estimated inventory of containerized waste stored inside the
20 303-K Storage Facility is 200 containers or 41,640 liters (11,000 gallons) of
21 waste. This total includes container sizes (not including overpacks) of 55,
22 30, and 7.5 gallons. Some of these containers contain lab-packs, and some
23 containers are partially filled.
24

25
26
27
28
29
30 **4.2 WASTE STORED AT THE 303-K STORAGE FACILITY**

31
32 Waste normally is received in 85-gallon overpack drums and DOT-approved
33 55-, 30-, and 7.5-gallon containers. Solvents are received in 17-H closed-
34 head containers or 30-gallon stainless-steel containers. No waste is received
35 at the 303-K Storage Facility in bulk loads. The 303-K Storage Facility
36 received a variety of chemical and radiological waste that was generated by
37 the fuels manufacturing processes in the 300 Area, including waste oils and
38 cutting lubricants, concreted waste from the 304 Concretion Facility, metal
39 heat-treatment salts (quench and beta), salt crystals from the waste acid
40 tanks in the 334-A Building, degreaser solvents, acid absorbed on opal clay,
41 and solids from the 313 Building waste acid treatment system. Waste is
42 designated according to Ecology waste designation regulations in
43 WAC 173-303-070. Waste descriptions are provided in Table 4-1.
44

45
46 There were no detailed procedures used for acceptance of waste at the
47 303-K Storage Facility. The 303-K Storage Facility serviced known
48 manufacturing processes with known waste byproducts. All waste and
49 contaminated equipment from radiation areas, or those suspected to contain
uranium, were sent to the 303-K Storage Facility.

Most waste containers were sampled before transfer to the 303-K Storage
Facility. The analysis was not always received before the drums were moved to
the 303-K Storage Facility. A few containers were sampled after the
containers were received at the 303-K Storage Facility. These analyses were
performed primarily to determine the content of uranium for accountability
purposes or to determine if the radioactivity was naturally occurring. Waste
determined to contain *de minimis* quantities of uranium or naturally occurring
radioisotopes was moved to the 333 East Pad until proper permits were obtained
and the waste was transferred out in less than 90 days. Analytical records,
from 1987 to present, are available for review to substantiate the waste codes
contained in the Part A permit application.

1 Hanford Facility operations contribute waste to the 303-K Storage
2 Facility under the common U.S. Environmental Protection Agency (EPA)/state
3 identification number. The 303-K Storage Facility receives waste generated
4 onsite from more than one source.
5

6 Table 4-2 shows the chemicals (MSDSs not listed) used and stored in the
7 303-K Storage Facility, from 1953 to 1977, during the decontamination of
8 aluminum spacers and equipment. Table 4-3 shows the spectrochemical analysis
9 and pH of material used in the decontamination of equipment and four
10 containers that contained caustic material stored in the 303-K Storage
11 Facility in 1976.
12

13 From the fall of 1979 through March 1980, during the testing program in
14 the northern half of the 303-K Storage Facility, a total of 14 billets burned.
15 Another 12 billets burned in the 303-K Storage Facility on March 13, 1982.
16 The March 13, 1982 fire required assistance from the Hanford Fire Department
17 because wooden pallets caught on fire. After the fires had burned out, burned
18 billet debris was recreted in the 304 Concretion Facility, and the walls,
19 ceiling, and floor were decontaminated by hosing with water that discharged to
20 the process sewer. Uranium oxide and small amounts of copper oxide and
21 zirconium oxide were formed by the burning billets but were removed by the
22 decontamination procedure. Air samples and radiation surveys in the general
23 area indicated no contamination release. Appendix C contains the Occurrence
24 Report.

1 Table 4-1. Waste Stored at the 303-K Storage
2 Facility Since 1986. (sheet 1 of 2)

3	Waste Description	
4	<u>Organic Constituents</u>	<u>Waste type</u>
5	Tetrachloroethylene	Spent halogenated solvent
6	(Perchloroethylene)	
7	Trichloroethylene	Spent halogenated solvent
8	1,1,1-Trichloroethane	Spent halogenated solvent
9	Methyl ethyl ketone	Spent nonhalogenated solvent
10	Toluene	Spent nonhalogenated solvent
11	Pentachlorophenol	Unknown solid block balls from heating, ventilation, air conditioning (HVAC) room in the 313 Bldg.
12	Ethyl Acetate	Spent nonhalogenated solvent
13	Hydraulic oil	Contaminated with halogenated hydrocarbons
14	<u>Organic Degradation Products</u>	
15	1,1-Dichloroethylene	Spent halogenated solvent
16	cis-1,2-Dichloroethylene	Spent halogenated solvent
17	trans-1,2-Dichloroethylene	Spent halogenated solvent
18	Vinyl chloride	Spent halogenated solvent
19	<u>Inorganic Constituents</u>	
20	Acid (HNO ₃ , HF, H ₂ SO ₄)	Crystals, solution, absorbed on opal clay
21	Arsenic ion	Solution, sludge
22	Barium ion	Solution, sludge
23	Beryllium/zircaloy-2	Metal alloy
24	Cadmium ion	Solution, sludge
25	Chromium ion	Solution, sludge

1 Table 4-1. Waste Stored at the 303-K Storage Facility Since 1986.
2 (sheet 2 of 2)

3 Waste Description	
4 <u>Inorganic Constituents</u>	<u>Waste Type</u>
5 <u>(continued)</u>	
6 Lead	Metal
7 Uranium	Metal, oxide, solution, sludge
8 Mercury ion	Solution, sludge
9 Silver ion	Solution, sludge
10 Zircaloy-2*	Metal alloy
11 Quench salt	Solid salt
12 (KNO ₃ , NaNO ₃ ,	
13 NaNO ₂)	
14 Beta salt	Solid salt
15 (KCl, NaCl)	
16 *Composed of zirconium with	
17 1.2 - 1.7% tin	
18 0.07 - 0.2% iron	
19 0.05 - 0.15% chromium	
20 0.03 - 0.08% nickel.	
21	

1 Table 4-2. Materials Used or Stored in the 303-K Storage Facility
2 from 1953 to 1977.

3	Process	Materials
4 5 6 7 8 9 10	Removal of radioactive contamination from used aluminum spacers. (All used solutions and rinse water were discharged to the process sewer and were known to contain small amounts of ^{65}Zn , ^{95}Zr , ^{95}Nb , ^{46}Sc , ^{59}Fe , ^{60}Co , and ^{58}Co .)	Sodium hydroxide, NaOH. Sodium nitrate, NaNO_3 .
11 12 13 14 15 16	Removal of radioactive contamination from equipment. (All used solutions and rinse water were discharged to the process sewer and were known to contain small amounts of uranium and thorium.)	Steam. ^a Sodium aluminate solution, NaAlO_2 . Turco [*] Aluminetch #2. Diversey ^{**} #202 Aluminum Cleaner. American Equipment & Supply, All Purpose Synthetic Cleaner. Diversey RX-1288. Turco Alkaline Rust Remover. ^a Containers of unknown caustic material.

17 ^aRefer to Table 4-3 for spectrochemical analysis and pH.

18 ^{*}Turco is a trademark of Turco Products Incorporated.

19 ^{**}Diversey is a trademark of Diversey Wyandotte Corporation.

20

Table 4-3. Spectrochemical Analysis and pH of Material Stored in the 303-K Storage Facility in 1976.

Material	pH	Content in ppm or percent as indicated															
		Al	Ba	Ca	Cd	Co	Cr	Cu	Fe	Mg	Mn	Na	Ni	P	Pb	Si	Sr
Sodium aluminate solution	10.5	1,000						40	20			4%	200			1,000	
Turco Aluminetch #2	11.8	2				50						>10%	200	5	5		
Diversey ^{**} #202 Al Cleaner	11.2			50								10%		1%			
American Equipment & Supply All Purpose Cleaner	11.2			6				10	6			6,000		1,000		1%	
Diversey RX-1288	9.2	20		200					50	1	2	>10%		1%		2%	
Turco Alkaline Rust Remover	unknown	10											5	10%		100	20
Containers of Unknown:																	
Container #14	Basic	500		2,000			10	1	50	10	5	>10%	50		5	1,000	50
Container #31	8.5	5		300	6			3,000		10		60	30			10	
Container #39	Basic	40	2	4			4		90	1	90	900	1		0.1	20	
Container #40	Basic	1,000	50	200			10		500	10	5	>10%	100			100	20

*Turco is a trademark of Turco Products Incorporated.

**Diversey is a trademark of Diversey Wyandotte Corporation.

ppm = parts per million.

CONTENTS

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8
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5.0 GROUNDWATER 5-1

FIGURE

5-1. Boundary of the 300-FF-5 Operable Unit F5-1

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5.0 GROUNDWATER

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3
4 In accordance with the Tri-Party Agreement (Ecology et al. 1992),
5 groundwater in the 300 Area will be included in the 300-FF-5 operable unit and
6 cleaned up as part of the CERCLA remedial action process. Therefore,
7 groundwater is not included as part of the 303-K Storage Facility Closure
8 Plan. The remedial investigation/feasibility study (RI/FS) draft work plan
9 for the 300-FF-5 operable unit was prepared in 1989 (DOE-RL 1989).

10
11 The 300-FF-5 operable unit consists of the aquifer beneath the 300-FF-1,
12 300-FF-2, and 300-FF-3 operable units and is bounded by the Columbia River on
13 the east (Figure 5-1). The operable unit is defined by "the observed and
14 assumed extent of uranium contamination in the groundwater" (DOE-RL 1989).
15 Ultimately, the operable unit will include all contamination exceeding
16 applicable or relevant and appropriate requirements emanating from the three
17 operable units as detected in groundwater and sediments below the water table.

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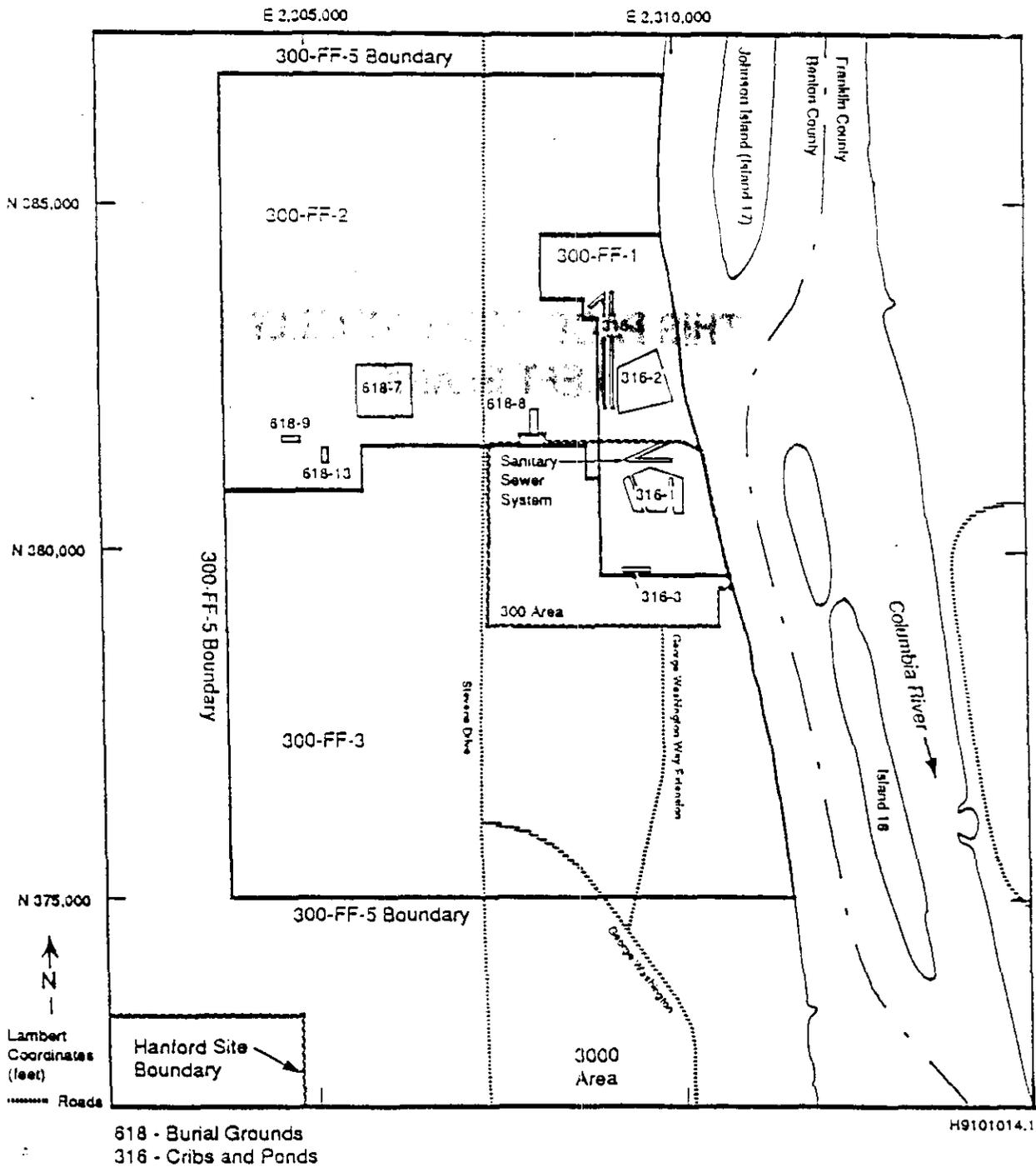


Figure 5-1. Boundary of the 300-FF-5 Operable Unit.

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12
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14
15
16
17
18
19
20
21
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6.0 CLOSURE STRATEGY AND PERFORMANCE STANDARDS 6-1

6.1 CLOSURE STRATEGY 6-1

6.2 GENERAL CLOSURE APPROACH 6-2

6.3 MINIMIZED NEED FOR FURTHER MAINTENANCE 6-3

6.4 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT 6-3

6.5 RETURN OF LAND TO THE APPEARANCE AND USE OF SURROUNDING LAND
AREAS 6-3

FIGURE

6-1. 303-K Storage Facility Closure Flowchart F6-1

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2
3
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6.0 CLOSURE STRATEGY AND PERFORMANCE STANDARDS

This chapter discusses the closure strategy, performance standards for protection of health and the environment, and closure activities.

6.1 CLOSURE STRATEGY

The closure strategy for the 303-K Storage Facility is to decontaminate to remove known or suspected contamination, followed by sampling for the constituents of concern, followed by data analysis, with an evaluation to determine the required actions to meet closure criteria. The closure criterion for the 303-K Storage Facility is to verify that potentially dangerous constituents treated, stored, or used in the 303-K Storage Facility are not present above action levels. If the potentially dangerous constituents are above action levels, an action level evaluation will determine the actions required. Figure 6-1 shows the closure strategy for the 303-K Storage Facility.

The action level evaluation would consider (1) the type and extent to which the action levels are exceeded and (2) assessment of health-based risk. Health-based risk standards for toxicity and carcinogenicity will be scientifically and technically defensible, and criteria guidance will be used, such as WAC 173-340, the Integrated Risk Information System (IRIS) database (EPA 1991), the *Human Health Evaluation Manual* (EPA 1989b), and other appropriate information.

To facilitate closure, the 303-K Storage Facility will be divided into four components: the building; the floor; the pads (concrete and asphalt); and the soil. These four components will be evaluated separately for closure.

If dangerous constituents exist in the building and building components in concentrations above action levels, additional decontamination will be performed if the additional decontamination is considered to be effective. If decontamination is not effective, the appropriate section (building, floor, or pad) will be removed and properly disposed of as dangerous waste.

If dangerous constituents are identified in the soil in concentrations above action levels, closure for the soil will take place during the remediation of the 300-FF-3 operable unit under the CERCLA remedial action process. Soils that would be considered an imminent hazard would be remediated as specified by the Hanford Federal Facility Agreement (Ecology, et al., 1990) Action Plan Section 7.2.3.

Because the process sewer system is scheduled to be addressed under the 300-FF-3 operable unit CERCLA remedial action process, it is not included in this closure plan. The process sewer system is considered to begin immediately beneath the building floor and pads. Soil samples will not be obtained in proximity to the process sewer.

1 Action levels are concentrations of constituents of concern that prompt
2 an action, such as removal-disposal, treatment, or further evaluation.
3 Initial action levels will be the greater of two levels: background or limit
4 of quantitation (LOQ). Background will be sitewide soil background
5 concentrations as defined in *Hanford Site Background: Part 1, Soil Background*
6 *for Nonradioactive Analytes* (DOE/RL 1994). The LOQ is generally 10 times the
7 standard deviation replicate analyses and a method block on low concentration
8 sample. If concentrations exceed initial action levels, health-based action
9 levels (HBL) will be assessed.

10
11 The HBLs will be based on equations and exposure assumptions presented in
12 the WAC 173-340, "Model Toxics Control Act Regulation." For noncarcinogens,
13 the principal variable relating human health to action levels is the oral
14 reference dose. The reference dose is defined as the level of daily human
15 exposure at or below which no adverse effect is expected to occur during a
16 lifetime. For carcinogens, the cancer slope factor is the basis for
17 determining human health effects; it is a measurement of risk per unit dose.
18 The oral reference dose and cancer slope factor are chemical-specific and are
19 obtained from the *Integrated Risk Information System* (IRIS) database
20 (EPA 1993). Health-based levels will be based on values that are current at
21 the time of approval of this closure plan.

22 23 24 6.2 GENERAL CLOSURE APPROACH

25
26 The 303-K Storage Facility will be closed in a manner consistent with
27 WAC 173-303. The general closure approach (Figure 6-1) is as follows:

- 28
29 • Remove dangerous waste inventory
- 30
31 • Decontaminate the building components, building walls, ceiling, floor,
32 and outside storage pads using one of the options described in
33 Chapter 7.0, Section 7.4
- 34
35 • Collect samples from the building, floor, and outside storage pads
- 36
37 • Collect soil samples under the floor and pads in areas with potential
38 pathways to the soil if required
- 39
40 • Conduct analytical testing of samples and evaluate data
- 41
42 • Compare data to action levels
- 43
44 • Conduct additional decontamination of building and outside storage
45 pads if required
- 46
47 • Collect and analyze samples to support additional decontamination, if
48 required
- 49
50 • If decontamination procedures do not remove contamination to action
51 levels, remove that portion of the building, floor, or pad
- 52

1 Action levels are concentrations of constituents of concern that prompt
2 an action, such as removal-disposal, treatment, or further evaluation.
3 Initial action levels will be the greater of two levels: background or limit
4 of quantitation (LOQ). Background will be sitewide soil background
5 concentrations as defined in *Hanford Facility Soil Background* (DOE/RL 1992).
6 The LOQ is generally 10 times the standard deviation replicate analyses and a
7 method block on low concentration sample. If concentrations exceed initial
8 action levels, health-based action levels (HBL) will be assessed.
9

10 The HBLs will be based on equations and exposure assumptions presented in
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20 the time of approval of this closure plan.
21
22

23 6.2 GENERAL CLOSURE APPROACH

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27

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- 29
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31 and outside storage pads using one of the options described in
32 Chapter 7.0, Section 7.4
- 33
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- 35
- 36 • Collect soil samples under the floor and pads in areas with potential
37 pathways to the soil if required
- 38
- 39 • Conduct analytical testing of samples and evaluate data
- 40
- 41 • Compare data to action levels
- 42
- 43 • Conduct additional decontamination of building and outside storage
44 pads if required
- 45
- 46 • Collect and analyze samples to support additional decontamination, if
47 required
- 48
- 49 • If decontamination procedures do not remove contamination to action
50 levels, remove that portion of the building, floor, or pad
1

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- 1 • Soil remediation, if required, will be accomplished under the
2 CERCLA remedial action process.
3

4 All equipment used in performing closure activities will be
5 decontaminated or disposed of at a permitted facility.
6

7 Closure activities will be monitored by an offsite independent registered
8 professional engineer who will certify that, in his or her judgment, closure
9 was accomplished in accordance with the specifications of the approved closure
10 plan as described herein. The professional engineer's report will be
11 submitted to the EPA and Ecology along with certification of closure. The
12 report and certification will be sent by registered mail or an equivalent
13 delivery service.
14

15 The closure activities will be completed in accordance with the schedule
16 contained in this closure plan after the schedule is approved by Ecology and
17 EPA. Two official copies of this closure plan will be located at the
18 following office: U.S. Department of Energy, Richland Operations Office
19 (DOE-RL), Federal Building, 825 Jadwin Avenue, P.O. Box 550, Richland,
20 Washington 99352. The DOE-RL office will be responsible for amending this
21 plan, as amendments become necessary, according to the amendment procedure
22 identified in WAC 173-303-610. The plan will be kept at the DOE-RL office
23 until closure is complete and certified. Other official copies will be kept
24 by Ecology, the EPA, Administrative Record Center, the 303-K Storage Facility
25 manager's office, and at the 303-K Storage Facility site.
26

27 28 **6.3 MINIMIZED NEED FOR FURTHER MAINTENANCE** 29

30 Closure of the 303-K Storage Facility by removing or decontaminating (to
31 proposed action levels) equipment, bases, structures, and other materials
32 contaminated with dangerous waste or waste residues will eliminate the need
33 for further maintenance. However, interim actions might be required if soils
34 are left in place for remediation under the CERCLA remedial action process.
35 These interim actions are described in Chapter 8.0, Section 8.2.
36

37 38 **6.4 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT** 39

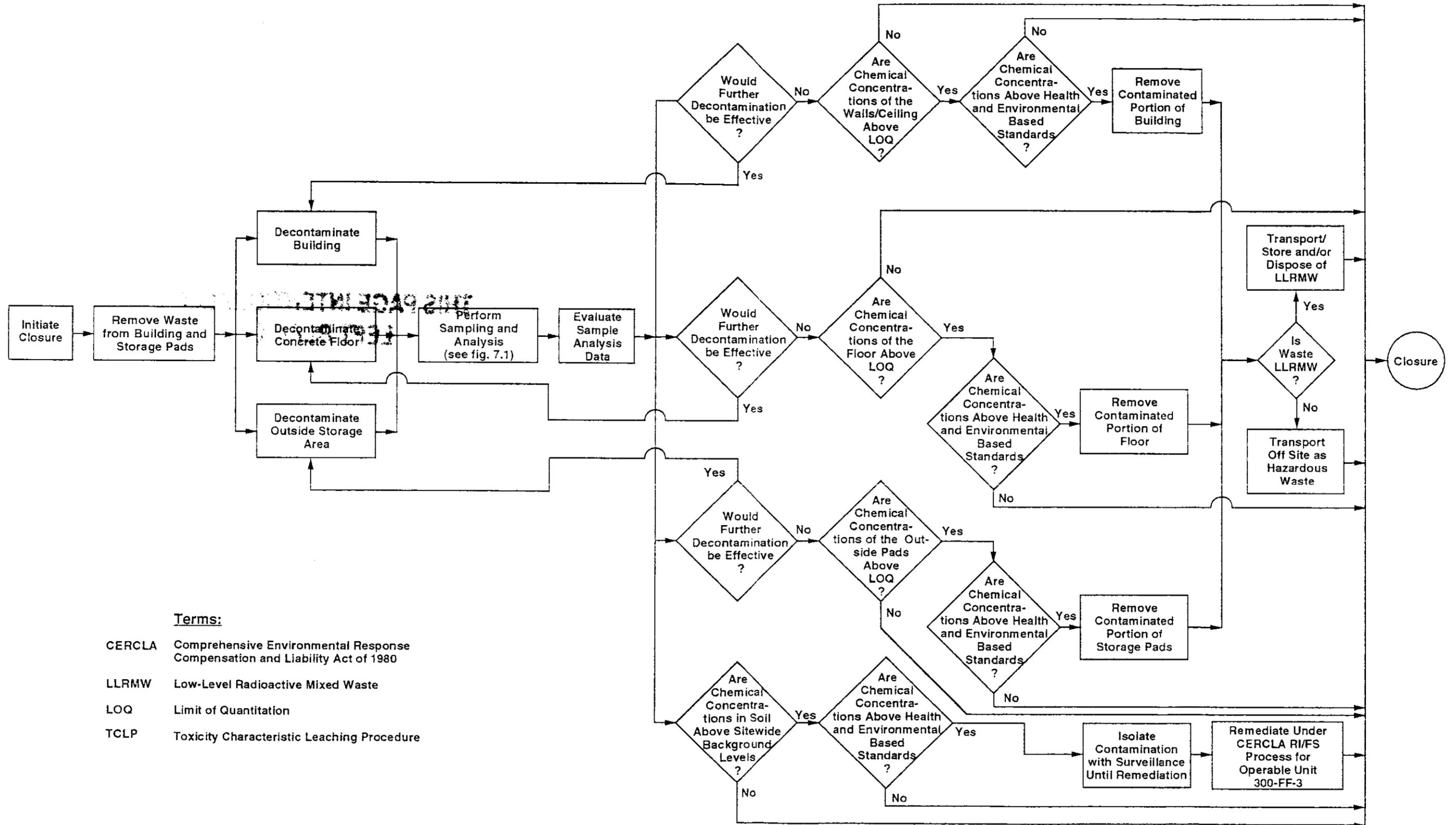
40 As discussed previously, the 303-K Storage Facility will be closed by
41 removing or decontaminating, to proposed action levels, all dangerous waste
42 and waste residues to protect human health and the environment.
43

44 45 **6.5 RETURN OF LAND TO THE APPEARANCE AND USE OF SURROUNDING LAND AREAS** 46

47 After closure of the 303-K Storage Facility is accomplished, the site
48 will be returned to the appearance and continued use of the surrounding
49 300 Area (e.g., a weedless gravel lot).

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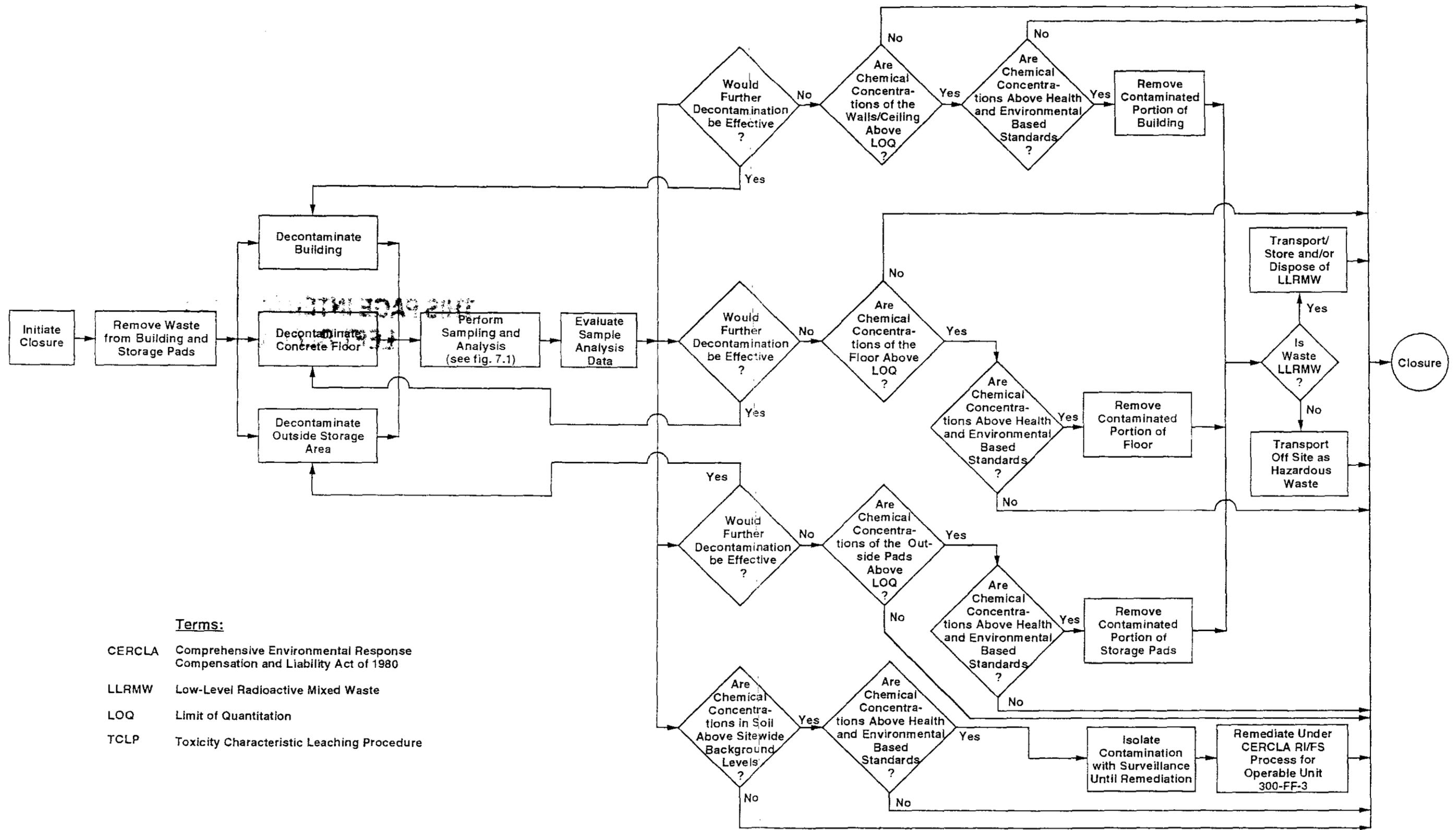


Terms:

- CERCLA Comprehensive Environmental Response Compensation and Liability Act of 1980
- LLRMW Low-Level Radioactive Mixed Waste
- LOQ Limit of Quantitation
- TCLP Toxicity Characteristic Leaching Procedure

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Figure 6-1. 303-K Facility Closure Flowchart.



Terms:

- CERCLA Comprehensive Environmental Response Compensation and Liability Act of 1980
- LLRMW Low-Level Radioactive Mixed Waste
- LOQ Limit of Quantitation
- TCLP Toxicity Characteristic Leaching Procedure

GENM092793-D

Figure 6-1. 303-K Facility Closure Flowchart.

CONTENTS

1		
2		
3		
4	7.0	CLOSURE ACTIVITIES 7-1
5		
6	7.1	REMOVAL OF DANGEROUS WASTE INVENTORY 7-1
7		
8	7.2	FACILITY SAMPLING 7-1
9	7.2.1	Sampling Design 7-1
10	7.2.1.1	Objectives 7-1
11	7.2.1.2	Analytical Parameters 7-2
12	7.2.1.3	Sampling Activities 7-2
13	7.2.1.4	Sampling Procedures 7-2
14	7.2.1.5	Sampling Locations 7-5
15	7.2.1.6	Data Quality 7-6
16	7.2.2	Modifications to the Waste Sampling and Analysis
17		Plan 7-7
18	7.2.3	Data Evaluation Process 7-7
19	7.2.4	Statistical Treatment of Data 7-7
20	7.2.5	Assessment of Data Reliability 7-8
21	7.2.6	Reporting 7-8
22	7.2.7	Sampling Equipment, Containers, and Preservation 7-9
23	7.2.7.1	Sampling Equipment 7-9
24	7.2.7.2	Sample Containers and Preservation 7-10
25	7.2.8	Sampling Quality Control 7-10
26	7.2.8.1	Field Quality Control 7-10
27	7.2.8.2	Field Logbook 7-11
28	7.2.8.3	Sample Labels 7-12
29	7.2.8.4	Sample Seals 7-12
30	7.2.8.5	Chain-of-Custody Records 7-12
31	7.2.8.6	Sample Analysis Request 7-13
32	7.2.8.7	Laboratory Receipt and Logging of Sample 7-13
33	7.2.8.8	Sample Disposition 7-14
34	7.2.8.9	Decontamination 7-14
35	7.2.9	Analytical Procedures 7-14
36	7.2.9.1	Concrete and Asphalt Inorganic Analysis
37		Methodology 7-14
38	7.2.9.2	Concrete and Asphalt Organic Analysis
39		Methodology 7-15
40	7.2.10	Laboratory Quality Control 7-15
41	7.2.11	Site Safety 7-16
42	7.2.11.1	Health and Safety Plan 7-16
43	7.2.11.2	Contamination Control 7-16
44	7.2.11.3	Personnel Training 7-17
45	7.2.11.4	Standard Safety Procedures 7-17
46		
47	7.3	REMOVAL OF CONTAMINATED MATERIAL AND WASTE RESIDUES 7-18
48		
49	7.4	DECONTAMINATION AND DISPOSAL OF BUILDING AND CONCRETE PAD 7-18
50		
51	7.5	OTHER ACTIVITIES REQUIRED FOR CLOSURE 7-19

CONTENTS (cont)

1 7.6 SCHEDULE OF CLOSURE 7-19
2
3 7.7 AMENDMENT OF PLAN 7-20
4
5 7.8 CERTIFICATION OF CLOSURE 7-20
6
7
8

9 FIGURES

10
11
12 7-1. Waste Sampling and Analysis Flowchart F7-1
13 7-2. 303-K Storage Facility, Floor Core Sampling Locations F7-2
14 7-3. 303-K Storage Facility, Sampling Locations on Outside Storage
15 Pads and in Gravel Area F7-3
16 7-4. 303-K Storage Facility Sampling Locations in Areas of Potential
17 Contamination F7-4
18 7-5. 303-K Storage Facility, South Wall (Inside) and North Wall
19 Sampling Locations F7-5
20 7-6. 303-K Storage Facility, East and West Wall Sampling Location . . . F7-6
21 7-7. 303-K Storage Facility, Ceiling Sampling Locations F7-7
22 7-8. 303-K Storage Facility Closure Schedule F7-8
23 7-9. Closure Certification for the 303-K Storage Facility F7-9
24
25

26 TABLES

27
28
29
30 7-1. Potential Compliance Constituents, Analytical Methods,
31 and Action Levels for the 303-K Storage Facility T7-1
32 7-2. Sampling Summary of the 303-K Storage Facility T7-2
33 7-3. Field Quality Control Samples T7-3
34 7-4. General Training Matrix T7-4

7.0 CLOSURE ACTIVITIES

This chapter describes the activities necessary to close the 303-K Storage Facility. Included is a sampling and analysis plan, and a schedule for completing the closure activities once the closure plan is approved. The overall strategy, on which the sampling and analysis plan is based, is described in Chapter 6.0.

7.1 REMOVAL OF DANGEROUS WASTE INVENTORY

The outdoor storage areas and the north half of the 303-K Storage Facility currently are in use as a greater-than-90-day storage unit. After the closure plan is approved and before any other closure activities are conducted, all waste stored at the 303-K Storage Facility will be transferred to the Central Waste Complex for interim storage and future treatment or disposal.

7.2 FACILITY SAMPLING

The following waste sampling and analysis plan has been prepared to evaluate contamination levels, if any, within the north half of the building, the outside storage areas, and near-surface soils associated with the 303-K Storage Facility. The south half of the building was not used for dangerous waste-related activities and is not included in this closure plan. The north and south halves of the building are separated completely by a cinder block wall. The other walls also are constructed of cinder block, and the building has a concrete floor and ceiling. This plan is based primarily on the history of the processes associated with the 303-K Storage Facility (Chapter 3.0).

A flowchart for sampling activities is provided in Figure 7-1. The 303-K Storage Facility is regulated by WAC 173-303, but located within a CERCLA operable unit. Because the 303-K Storage Facility is located in a CERCLA operable unit (300-FF-3), any soil remediation will be accomplished under the CERCLA remedial action process.

7.2.1 Sampling Design

This section discusses the details and design of the sampling program. Subjects being addressed include sampling parameters, sampling activities, sampling procedures, and data quality.

7.2.1.1 Objectives. The objectives of the waste sampling and analysis plan are as follows:

- Determine whether building surfaces, the concrete floor, and the outside storage areas contain dangerous waste constituents as defined by WAC 173-303

- 1 • Identify and quantify the specific dangerous waste constituents
2 (if any) present using methods outlined in SW-846 (EPA 1986). If any
3 other methods are used, the method will be referenced and submitted to
4 Ecology
5
- 6 • Determine whether near surface soils (no deeper than 1 meter [3 feet])
7 underlying the 303-K Storage Facility are contaminated above action
8 levels as a result of operations at the 303-K Storage Facility
9
- 10 • Evaluate analytical data to determine initial actions and closure
11 status.
12
13

14 **7.2.1.2 Analytical Parameters.** Analytical parameters and methods are based
15 on knowledge of the operations and contents at the 303-K Storage Facility.
16 A plan was developed to determine the presence of potentially dangerous
17 constituents from chemicals used and waste stored at the 303-K Storage
18 Facility.
19

20 A list of the potential contaminants used and stored at the
21 303-K Storage Facility, the initial action levels, and the analytical method
22 for each constituent are provided in Table 7-1.
23

24 As discussed in Chapter 6.0, the soil samples from the 303-K Storage
25 Facility will be analyzed for the constituents listed in Table 7-1. These
26 results will be compared to the action levels, which are the sitewide
27 background threshold concentrations and health-based standards for soil.
28 The initial action levels for samples of concrete and asphalt are LOQs for
29 inorganic and organic constituents.
30

31 **7.2.1.3 Sampling Activities.** Once the building area and the outside storage
32 areas have been decontaminated (Section 7.4), sampling activities will be
33 conducted in the 303-K Storage Facility as follows:
34

- 35 • Core the concrete floor and the concrete and asphalt pads and collect
36 soil samples to a maximum depth of 1 meter (3 feet) in areas with
37 pathways (cracks, expansion joints, etc.) to the soil
38
- 39 • Collect concrete core samples from the floor, walls, and ceiling
40
- 41 • Collect core samples from outside storage pads
42
- 43 • Collect soil samples up to a depth of 1 meter (3 feet) in the outside
44 gravel storage area.
45

46 **7.2.1.4 Sampling Procedures.** Sampling procedures to be used for determining
47 whether chemical waste has contaminated the building, outside storage areas,
48 and the associated soils are described in this section. Sampling procedures
49 will be conducted in conformance with environmental investigation instructions
50 (EII) *Environmental Investigations and Site Characterization Manual* (WHC 1988)
51 and pertinent EPA guidelines where these exist.
52

1 Areas to be randomly sampled will be divided into 1-square meter grids,
2 and 5 percent of the gridded locations will be sampled. A sample will be
3 taken at the center of each randomly selected 1-square meter location. In
4 addition to the random samples, some authoritative samples will be obtained
5 from areas of higher potential contamination (e.g., the floor trench and the
6 soil beneath potential pathways in the floor or pads).

7
8 **7.2.1.4.1 Floor and Outside Storage Pads.** Samples will be taken at
9 gridded locations on the concrete floor and outside on the concrete and
10 asphalt storage pads (Figures 7-2 and 7-3). In addition to the random
11 samples, two authoritative samples will be obtained in the drainage trench
12 near the drain (Figure 7-4). Concrete and asphalt samples will be obtained by
13 coring.

14
15 A coring device will be used to obtain a concrete or asphalt core sample.
16 The coring device will employ a diamond core drill [typically 100 millimeter
17 [4-inch outside diameter [OD]] and use distilled water as a cutting lubricant
18 to minimize dust generation. As little water as necessary will be used to
19 obtain the samples. The core samples will be 150 millimeters (6 inches) to
20 200 millimeters (8 inches) long. Any waste generated by the sampling process
21 will be handled in the same manner as the coring conducted to sample the soil
22 beneath the concrete (Section 7.2.1.4.3).

23
24 Soil samples from the gravel pad will be obtained as described in
25 Section 7.2.1.4.3.

26
27 **7.2.1.4.2 Concrete Walls and Ceiling.** The interior concrete walls and
28 ceiling will be core sampled. The interior walls and ceiling will be divided
29 into 1-square meter grids and 5 percent of the squares will be sampled
30 (Figures 7-5 through 7-7). The samples will be obtained and analyzed in the
31 same manner as described for the floor and pads (Section 7.2.1.4.1).

32
33 **7.2.1.4.3 Soils.** Coring of concrete and asphalt will be conducted as a
34 means of accessing the soil beneath. This will be done at locations where
35 potential pathways to the soil exist.

36
37 A coring device will cut the core from each selected location. The
38 coring device will employ a diamond core drill that uses a minimum amount of
39 distilled water as a cutting lubricant to minimize dust generation. No
40 organic-based lubricant will be used. Appropriate measures will be taken to
41 control dust during this operation, including the use of temporary site
42 enclosures and air filtration.

43
44 If required, an industrial-size shop vacuum will be used to remove excess
45 water from around the core. This will be done to minimize surface
46 contamination flowing into the underlying soil. The waste water from within
47 the shop vacuum will be emptied into a new 17-H open-headed 55-gallon drum and
48 will be stored at the 303-K Facility until waste designation is completed.
49 The coring device will be decontaminated between samples in accordance with
50 procedures outlined in EII 5.4, "Field Cleaning and/or Decontamination of
51 Equipment" or in EII 5.5, "1706 KE Laboratory Decontamination of RCRA/CERCLA

1 Sampling Equipment" (WHC 1988). All decontamination fluids will be
2 containerized with the waste water.
3

4 Concentrations of inorganic constituents added to the soil by sorption
5 from an effluent containing even drinking water levels of these constituents
6 are greatest in the upper few millimeters, and decrease with increased depth
7 of the soil column. Because of the well-known process of sorption (Pendias
8 and Pendias 1984; Routson et al. 1979; Conway 1982; Freeze and Cherry 1979),
9 any contamination remaining in the soil would be the result of equilibrium
10 reactions and/or irreversible sorption. In either case, residual
11 contamination mostly would be concentrated in the uppermost part of the soil
12 column, with rapidly decreasing concentrations downward. Therefore, the
13 uppermost part of the soil column is most likely to contain contamination if
14 present.
15

16 Any contamination of the soil by organic solvents associated with the
17 303-K Storage Facility is likely to be small and, if present, dominant in the
18 uppermost part of the soil column. The only pathway for the organic
19 contaminants to the soil would have involved the transport of a small fraction
20 of any spill (no spills were reported) to the soil through cracks in the
21 concrete floor. Because of the relatively small amount of potential
22 contamination, the general lack of evaporation under the concrete floor, and
23 the tendency for such small amounts to be retained in the soil, any potential
24 organic contamination from this source is most likely to be present in the
25 upper part of the soil column.
26

27 Because the potential contamination from the 303-K Storage Facility would
28 remain in the upper part of the soil column, a maximum sampling depth of
29 1 meter (3 feet) would be adequate. During soil sampling, samples will be
30 obtained from the surface, at 30 centimeters (1 foot), 61 centimeters
31 (2 feet), and 1 meter (3 feet). The sample will consist of soil
32 2.5 centimeters (1 inch) above and 2.5 centimeters (1 inch) below the sampling
33 point. For example, the sample at the 61 centimeter (2 foot) mark would
34 include the section of dirt that was 58.5 centimeters (1 foot, 11 inches) to
35 63.5 centimeters (2 feet, 1 inch) below the surface.
36

37 Soil samples from the gravel area and beneath the storage pads will be
38 considered worst-case contamination. If no contamination is detected in the
39 near surface soil samples, the 303-K Storage Facility will be considered to
40 have contributed no contamination to the subsurface below 1 meter (3 feet).
41

42 The soil samples will be analyzed for the constituents listed in
43 Table 7-1.
44

45 A hand-operated soil auger (typically 102 millimeter [4-inches] or
46 76.2 millimeter [3-inches] OD) will be used at each sampling location and soil
47 will be removed to a total depth of 1 meter (3 feet). If access to the
48 sampling location is restricted, a small stainless steel shovel or trowel may
49 be used. Samples from the hole will be placed immediately in a laboratory-
50 prepared sample container to minimize loss of volatiles and will be stored on
51 ice in a cooler at 4 ± 2 °C. The soil auger, as well as all sampling
52 equipment, will be decontaminated in accordance with procedures outlined in

1 equipment, will be decontaminated in accordance with procedures outlined in
2 EII 5.5, "1706 KE Laboratory Sampling of RCRA/CERCLA Sampling Equipment"
3 (WHC 1988). If required, the soil auger and any other sampling equipment can
4 be field cleaned in accordance with the procedures outlined in EII 5.5, "Field
5 Cleaning and/or Decontamination of Equipment" (WHC 1988). The equipment will
6 be cleaned before use at each sample location.

7
8 Excess soil that is removed from each hole will be containerized in a
9 17-H open-headed 55-gallon container until results of the soil analyses are
10 received. The container will be stored at the 303-K Storage Facility until
11 designated according to onsite procedures. Each hole in the floor or pad will
12 be sealed with concrete or asphalt after sampling is completed.

13
14 **7.2.1.5 Sampling Locations.** Areas to be sampled have been divided into eight
15 sections, consisting of the four walls, the floor, the ceiling, outside
16 storage pads, and the gravel area. Sampling locations have been selected
17 randomly except where authoritative sampling is warranted in areas of
18 potential contamination. Each of the eight sections has been gridded to
19 facilitate the selection and identification of random sample locations.
20 A minimum of 5 percent of the gridded area for each section will be sampled.
21 The use of random-sampling strategy will ensure that data obtained will be
22 representative of the population from which the samples were taken. Areas of
23 potential contamination were selected for authoritative sampling because of
24 the higher potential for contamination. The randomly selected sampling
25 locations are included in Appendix B. The number and location of each type of
26 sample is presented in Table 7-2. Each section is discussed in the following
27 sections with respect to sample locations.

28
29 **7.2.1.5.1 Building Walls.** The sampling locations for the north wall are
30 shown in Figure 7-5. There are 24 1-square meter grids. Two locations will
31 be sampled.

32
33 The sampling locations for the south (inside) wall are shown in
34 Figure 7-5. There are 24 1-square meter grids. Two locations will be
35 sampled.

36
37 The sampling locations for the east wall are shown in Figure 7-6. Only
38 the northern portion of the building was used for storage of mixed waste.
39 There are 24 1-square meter grids. Two locations will be sampled.

40
41 The sampling locations for the west wall are shown in Figure 7-6. There
42 are 24 1-square meter grids. Two locations will be sampled.

43
44 **7.2.1.5.2 Ceiling.** The ceiling will be gridded and sampled because of
45 the possibility of contamination caused by the billet fires. The sampling
46 locations are shown in Figure 7-7. There are approximately 64 1-square
47 meter grids. Three locations will be sampled.

48
49 **7.2.1.5.3 Outside Storage Areas.** The sampling locations for the outside
50 storage areas are shown in Figure 7-3. The two concrete-covered areas contain
51 approximately 67 1-square meter grids. A total of five locations will be core
52 sampled. In addition, areas where potential pathways are visible will be

1 sampled by collecting a soil sample under the pad (Figure 7-4). These samples
2 will be analyzed for contaminants listed in Table 7-1.

3
4 The asphalt portion of the outside storage area also will be gridded for
5 core samples (Figure 7-3). The asphalt-covered areas contain approximately
6 254 1-square meter grids and 13 locations were selected for sampling. These
7 samples will be analyzed for contaminants listed in Table 7-1.

8
9 The sampling locations for the graveled portion of the outside storage
10 area are shown in Figure 7-3. This portion of the area has been divided into
11 approximately 91 1-square meter grids, and five locations were selected for
12 sampling. A hand auger will be used to sample the soils to a depth of 1 meter
13 (3 feet). Samples will be taken from the surface at 30 centimeter (1 foot),
14 61 centimeter (2 feet), 1 meter (3 feet). The samples will be analyzed for
15 the contaminants listed in Table 7-1.

16
17 The soil beneath the storage pads and building floor will be
18 authoritatively sampled in areas of potential pathways (cracks, expansion
19 joints). The potential pathways will be documented in a scale drawing before
20 sampling. This will ensure that all potential pathways, with the exception of
21 hairline cracks (cracks that do not penetrate beyond the surface), are
22 sampled. The sampling location on each potential pathway will be selected to
23 ensure that the most likely point of soil contamination will be sampled. The
24 sample location indicators (most likely to allow for infiltration of
25 contaminants) are the widest portions of the potential pathway, the portions
26 of the pathway with the lowest elevation, and any areas on the pathway that
27 are stained. At least 5 percent of the length of each potential pathway will
28 be sampled (once every 6.10 meters [20 feet]). Each separate potential
29 pathway will be sampled at least once. Soil samples will be taken through the
30 core hole in the pad or floor. Samples will be taken from the surface at
31 30 centimeters (1 foot), 61 centimeters (2 feet), and 1 meter (3 feet).

32
33 **7.2.1.5.4 Floor.** Core sampling locations for the trench are shown in
34 Figure 7-4 and the core sampling locations for the concrete floor are shown in
35 Figure 7-2. According to historical records, only the northern portion of the
36 building was used to store dangerous or mixed waste. Three sampling locations
37 within the approximately 64 1-square meter floor grids will be core sampled.
38 The soil beneath cracks in the building floor will be sampled as described in
39 Section 7.2.1.5.3.

40
41 **7.2.1.6 Data Quality.** To ensure quality data, all sampling will be conducted
42 in conformance with onsite procedures (WHC 1988). All laboratory analyses
43 will be performed in accordance with standard EPA methods described in the
44 most recent edition of SW-846 (EPA 1986). The EPA guidelines for reporting
45 accuracy, precision, method detection limits, and limits of quantification
46 specified in the analytical methods will be met.

47
48 Quality control of sampling will be ensured by using field duplicates,
49 equipment blanks, and trip blanks. Each of these sample types is discussed in
50 Section 7.2.8. Quality control of records and documentation will be
51 accomplished by following procedures outlined in EII 1.6, "QA Records
52 Processing" (WHC 1989).

1 Sampling records to be kept on file include field notes, daily memoranda,
2 records of meetings, and activities concerning the sampling program, and
3 chain-of-custody records. In addition, QC will be implemented through the
4 recording of field memoranda and field notes. The types of records and
5 documentation required for all samples are described in Section 7.2.8.

6
7 Appendix F contains the quality assurance project plan (QAPJP) for
8 sampling and analysis at the 303-K Storage Facility.

9 10 7.2.2 Modifications to the Waste Sampling and Analysis Plan

11
12 The optimal aspects of sample design are sometimes not achievable because
13 of unanticipated or changing conditions. Factors adversely influencing
14 sampling efforts can include equipment malfunction or breakdown, improper
15 equipment, physical barriers to coring equipment, and overly optimistic
16 evaluation of other physical conditions at sites with no previous history of
17 dangerous waste characterization. When changes to the planned activity are
18 necessary, the changes will be recorded in the field logbook along with
19 circumstances requiring the action. The field logbook will be reviewed and
20 signed by the project manager daily, as described in EII 1.5, "Field Logbooks"
21 (WHC 1988). This procedure will provide an accurate record of changes and
22 approvals, while allowing sampling to proceed safely while maintaining
23 efficient manpower and equipment usage. When deviations from an EII are
24 required, procedures outlined in EII 1.4, "Instruction Change Authorization"
25 (WHC 1988) will be followed. In addition, any changes to the closure plan
26 will be in accordance with WAC 173-303.

27 28 29 7.2.3 Data Evaluation Process

30
31 Analytical results from the 303-K Storage Facility sampling will be
32 compiled, evaluated, and summarized in the following manner:

- 33
34 • Conduct the statistical evaluation of the analytical data as described
35 in Section 7.2.4
- 36
37 • Prepare summary statistics for constituents as described in
38 Section 7.2.4
- 39
40 • Test the significance of the location and/or depth effects of
41 analytical results
- 42
43 • Compare the sample results to the action levels.

44 45 46 7.2.4 Statistical Treatment of Data

47
48 All data collected will be analyzed and tabulated for evaluation using
49 the methods described in SW-846 (EPA 1986). Other guidance documents and
50 statistical references may be used where applicable [e.g., Barth and
51 Mason 1984 and *Statistical Analysis of Ground Water Monitoring Data at RCRA*
52 *Facilities, Interim Final Guidance* (EPA 1989c)]. Laboratory data will be

1 provided to Ecology upon completion of sampling and analysis. Data for
2 individual constituents will be summarized and will include the following
3 information:

- 4
- 5 • Number of less than detection limit values
- 6 • Total number of values
- 7 • Mean values
- 8 • Standard deviation
- 9 • Accuracy
- 10 • Coefficient of variation
- 11 • Method detection limit values
- 12 • LOQ values
- 13 • Representative method precision
- 14 • Median value
- 15 • Minimum value
- 16 • Maximum value.

17
18 The data will be interpreted by qualified scientists and statisticians.
19 Data evaluation will be based on statistical criteria and professional
20 judgment as appropriate.

21 22 23 **7.2.5 Assessment of Data Reliability**

24
25 Data reliability will be assessed by evaluating the sample handling and
26 analysis QC. Sample handling QC will be evaluated by reviewing field
27 documentation and results of QA samples to establish that sampling error was
28 minimized. The review will be conducted to verify that decontaminated
29 equipment was used, cross-contamination was minimized, samples were preserved
30 properly, and that the chain of custody of the samples was not broken.

31
32 Analytical data received from any sampling performed at the 303-K Storage
33 Facility will be scrutinized against the QC report provided by the contractor
34 laboratory to assess the reliability of the results. Both organic and
35 inorganic chemical analytical results will be checked as follows:

- 36
- 37 • Inorganic chemical analysis laboratory assessment
 - 38 - Holding times are acceptable
 - 39 - Contractor's detection limits are below those required by the EPA
 - 40 - Laboratory blanks and replicates are within established QC limits
 - 41 - Sample spike recoveries are within QC limits
- 42
- 43 • Organic chemical analysis laboratory assessment
 - 44 - Holding times are acceptable
 - 45 - Instrument detection limits, blank recoveries, surrogate
 - 46 recoveries, and spike recoveries are within EPA established
 - 47 QC limits.
- 48
- 49

1 7.2.6 Reporting

2
3 After completion of the sampling effort, verification documents will be
4 provided for actual sample locations, number of samples, and specific methods
5 used for collection if different from those provided in this waste sampling
6 and analysis plan. Data received from the laboratory will be reviewed,
7 analyzed, and summarized statistically. The results will be used to provide
8 further closure evaluations.

10 7.2.7 Sampling Equipment, Containers, and Preservation

11 This section describes the equipment, containers, and preservation
12 methods used for sample collection at the 303-K Facility.

13 7.2.7.1 Sampling Equipment. Sampling equipment to be used will be
14 appropriate to the spectrum of media that might be encountered. The media to
15 be sampled consist of the following:

- 16 • Concrete
- 17 • Soils
- 18 • Asphalt.

19 The following are examples of the types of sampling equipment that might
20 be used during the various phases of the investigation:

21 <u>Concrete/asphalt</u>	22 <u>Soils/gravel</u>
23 • Concrete/asphalt 24 coring device	25 • Auger 26 • Split spoon 27 • Trowel 28 • Scoop 29 • Shovel

30 An auger and split spoon will be used to collect soil and gravel samples
31 if site conditions permit. Otherwise, a trowel, scoop, or shovel will be
32 used. The sampling equipment will be constructed of stainless steel or have
33 liners constructed of inert materials.

34 Additional equipment and supplies will be procured as required to perform
35 the necessary sampling. Equipment could include, but not be limited to, the
36 following items:

- 37 • Bore or wire brushes
- 38 • Stainless steel mixing bowls
- 39 • Sized, heavy-duty plastic bags
- 40 • Stainless steel spatulas, scoops, and spoons
- 41 • Adhesive tape
- 42 • 100-foot steel tape, 12-foot steel tape
- 43 • Compass
- 44 • Indelible marking pens or pencils

- 1 • Hammer/sledgehammer
- 2 • Ice chests and ice
- 3 • Security tape, flagging
- 4 • Gloves of material suitable for anticipated hazards
- 5 • Field radio
- 6 • Rags
- 7 • Appropriate drawings and maps
- 8 • Tags
- 9 • Plastic sheeting
- 10 • Water containers
- 11 • Extra glass and plastic bottles (in case of breakage or contamination)
- 12 • Industrial-size shop vacuum
- 13 • Teflon sheets
- 14 • Concrete.

15
16 **7.2.7.2 Sample Containers and Preservation.** Sample containers will be chosen
17 based on their compatibility with the samples, resistance to leaking or
18 breakage, ability to seal tightly, and capacity to hold the required volume
19 for an optimum sample. Containers for collecting and sorting samples will be
20 made of high-density plastic or glass appropriate for the constituents to be
21 analyzed. The containers will have tight, screw-type lids with Teflon cap
22 liners for glass bottles.

23
24 All samples will be packaged according to EII 5.11, "Sample Packaging and
25 Shipping" (WHC 1988), placed in an ice chest, and cooled to 4 ± 2 °C
26 immediately after collection. Soil and sediment sample containers will be
27 those specified in EII 5.2, "Soil and Sediment Sampling" (WHC 1988). Because
28 the samples will be collected from radiation zones, the samples must be
29 checked by a radiation protection technologist before being removed from the
30 site, according to onsite operating procedures and the site-specific health
31 and safety plan (HASP) to be developed. For samples collected from radiation
32 zones, a dose assessment will be conducted for use in developing an as low as
33 reasonably achievable (ALARA) plan for sampling activities. The assessment
34 will be conducted in a manner that will not compromise the validity of the
35 sample. All deviations from SW-846 protocols (EPA 1986), including sample
36 size, will be documented with a justification for the deviation.

37 38 39 **7.2.8 Sampling Quality Control**

40
41 The required QC procedures will be followed to adequately control
42 sampling activities. The various QC procedures are described in the following
43 sections.

44
45 **7.2.8.1 Field Quality Control.** Field QC will be accomplished by various
46 sampling duplicates and blanks, as described in the following paragraphs. The
47 QC samples will be taken as listed in Table 7-3.
48

49 *Teflon is a trademark of E. I. duPont de Nemours and Company,
50 Incorporated.

1 Field duplicate samples will be taken for concrete cores and underlying
2 soils. Duplicate samples are two separate samples collected from the same
3 sampling point and placed into separate containers. The duplicates will
4 indicate the repeatability of the analytical data.

5
6 Equipment blanks will serve as a check on sampling device cleanliness.
7 An equipment blank will consist of distilled water that is transported to the
8 site, opened in the field, and poured over or through the sample collection
9 device, collected in a sample container, and returned to the laboratory for
10 analysis. These samples will be collected daily.

11
12 Trip blanks will identify any possible contamination originating from
13 container preparation methods, shipment, handling, storage, or site
14 conditions. Trip blanks will consist of pure deionized, distilled water in a
15 clean sample container, which will accompany each batch of containers shipped
16 to the field. Trip blanks will be returned unopened to the laboratory for
17 analysis.

18
19 **7.2.8.2 Field Logbook.** The personnel conducting sampling will maintain an
20 official logbook during the effort, as outlined in EII 1.5, "Field Logbooks"
21 (WHC 1988). The book will be bound and will have consecutively numbered
22 pages. All information pertinent to the sampling must be recorded in the
23 logbook in a legible fashion. If changes are necessary, changes will be
24 indicated by a single line drawn through the affected text. The individual
25 responsible for the change will initial and date the entry. Each day's
26 activities or separate sampling episodes must be signed. The logbook will be
27 protected, stored in a safe file or other repository, and retained as a
28 permanent record.

29
30 The following types of information will be included in the logbook:

- 31 • Site map, sketch, drawing, or other definitive site description
 - 32 • Locations of all sampling points, including reference points and scale
 - 33 • Sample method
 - 34 • Sampling location
 - 35 • Date and time of collection
 - 36 • Collector's name
 - 37 • Number, type, and volume of samples taken
 - 38 • Identification number for each sample
 - 39 • Field observations (weather conditions, temperature, wind, wetness,
40 and appearance of sample)
 - 41 • Laboratory of destination
- 42
43
44
45
46
47
48
49
50
51
52

- 1 • Field measurements, including the results of the radiation survey
- 2
- 3 • Signature of recording personnel.
- 4
- 5

6 The following items could be included in the logbook:

- 7
- 8 • Name and address of field contact
- 9
- 10 • Producer of waste
- 11
- 12 • Type of process
- 13
- 14 • Type of waste
- 15
- 16 • Type and/or purpose of sampling
- 17
- 18 • Sample transportation method
- 19
- 20 • Photographs of site for field conditions and site location
- 21 verification.
- 22

23 **7.2.8.3 Sample Labels.** Labels will be securely attached to each sample to
24 prevent misidentification. Labels can be adhesive labels or tags and will be
25 affixed to the proper sample containers before or at the time of collection.
26 All information will be completed at the time of collection. Indelible pencil
27 or ink must be used. Each label will contain at least the following
28 information:

- 29
- 30 • Site contractor
- 31 • Collector's name
- 32 • Date and time collected
- 33 • Sample number.
- 34

35 **7.2.8.4 Sample Seals.** Sample seals will be used to prevent and/or detect
36 tampering with samples between the time of collection and the beginning of
37 analysis. Seals will be applied to the sample containers before the
38 containers leave the sample location. The seals will be attached so the seal
39 must be broken to open the container.

40

41 **7.2.8.5 Chain-of-Custody Records.** To ensure the integrity of the samples
42 from collection through analysis to final disposition, documentation will be
43 necessary to trace sample possession and handling. This documentation
44 generally takes the form of a record providing a history of all the people
45 having custody of the sample, including the following situations when a sample
46 is:

- 47
- 48 • In a person's physical possession
- 49 • In view of a person
- 50 • Secured by an individual to prevent tampering
- 51 • Placed in an area restricted to authorized personnel only.
- 52

1 A chain-of-custody record will be completed and must accompany all
2 samples from collection to analysis. Multiple copies will be required, and at
3 least one copy must be maintained by the sampling supervisor. The following
4 information will be included:

- 5
- 6 • Contractor
- 7 • Sample numbers
- 8 • Date and time collected
- 9 • Sample type
- 10 • Number of containers
- 11 • Collector's signature
- 12 • Signature of person receiving possession
- 13 • Inclusive dates of possession
- 14 • Condition of samples upon receipt.

15
16 Procedures outlined in EII 5.1, "Chain of Custody" (WHC 1988) will be
17 followed.

18
19 **7.2.8.6 Sample Analysis Request.** The sample analysis request form is
20 designed to accompany the samples to the laboratory and to designate the
21 analyses to be performed on each sample. This form also provides a check to
22 ensure that all samples have been received and that correlation between sample
23 analysis and sample number is finalized and complete.

24
25 This form should include the following information:

- 26
- 27 • Contractor
- 28 • Company contact
- 29 • Collector
- 30 • Sample number
- 31 • Sample type
- 32 • Analysis requested
- 33 • Data and time collected
- 34 • Laboratory sample custodian.

35
36 Procedures outlined in EII 5.1, "Chain of Custody," and 5.2, "Soil and
37 Sediment Sampling" (WHC 1988) will be followed.

38
39 **7.2.8.7 Laboratory Receipt and Logging of Sample.** In the laboratory, a
40 sample custodian will be assigned to receive the samples. Upon receipt of a
41 sample, the custodian will (1) inspect the condition of the sample and the
42 sample seal, (2) verify the information on the sample label and seal against
43 that on the chain-of-custody record, (3) assign a laboratory number, (4) log
44 in the sample in the laboratory logbook, (5) store the sample in a secured
45 sample storage room or cabinet, which is adequate for the preservation
46 requirements of the sample, and (6) report missing or damaged samples
47 immediately. The results of the radiation survey data will be provided to the
48 laboratory performing analyses of those samples exhibiting activity greater
49 than 200 counts/minute.

50
51 **7.2.8.8 Sample Disposition.** At the certified completion of all analyses, the
52 samples will be returned to the collector. In no case will the samples be

1 retained longer than 3 years unless specifically designated by the cognizant
2 engineer.
3

4 **7.2.8.9 Decontamination.** This section discusses personnel, equipment, and
5 sample containers decontamination procedures.
6

7 **7.2.8.9.1 Personnel Decontamination Procedures.** A decontamination area
8 will be established near the 303-K Storage Facility and upwind of sampling
9 activity. If it is not possible to provide a decontamination area upwind and
10 the wind is a problem, sampling will not occur that day. Procedures for
11 personnel decontamination will be provided in a HASP. In addition, the
12 303-K Storage Facility-specific HASP will be prepared before sampling and
13 added to the closure plan at that time. This plan (titled a hazardous waste
14 operation permit) will be prepared in accordance with EII 2.1, "Preparation of
15 Site Specific Health and Safety Plans" (WHC 1988).
16

17 **7.2.8.9.2 Equipment Decontamination.** Extreme care is necessary in field
18 sampling to ensure that there is no cross-contamination of samples by sampling
19 equipment. To prevent this source of contamination, freshly cleaned or
20 disposable sampling tools will be used. When equipment must be reused in the
21 field, it will be cleaned as thoroughly as practical in accordance with
22 EII 5.4, "Field Cleaning and/or Decontamination of Equipment" (WHC 1993).
23 Decontamination wash water will be placed in 55-gallon containers and
24 solidified with a clay mixture for disposal as solid low-level radioactive or
25 mixed waste. Whenever possible, equipment will be cleaned in the laboratory
26 according to procedures specified in EII 5.5, "1706 KE Laboratory
27 Decontamination of RCRA/CERCLA Sampling Equipment" (WHC 1988).
28

29 **7.2.8.9.3 Sampling Container Decontamination Procedures.** Containers
30 will be purchased pre-cleaned from the factory and maintained under strict
31 chain of custody to preserve the integrity of the samples from collection
32 through disposal. Sample containers will be disposed of after analysis.
33

34 **7.2.9 Analytical Procedures**

35
36
37 Analyses of all constituents except uranium will be performed by the
38 laboratory in accordance with EPA requirements in SW-846 (EPA 1986). The EPA
39 specified detection limits are goals; the actual detection limits will be
40 presented in the analytical certification reports. One of two methods will be
41 used for uranium analysis (Table 7-1). The SCINTREX^{*} UA-3 laser method may
42 be better suited to detect uranium than the EPA method that detects only gross
43 alpha and beta.
44

45 **7.2.9.1 Concrete and Asphalt Inorganic Analysis Methodology.** Ecology
46 guidelines for sampling inorganics in concrete and asphalt will be followed.
47 The preferred concrete inorganic analysis methodology involves a two-part
48 process. The initial part is hot acid digestion (SW-846 Method 3050), with
49 total metals analysis using inductively coupled plasma atomic emission

50 ^{*}SCINTREX is a trademark of SCINTREX, Inc.

1 spectroscopy (ICP-AES) (SW-846 Method 6010, EPA 1986). This part indicates
2 which metals are present in the concrete matrix in sufficient quantities to
3 present a potential threat to the environment. The second part, which is
4 performed on a second test portion of sample material, is the toxicity
5 characteristic leaching procedure (SW-846 Method 1311) followed by total
6 metals analysis using ICP-AES (SW-846 Method 6010). This part determines if
7 any of the metals present can leach out of the concrete matrix and pose a
8 threat to human health and the environment.

9
10 Both parts will be conducted with a full analysis for all constituents of
11 concern. This will ensure that all potential inorganic contamination
12 constituents are included and identified rather than only for those that show
13 high concentrations in the initial part.

14
15 **7.2.9.2 Concrete and Asphalt Organic Analysis Methodology.** There is not an
16 established analytical method for volatile organics analysis (VOA) of concrete
17 or asphalt samples. The most promising method is that for soils and sediments
18 as given in SW-846 Method 8260A (EPA 1986). However, this method is
19 undocumented for concrete or asphalt analysis. The problems and uncertainties
20 associated with using Method 8260A for concrete and asphalt VOA can be reduced
21 with a modified procedure for collecting the VOA contamination from a sample
22 of concrete or asphalt. The collection methodology desorbs the organic
23 constituents from the concrete or asphalt into high purity water using
24 agitation provided by an ultrasonic bath. The water is then analyzed for
25 volatile organics by gas chromatography/mass spectroscopy (GC/MS) using a
26 modified procedure based on SW-846 Method 8260A (EPA 1986). This methodology
27 will only be used if it is not possible to avoid sampling for organics.

28 29 30 **7.2.10 Laboratory Quality Control**

31
32 The contractor laboratory will ensure the integrity and validity of test
33 results through implementation of an internal QC program. The program will
34 meet the QC criteria of SW-846 (EPA 1986). A system of reviewing and
35 analyzing the results of these samples will be maintained to detect problems
36 caused by contamination, inadequate calibrations, miscalculations, improper
37 procedures, or other factors. Standard methods will be used whenever
38 possible. Alternative methods that are developed or adapted will be tested
39 and completely documented per the requirements of SW-846 (EPA, 1986). All
40 methods and method changes will be approved by an onsite contracts
41 representative.

42
43 The QC procedures for dangerous waste analyses will include [as
44 appropriate to each analysis and as specified in Section 1.2 of SW-846
45 (EPA 1986)] evaluation of blanks, duplicates random matrix spikes (for
46 10 percent of the samples), internal standards, surrogates, and standard
47 calibration curves. Spikes will be added in amounts depending upon the amount
48 of analyte present in the sample. The QC procedures specific to individual
49 methods will be detailed in the laboratory's documented analytical procedures
50 and QC data included with each batch of samples analyzed. Appendix F contains
51 the QAPP.
52

1 7.2.11 Site Safety
2

3 This section discusses the site-specific health and safety plan,
4 contamination control and waste handling, personnel training, and standard
5 safety procedures.
6

7 7.2.11.1 Health and Safety Plan. A HASP is required for all dangerous waste
8 sampling sites. HASP is intended to specify information pertinent to field
9 assignments and to be a guide in unusual situations or emergencies. A site-
10 specific version of the general RCRA/CERCLA investigation health and safety
11 manual will be developed for use in sampling at the 303-K Facility. The
12 site-specific HASP will be prepared in accordance with EII 2.1, "Preparation
13 of Site-specific Health and Safety Plans" (WHC 1988).
14

15 7.2.11.2 Contamination Control. Because sampling is to be undertaken within
16 a radiological control area, standard onsite radiation work procedures will be
17 followed. In addition, the following activities will be performed:
18

- 19 • Modification to personnel decontamination procedures--All
20 modifications to decontamination procedures will be approved by the
21 field team leader (cognizant engineer) and the site safety officer.
22 Modifications will be recorded in the appropriate logbooks.
23
- 24 • Disposal procedures--Excess sample material will be containerized in a
25 17-H open-headed 55-gallon container. Rinse waters also will be
26 containerized. Disposal procedures of unknown or suspect waste
27 materials will be performed in accordance with EII 4.2, "Interim
28 Control of Unknown, Suspected Hazardous and Mixed, and Radioactive
29 Waste" (WHC 1988).
30

31 Waste materials are designated as unknown waste when:
32

- 33 - Criteria for suspected hazardous waste are not met
- 34 - Field readings are suspect.
35

36 Waste material will be designated as suspected hazardous waste based
37 on process knowledge of material that is known to have been discharged
38 to the area under investigation, provided the following:
39

- 40 - Direct instrumentation reading of organic vapor is in excess of
41 10 parts per million above background levels
- 42 - pH is less than 3 or greater than 12.
43

44 Articles such as protective clothing that have been soiled with
45 potentially contaminated materials will be temporarily placed in
46 containers.
47

48 In accordance with WAC 173-303-200(2) and EII 4.2 (WHC 1993), the
49 55-gallon containers will be stored in satellite accumulation areas.
50 When waste is generated, the major risk(s) will be marked on the
51 containers. Sampling and analysis will be conducted as needed to
52 complete waste designation. When a container is full it will be
53 marked with the accumulation data (drum fill date). Then the

1 container will either be moved to a less-than-90-day accumulation area
2 or shipped directly to a different RCRA permitted
3 treatment/storage/disposal facility within 72 hours of filling the
4 drum. If a less-than-90-day accumulation area, the waste will be
5 moved to a different RCRA permitted treatment/storage/disposal
6 facility within 90 days of the accumulation date. If hazardous
7 contamination is not found, materials will be laundered or disposed of
8 according to onsite procedures that are written in accordance to
9 WAC 173-303, DOE orders, and 40 CFR 261.

10
11 **7.2.11.3 Personnel Training.** All personnel involved with the closure
12 activities at the 303-K Storage Facility will receive a minimum level of
13 dangerous waste training as follows:

- 14 • Managers and supervisors are responsible for supervising,
15 coordinating, and directing the closure activities and personnel.
- 16
17 • Metal operators and decommissioning and decontamination workers are
18 responsible for packaging and handling dangerous waste (both
19 nonradioactive and radioactive material).
- 20
21 • Samplers are responsible for obtaining the samples.
- 22
23 • Health physics technicians are responsible for surveying for
24 radiological contamination.
- 25
26 • Crafts personnel are responsible for specialized work. The various
27 crafts include carpenters, electricians, ironworkers/riggers, heavy
28 equipment operators, crane operators, millwrights, pipefitters, and
29 painters.
- 30
31

32 Table 7-4 contains a matrix that relates job categories to the individual
33 training course. Appendix E contains brief descriptions of the training
34 courses, including descriptions of the target audience, instructional
35 technique, evaluation method, length of course, and frequency of retraining.

36
37 **7.2.11.4 Standard Safety Procedures.** The following safety procedures will
38 apply each time personnel make a site entry for sampling purposes:

- 39 • No personnel will be at the site without a designated 'buddy'.
- 40
41 • One of the people entering the site will be designated to be in
42 charge.
- 43
44 • Personal protective equipment will be worn as specified. Approved
45 deviations will be entered in the field logbook and signed by the
46 field team leader (cognizant engineer) and the site safety officer.
- 47
48 • Field work will be planned before the site is entered.
- 49
50

- 1 • Equipment needed for work will be inventoried and inspected before the
2 site visit to ensure that all equipment is present and in operable
3 condition.
4

5
6 **7.3 REMOVAL OF CONTAMINATED MATERIAL AND WASTE RESIDUES**
7

8 Waste remaining in the building and in the outside storage areas at the
9 commencement of closure activities will be removed. General housekeeping
10 cleanup procedures will be followed to remove any remaining waste residues.
11

12
13 **7.4 DECONTAMINATION AND DISPOSAL OF BUILDING AND CONCRETE PAD**
14

15 The building's interior will be decontaminated using some combination of
16 the following techniques:
17

- 18 • Damp wipe downs
19 • Vacuum-assisted mechanical removal
20 • Sandblasting
21 • High-pressure steam and suction.
22

23 It is anticipated that a majority of the decontamination work can be
24 accomplished using damp wipe downs and vacuuming. However, the actual method
25 of decontamination will be specified in a decommissioning work plan, which
26 will address each area of concern (sandblasting or scabbling might be
27 necessary for some floor areas, while this method might be inappropriate and
28 unnecessary for wall areas). Decontamination waste will be tested for the
29 constituents in Table 7-1 to determine the appropriate method of disposal.
30

31 A 'decommissioning work plan' is a generic term for the implementation
32 procedure used to provide specific field direction to workers actually
33 performing the decontamination and demolition. The general decontamination
34 information is included in Sections 7.3, 7.4, and 7.5. The actual
35 decommissioning work plan will specify sufficient detail for field
36 implementation of the items addressed in these sections. The decommissioning
37 work plan will be included as an appendix in the closure plan. This will take
38 place just before the work begins.
39

40 Sampling (as described in Section 7.2) will be conducted following the
41 cleaning process to determine the effectiveness of the cleaning procedure and
42 the appropriate remedial options.
43

44 The analytical results of the concrete and asphalt core samples will be
45 evaluated to determine if the building and storage pads can be used for less-
46 than-90-day storage. If portions of the building and storage pads do not meet
47 the action levels presented in this closure plan, those portions will be
48 removed and disposed of based on the following criteria:
49

- 50 • If the material is a dangerous waste (only), the material will be
51 transported and disposed of offsite at a permitted treatment, storage,
52 and/or disposal (TSD) facility.

- 1 • If the material is mixed waste, the material will be transferred to
2 the Central Waste Complex for interim storage and future treatment or
3 disposal. Requirements for solid mixed waste packaging, storage, and
4 disposal (WHC 1991) will be followed when preparing waste for storage
5 and/or disposal.
6
- 7 • If the material is not dangerous but is low-level radioactive waste,
8 the material will be disposed of onsite in the 200 Area.
9

10 With the exception of an imminent health threat, all soil remediation
11 will take place under the CERCLA remedial action process for the 300-FF-3
12 operable unit.
13

14 7.5 OTHER ACTIVITIES REQUIRED FOR CLOSURE

15 An interim cover might be placed over the building location if the
16 building and outside storage pads are removed and if WAC 173-303 contaminants
17 are left in place, pending remediation of the 300-FF-3 operable unit. The
18 cover material will depend on the results of the soil samples but could
19 consist of packed clay, asphalt, concrete, a synthetic liner, fixative spray,
20 or a combination of these materials. Reclamation might be justified to
21 control dust, erosion, surface water run-off, and to promote postclosure
22 usage. Site restoration might include backfilling disturbed soil areas with
23 noncontaminated native soil, compaction, and grading (Chapter 8.0,
24 Section 8.2).
25

26 Depending on the surface area, method, material, and location of areas to
27 be decontaminated, a greenhouse might be necessary to control the spread of
28 low-level radiological and dangerous contaminants. This greenhouse will
29 provide a negative air pressure (via HEPA filter-equipped exhauster), airlock
30 entry and exits, and other attributes similar to an asbestos work enclosure
31 described by EPA in *Asbestos Waste Management Guidance* (EPA 1985).
32

33 All equipment used during closure activities will be decontaminated or
34 disposed of according to the following:
35

- 36 • EII 4.2, "Interim Control of Unknown, Suspected Hazardous and Mixed,
37 Radioactive Waste" (WHC 1988)
38
- 39 • EII 5.4, "Field Cleaning and/or Decontamination Equipment"
40
- 41 • EII 5.5, "1706 KE Laboratory Decontamination of RCRA/CERCLA Sampling
42 Equipment" (WHC 1988).
43
44
45
46

47 7.6 SCHEDULE OF CLOSURE

48 Closure of the 303-K Storage Facility will begin on notification by
49 Ecology of closure plan approval. Closure will proceed according to the
50 schedule presented in Figure 7-8.
51
52

1 **7.7 AMENDMENT OF PLAN**
2

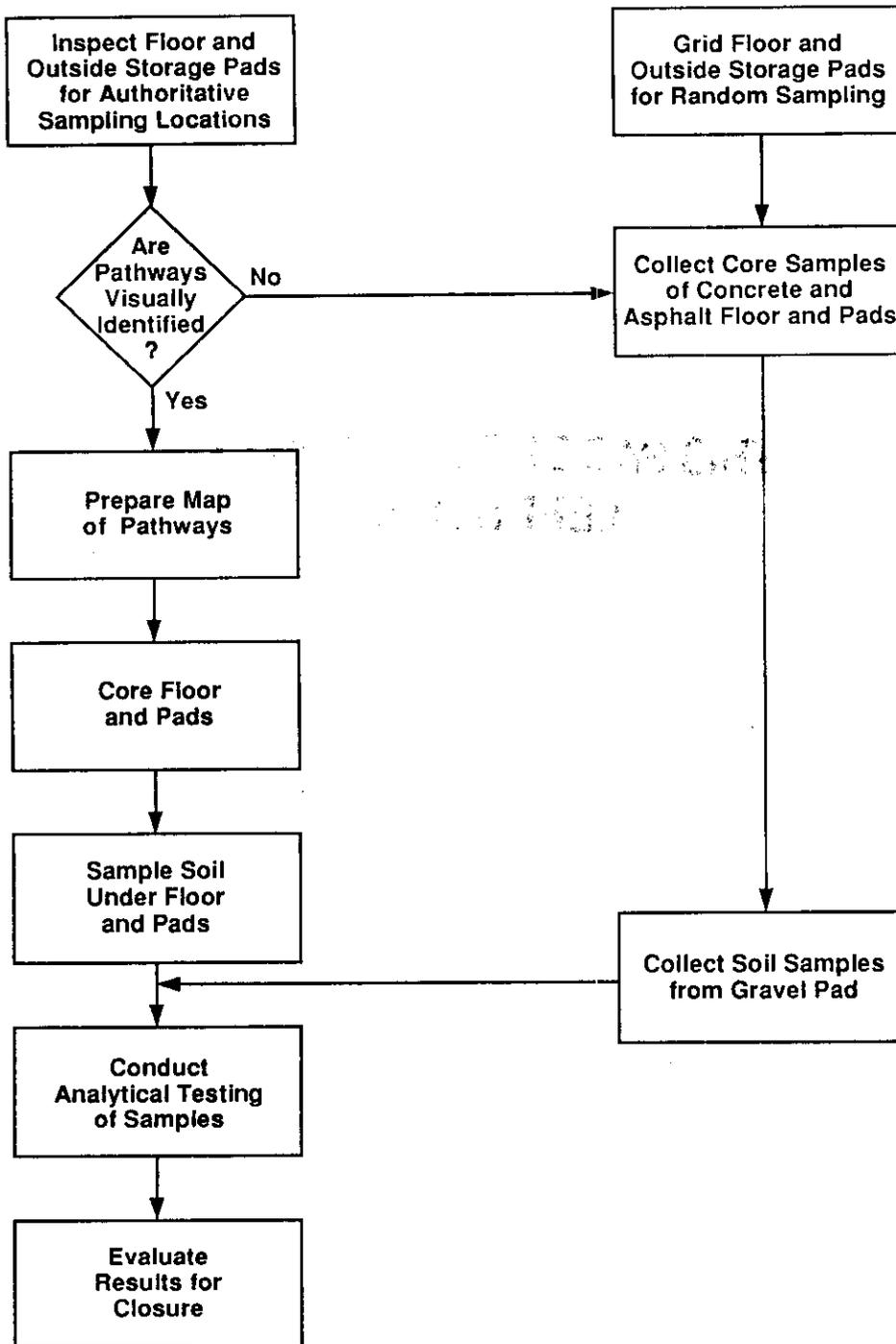
3 The closure plan for the 303-K Storage Facility will be amended whenever
4 changes in operating plans or design affect the closure plan, whenever there
5 is a change in the expected year of closure, or if, when conducting closure
6 activities, unexpected events require a modification to the closure plan. The
7 closure plan will be modified in accordance with WAC 173-303-610(3). This
8 plan may be amended any time before certification of final closure of the
9 303-K Storage Facility.

10
11 If an amendment to the approved closure plan is required, the DOE-RL will
12 submit a written request to Ecology to authorize a change in the approved
13 plan. The written request will include a copy of the closure plan amendment
14 for approval.
15
16

17 **7.8 CERTIFICATION OF CLOSURE**
18

19 Within 60 days of closure of the 303-K Storage Facility, the DOE-RL will
20 submit to Ecology a certification of closure. The certification will be
21 signed by both DOE-RL and an independent professional engineer. The
22 certification will state that the 303-K Storage Facility has been closed in
23 accordance with the approved closure plan. The certification will be
24 submitted by registered mail or an equivalent delivery service. Documentation
25 supporting the independent professional engineer's closure certification will
26 be retained and furnished to Ecology upon request.
27

28 The DOE-RL and the independent professional engineer will certify with a
29 document similar to Figure 7-9.



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Figure 7-1. Waste Sampling and Analysis Flowchart.

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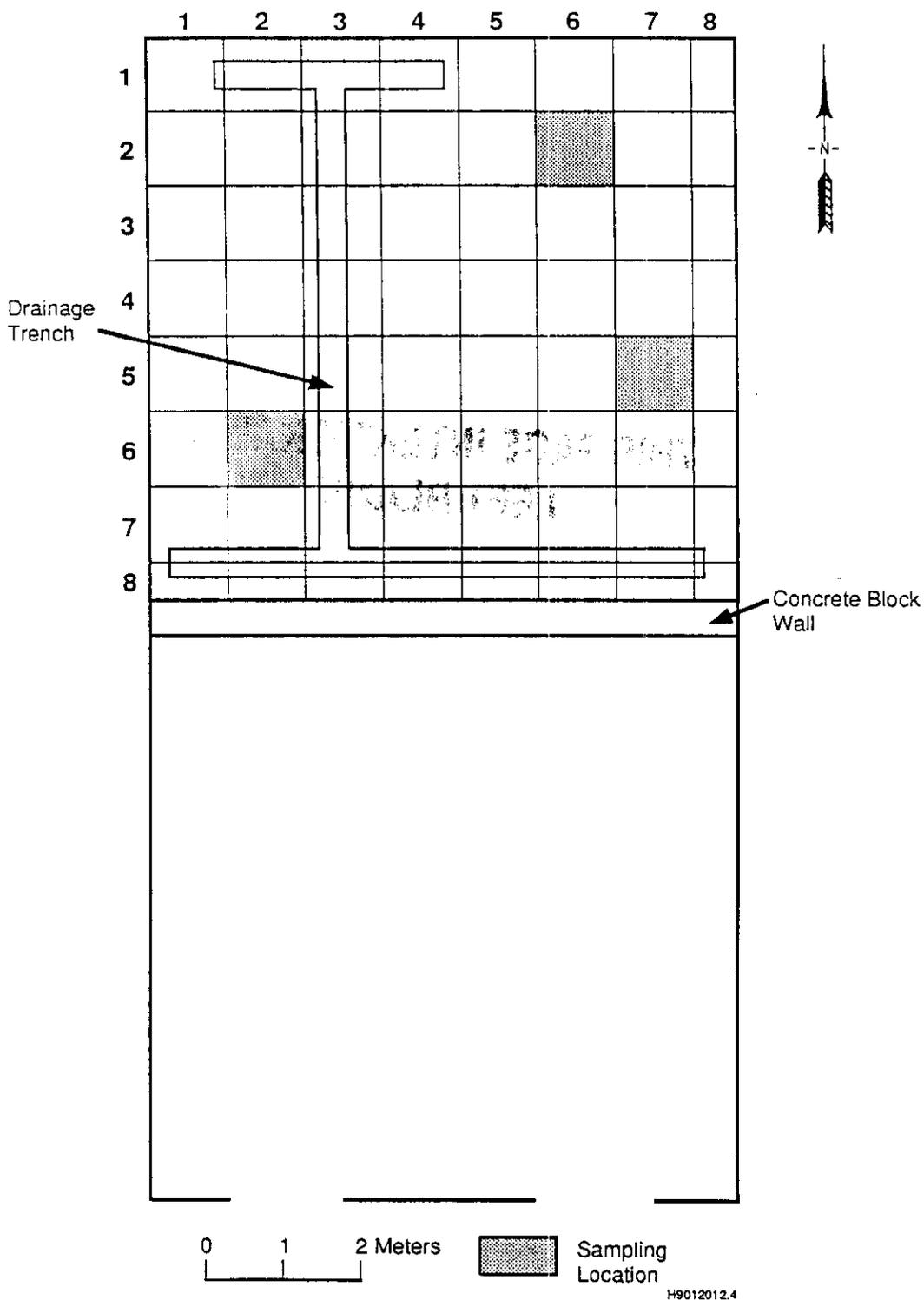
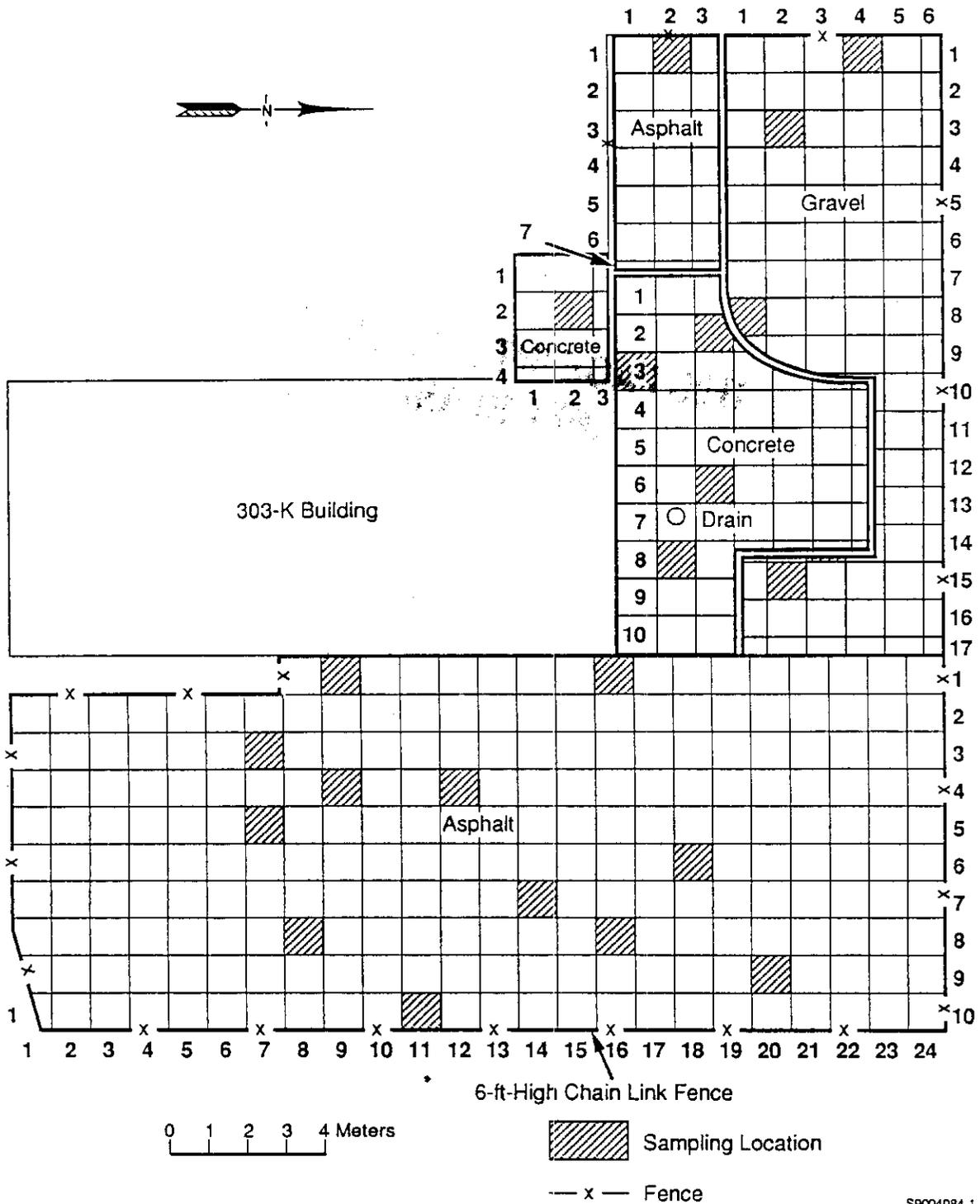


Figure 7-2. 303-K Storage Facility, Floor Core Sampling Locations.

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Figure 7-3. 303-K Storage Facility, Sampling Locations on Outside Storage Pads and in Gravel Area.

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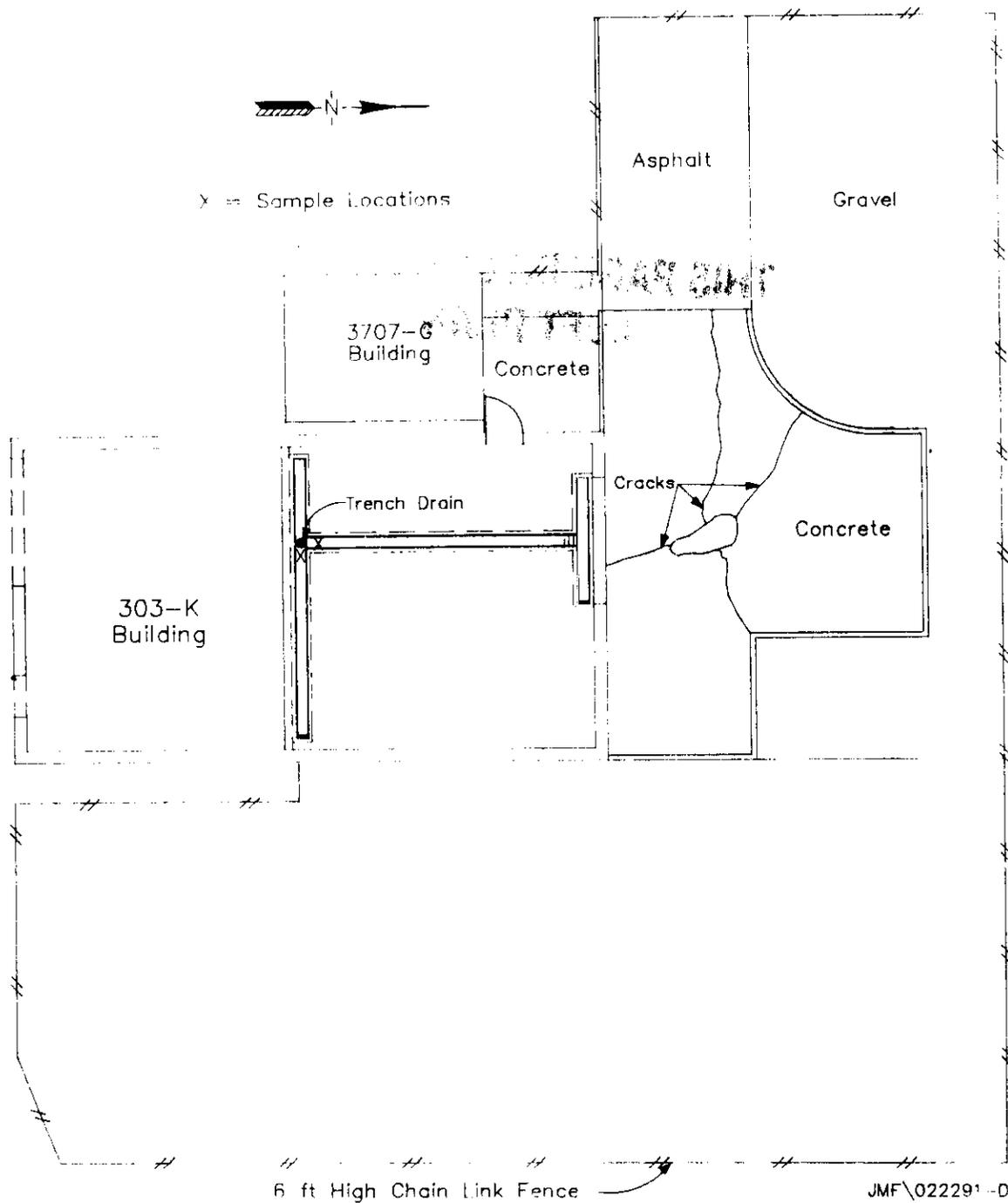
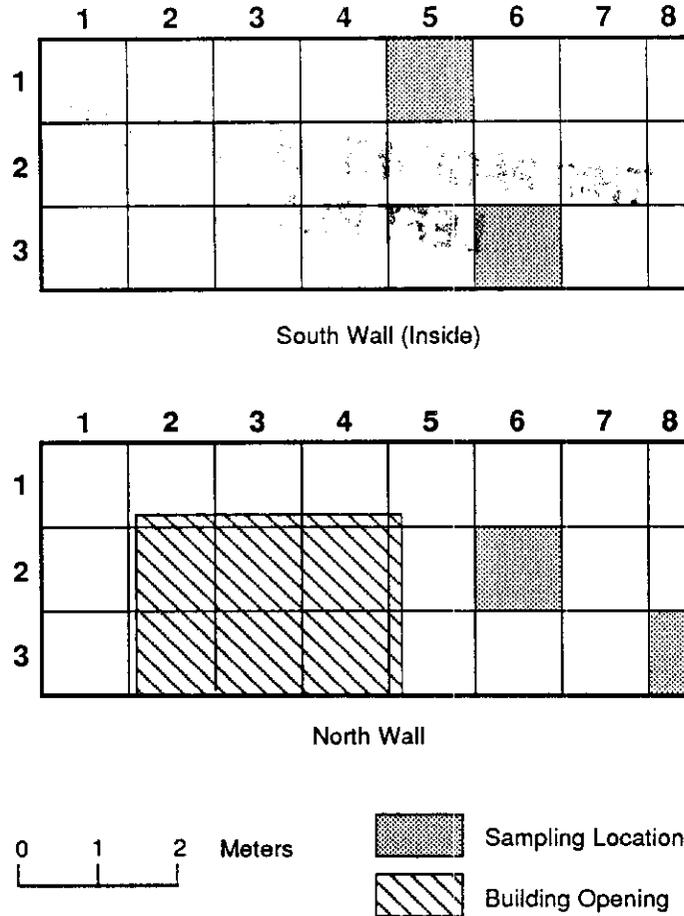


Figure 7-4. 303-K Storage Facility Sampling Locations in Areas of Potential Contamination.

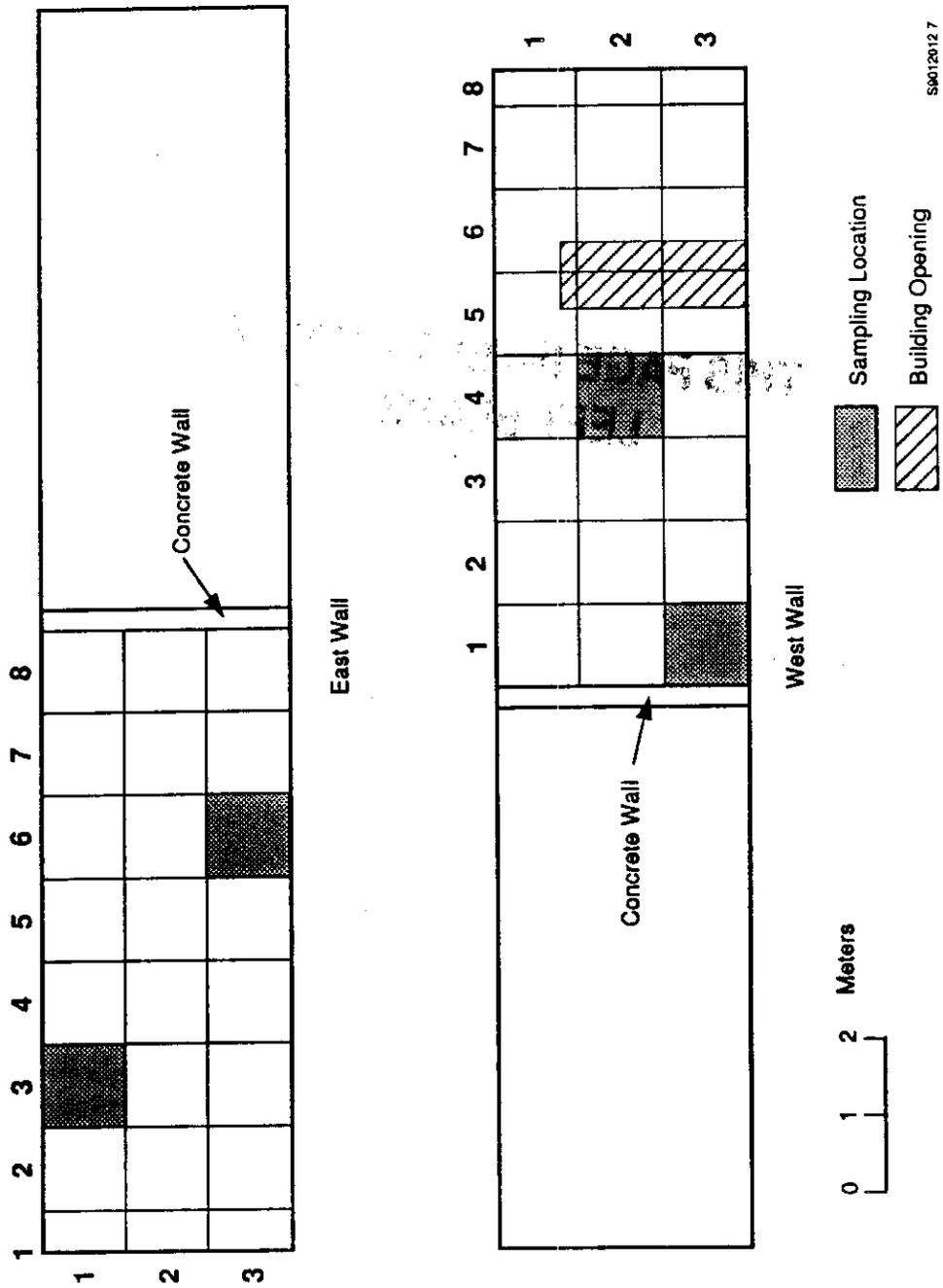
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Figure 7-5. 303-K Storage Facility, South Wall (Inside) and North Wall Sampling Locations.

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Figure 7-6. 303-K Storage Facility, East and West Wall Sampling Location.

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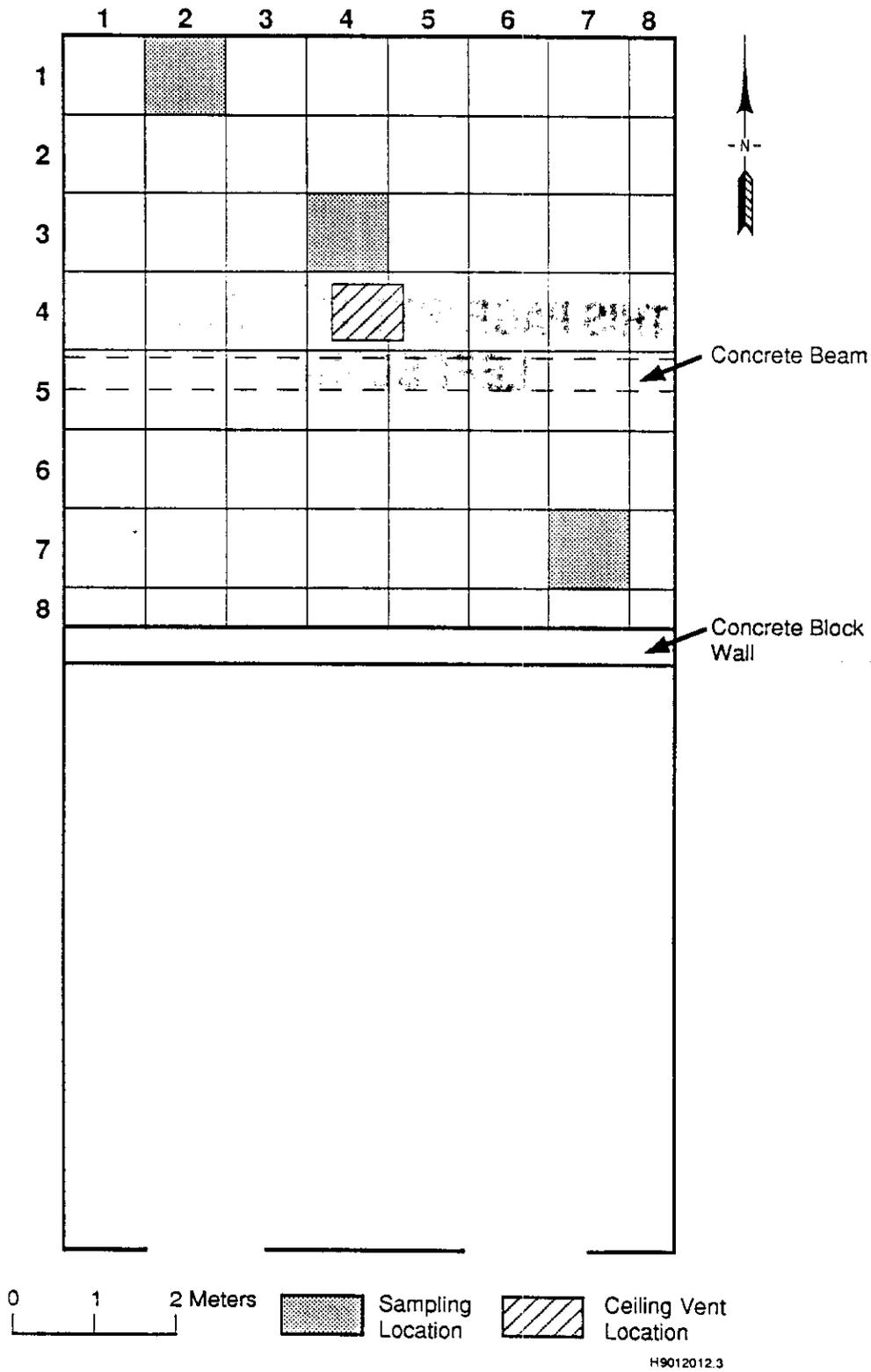
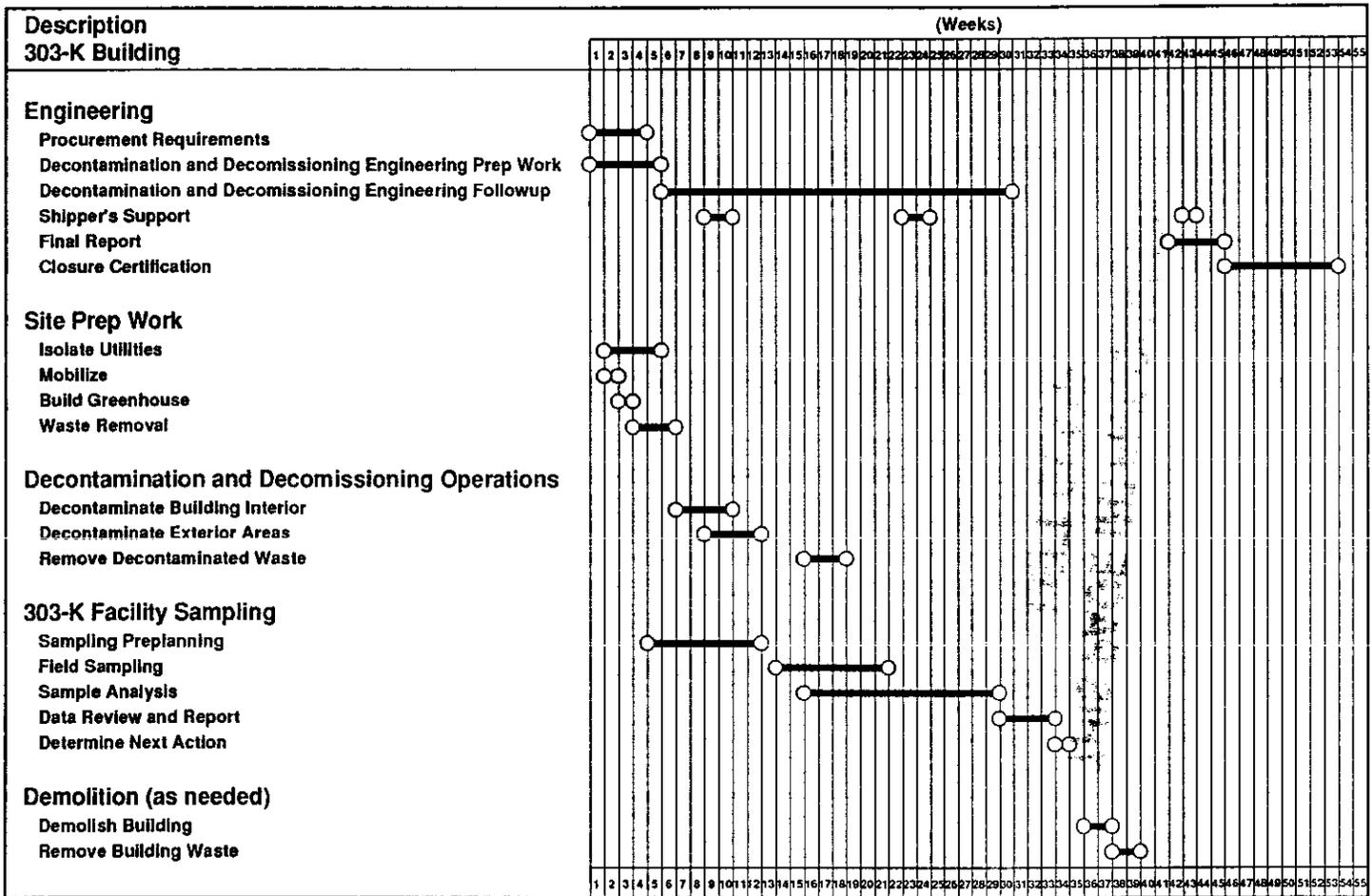


Figure 7-7. 303-K Storage Facility, Ceiling Sampling Locations.

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Figure 7-8. 303-K Storage Facility Closure Schedule.

F7-8



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**CLOSURE CERTIFICATION
FOR**

Hanford Facility
U.S. Department of Energy, Richland Field Office

We, the undersigned, hereby certify that all _____
_____ closure activities were performed in accordance
with the specifications in the approved closure plan.

Owner/Operator Signature DOE-RL Representative Date
(Typed Name)

Signature Independent Registered Professional Engineer Date
(Typed Name, Professional Engineer license number, state of issuance, and
date of signature) P.E.# _____ State _____

Figure 7-9. Closure Certification for the 303-K Storage Facility.

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Table 7-1*. Potential Compliance Constituents, Analytical Methods, and Action Levels for the 303-K Storage Facility.

Constituent	Analytical Method			Initial Action Levels		
	Soil	Concrete ^{a,b}	Asphalt ^{a,b}	Soil	Concrete	Asphalt
Arsenic	SW-846, 7060	SW-846, 7060	SW-846, 7060	>SWB	LOQ	LOQ
Barium	SW-846, 6010	SW-846, 6010	SW-846, 6010	>SWB	LOQ	LOQ
Beryllium	SW-846, 6010	SW-846, 6010	SW-846, 6010	>SWB	LOQ	LOQ
Cadmium	SW-846, 6010	SW-846, 6010	SW-846, 6010	>SWB	LOQ	LOQ
Chloride	SW-846, 9056	SW-846, 9056	SW-846, 9056	>SWB	LOQ	LOQ
Chromium	SW-846, 6010	SW-846, 6010	SW-846, 6010	>SWB	LOQ	LOQ
Lead	SW-846, 7421	SW-846, 7421	SW-846, 7421	>SWB	LOQ	LOQ
Mercury	SW-846, 7471	SW-846, 7471	SW-846, 7471	>SWB	LOQ	LOQ
Nickel	SW-846, 6010	SW-846, 6010	SW-846, 6010	>SWB	LOQ	LOQ
Nitrate	SW-846, 9056	SW-846, 9056	SW-846, 9056	>SWB	-	-
Nitrite	SW-846, 9056	SW-846, 9056	SW-846, 9056	>SWB	-	-
Silver	SW-846, 7761	SW-846, 7761	SW-846, 7761	>SWB	LOQ	LOQ
Uranium	LKPA	LKPA	LKPA	n/a	n/a	n/a
Trichloroethylene	SW-846, 8021 or 8240	SW-846, 8021 or 8240	SW-846, 8021 or 8240	>SWB	LOQ	LOQ
1,1,1-Trichloroethane	SW-846, 8021 or 8240	SW-846, 8021 or 8240	SW-846, 8021 or 8240	>SWB	LOQ	LOQ
1,1-Dichloroethane	SW-846, 8021 or 8240	SW-846, 8021 or 8240	SW-846, 8021 or 8240	>SWB	LOQ	LOQ
cis-1,2-Dichloroethane	SW-846, 8021	SW-846, 8021	SW-846, 8021	>SWB	LOQ	LOQ
trans-1,2-Dichloroethane	SW-846, 8021	SW-846, 8021	SW-846, 8021	>SWB	LOQ	LOQ
Toluene	SW-846, 8021 or 8240	SW-846, 8021 or 8240	SW-846, 8021 or 8240	>SWB	LOQ	LOQ
Tetrachloroethane (Perchloroethane)	SW-846, 8021 or 8240	SW-846, 8021 or 8240	SW-846, 8021 or 8240	>SWB	LOQ	LOQ
Ethyl Acetate	TIC SW-846, 8240	TIC SW-846, 8240	TIC SW-846, 8240	>SWB	n/a	n/a
Methyl Ethyl Ketone	SW-846, 8240	SW-846, 8240	SW-846, 8240	>SWB	LOQ	LOQ
Pentachlorophenol	SW-846, 8250	SW-846, 8250	SW-846, 8250	>SWB	LOQ	LOQ
Vinyl Chloride	SW-846, 8021 or 8240	SW-846, 8021 or 8240	SW-846, 8021 or 8240	>SWB	LOQ	LOQ

SW-846 = EPA, 1986, Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846, U. S. Environmental Protection Agency, Washington, DC. NOTE: Each 4 digit number identifies a specific SW-846 method.

LKPA = Laser Kinetic Phosphorimetric Analysis

n/a = not applicable

TIC = Analyzed as Tentatively Identified Compound from SW-846 Methods 8240.

LOQ = Limit of quantitation

>SWB = greater than the Hanford site-wide soil background threshold

^a Inorganic analysis uses extraction by concrete inorganic analysis methodology, see Section 7.2.9.1.

^b If required, organic analysis uses extraction by concrete organic analysis methodology, see Section 7.2.9.2.

* This is a complete rewrite, revision bars are not used.

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1 Table 7-2. Sampling Summary of the 303-K Storage Facility.

2	Location	Number of sampling locations
3	North wall	
4	Concrete core samples	2
5	Random	
6	South wall	
7	Concrete core samples	
8	Random	2
9	East wall	
10	Concrete core samples	2
11	Random	
12	West wall	
13	Concrete core samples	
14	Random	2
15	Ceiling	
16	Concrete core samples	
17	Random	2
18	Floor	
19	Concrete core samples	
20	Random	3
21	Authoritative	2
22	Soil	
23	Authoritative	~ 1
24	Outside storage pads	
25	Concrete core samples	
26	Random	5
27	Asphalt core samples	
28	Random	13
29	Soil	
30	Random (gravel storage area)	5
31	Authoritative (beneath potential	
32	pathways)	~ 4

33

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Table 7-3. Field Quality Control Samples.

2

Type of sample	Number of sampling locations	Equipment blank	Field blank	Trip blank	Duplicate blank
Concrete	21	1	1	1	1
Soil	~10	1	1	1	1
Asphalt	13	1	1	1	1

3

4

5

6

7

8

9

Assumptions: This table represents the minimum number of quality control samples. If samples of each type are not completed in one day, quality control samples will be collected each day.

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1 Table 7-4. General Training Matrix.

2	Course title	Type	Target/Audience				
			MS	MO	HPT	CR	S
3	Generator Hazards Safety Training	I	X	X	X	X	X
4	Hazardous Waste Worker Safety Training	I	X	X	X	X	X
5	Hazardous Waste Worker Safety Training,	C	X	X	X	X	X
6	Refresher						
7	Hazardous Materials/Waste Job-Specific	I	X	X	X	X	X
8	Training						
9	Scott *SKA-PAK MSA PAPR	C	X	X	X	X	X
10	Self-Contained Breathing Apparatus	C	X	X	X	X	X
11	(SCBA) Training (optional)						
12	Radiation Safety Training	C	X	X	X	X	X
13	On-the-Job Training	C	X	X	X	X	X
14	Cardiopulmonary Resuscitation	C	X	X	X	X	X
15	Noise Control (optional)	C	X	X	X	X	X
16	Hazardous Waste Site Supervisor/	I	X	--	--	--	--
17	Manager Safety Management Training						

- 18 C = continuing course.
- 19 CR = crafts.
- 20 HPT = health physics technicians.
- 21 I = introductory course.
- 22 MO = metal operator
- 23 MS = manager and supervisors.
- 24 S = samplers.
- 25 X = required course.

26 *SKA-PAK is a trademark of Figgie, International.

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CONTENTS

1		
2		
3		
4	8.0	POSTCLOSURE 8-1
5		
6	8.1	NOTICE TO LAND AUTHORITY 8-1
7		
8	8.2	NOTICE-IN-DEED 8-1
9		
10	8.3	POSTCLOSURE CARE 8-2

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2
3
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8.0 POSTCLOSURE

This closure plan proposes clean closure of the 303-K Facility. However, if clean closure cannot be obtained and postclosure care is required, the following actions will be taken in accordance with WAC 173-303-610 (1)(b).

8.1 NOTICE TO LAND AUTHORITY

No later than the submission of the certification of closure, DOE-RL shall file a survey plat with the Benton County Planning Department, EPA Region 10, and Ecology (whichever are applicable) showing the location and dimensions of the 303-K Facility with respect to permanently surveyed benchmarks. This plat will be prepared and certified by a professional land surveyor. The plat must contain a note, prominently displayed, which states the owner's or operator's obligation to restrict disturbance of the dangerous waste disposal unit in accordance with the applicable requirements of WAC 173-303-610.

No later than sixty days after certification of closure of each dangerous waste disposal unit, DOE-RL shall submit to the Benton County Planning Department, EPA Region 10, and Ecology (whichever are applicable), a record of the type, location, and quantity of dangerous wastes disposed of within the 303-K Storage Facility.

8.2 NOTICE-IN-DEED

Within 60 days of the certification of closure, the DOE-RL will sign, notarize, and file for recording the notice indicated below. The notice will be sent to the Auditor of Benton County, P.O. Box 470, Prosser, Washington, with instructions to record this notice in the deed book.

TO WHOM IT MAY CONCERN

The United States Department of Energy, Richland Operations Office, an operations office of the United States Department of Energy, which is a department of the United States government, the undersigned, whose local address is the Federal Building, 825 Jadwin Avenue, Richland, Washington, hereby gives the following notice as required by 40 CFR 265.120 and WAC 173-303-610(10) (whichever is applicable).

- (a) The United States of America is, and since April 1943, has been in possession in fee simple of the following described lands: (legal description of 303-K Storage Facility site).
- (b) The United States Department of Energy, Richland Operations Office, by operation of the 303-K Storage Facility, has disposed of hazardous and/or dangerous waste under the terms of regulations promulgated by the United States Environmental Protection Agency and

1 Washington State Department of Ecology (whichever is applicable) at
2 the above described land.
3

4 (c) The future use of the above described land is restricted under terms
5 of 40 CFR 264.117(c) and WAC 173-303-610(7)(d) (whichever is
6 applicable).
7

8 (d) Any and all future purchasers of this land should inform themselves
9 of the requirements of the regulations and ascertain the amount and
10 nature of waste disposed of on the above described property.
11

12 (e) The United States Department of Energy, Richland Operations Office
13 has filed a survey plat with the Benton County Planning Department
14 and with the United States Environmental Protection Agency,
15 Region 10, and the Washington State Department of Ecology (whichever
16 are applicable) showing the location and dimensions of the
17 303-K Storage Facility site and a record of the type, location, and
18 quantity of waste treated.
19
20

21 | 8.3 POSTCLOSURE CARE 22

23 Postclosure care generally is required when a TSD unit cannot attain a
24 clean closure. At the 303-K Storage Facility, underlying soils and
25 groundwater might have been contaminated by waste generated during
26 past-practice operations in the 300 Area. Under the Tri-Party Agreement
27 (Ecology et al. 1992), a procedure to coordinate the TSD unit closure or
28 permitting activity with the past-practice investigation and remediation
29 activity is necessary to prevent overlap and duplication of work, thereby
30 economically and efficiently addressing the contamination.
31

32 With the exception of an imminent health threat, all soil remediation
33 will take place under the CERCLA remedial action process. If the soil within
34 the 303-K Storage Facility boundary is found to be contaminated (chemical
35 concentrations above local background threshold and health-based standards)
36 from operations conducted (chemicals used or waste stored) in the
37 303-K Storage Facility, the 303-K Storage Facility will not be considered
38 closed until the remediation under CERCLA is complete. During the time
39 between closure of the building, floor, and pads and any soil remediation
40 under CERCLA, steps will be taken to isolate any contamination.
41

42 Any data obtained from sampling and analyses during closure activities
43 will be part of the record and included in the closure plan. These data will
44 be taken into account and used during the CERCLA evaluation of the 300-FF-3
45 operable unit, as well as data collected specifically for the
46 CERCLA evaluation.
47

48 Temporary covers will be installed, if necessary, to prevent migration of
49 any contamination. The temporary covers would be less permeable than the
50 surrounding soil and could be composed of constituents such as asphalt, clay,
51 concrete, synthetic liner, or a fixative spray. The existing floor and pads
52 might be used as covers if these were found to be uncontaminated or were

1 decontaminated. The exact nature of any covers would be determined at the
2 time the need was identified, and this information would be added to the
3 closure plan. In addition, access to the areas of contamination would be
4 controlled, if necessary, to protect personnel or prevent the migration of
5 contamination.
6

7 During the period between closure of the building and soil remediation
8 under CERCLA, the closure area would be inspected at a minimum of once a week.
9 This inspection would be combined with inspections presently conducted. The
10 inspections would determine the need for maintenance of any temporary covers
11 or other physical barriers. Any required maintenance would be performed by
12 trained personnel.

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CONTENTS

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6
7
8
9
10
11
12
13

9.0 REFERENCES 9-1

9.1 DOCUMENTS 9-1

9.2 CODE OF FEDERAL REGULATIONS 9-2

9.3 FEDERAL AND STATE ACTS 9-2

9.4 REVISED CODE OF WASHINGTON AND WASHINGTON ADMINISTRATIVE CODE . 9-3

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9.0 REFERENCES

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20
21 **9.2 CODE OF FEDERAL REGULATIONS**

22
23 29 CFR 1910, "Occupational Safety and Health Standards," Title 29, *Code of*
24 *Federal Regulations*, Part 1910, as amended, Occupational Safety and
25 Health Administration, Washington, D.C.

26
27 40 CFR 261, "Identification and Listing of Hazardous Wastes," Title 40, *Code*
28 *of Federal Regulations*, Part 261, as amended, U.S. Environmental
29 Protection Agency, Washington, D.C.

30
31 40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment,
32 Storage and Disposal Facilities," Title 40, *Code of Federal Regulations*,
33 Part 264, as amended, U.S. Environmental Protection Agency,
34 Washington, D.C.

35
36 40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous
37 Waste Treatment, Storage and Disposal Facilities," Title 40, *Code of*
38 *Federal Regulations*, Part 265, as amended, U.S. Environmental Protection
39 Agency, Washington, D.C.

40
41
42 **9.3 FEDERAL AND STATE ACTS**

43
44 *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*,
45 as amended, 42 USC 9601 et seq.

46
47 *Resource Conservation and Recovery Act of 1976*, as amended, 42 USC 6901,
48 et seq.

49
50

- 1 | 9.4 REVISED CODE OF WASHINGTON AND WASHINGTON ADMINSTRATIVE CODE
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- 3 | WAC 173-340, *Model Toxics Control Act Regulation*, as amended, Washington
- 4 | State Department of Ecology, Olympia, Washington.

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APPENDICES

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- 3
- 4
- 5 A PHOTOGRAPHS
- 6
- 7 B RANDOM SAMPLING LOCATIONS
- 8
- 9 C BILLET FIRE OCCURRENCE REPORT
- 10
- 11 D MATERIAL SAFETY DATA SHEETS
- 12
- 13 E PERSONNEL TRAINING
- 14
- 15 | F QUALITY ASSURANCE PROJECT PLAN FOR SAMPLING AND ANALYSIS FOR THE
- 16 303-K STORAGE FACILITY.

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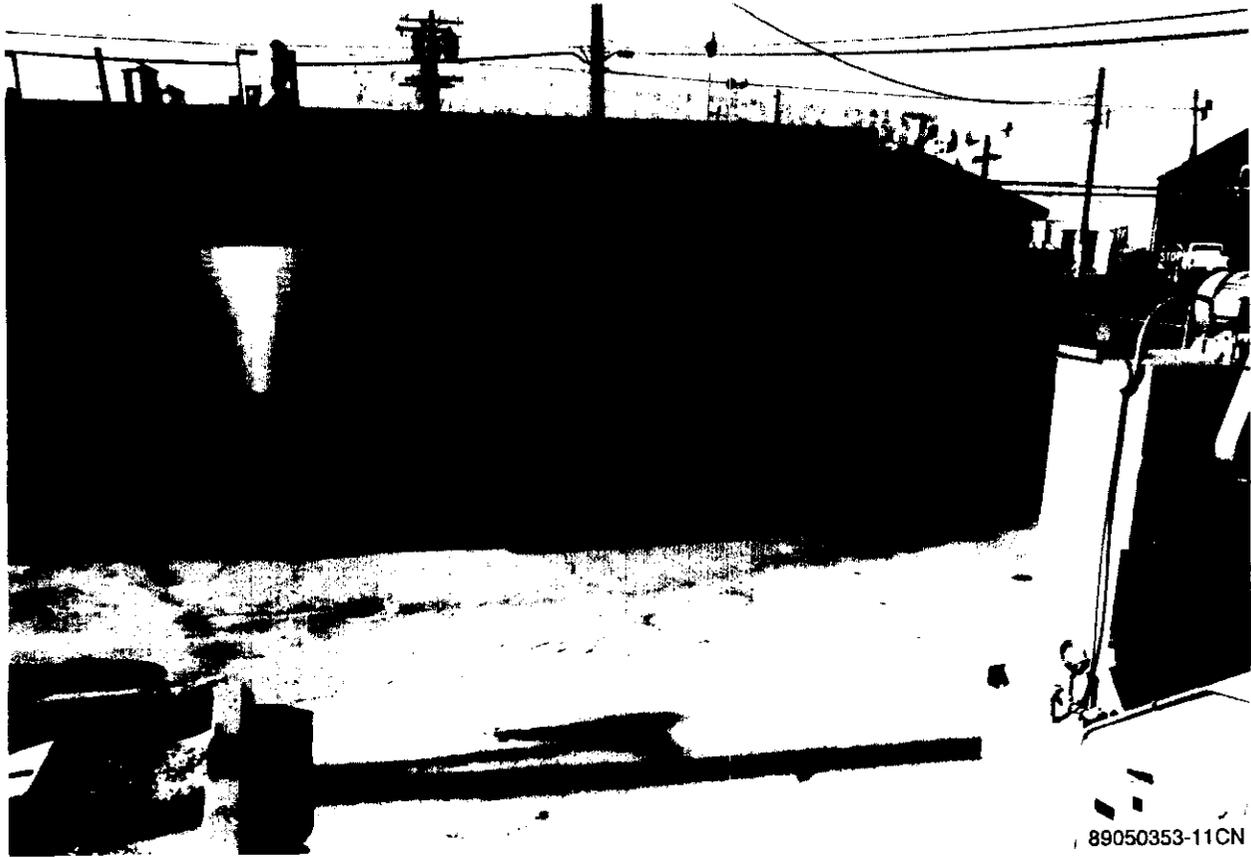
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APPENDIX A

PHOTOGRAPHS

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The 303-K Storage Facility and Concrete Pad.

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The 303-K Storage Facility Asphalt Pad.

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APPENDIX B

RANDOM SAMPLING LOCATIONS



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1 Table B-1. The 303-K Storage Facility Random
 2 Sampling Locations - 5 Percent of the Available
 3 Sampling Locations are Selected.

4	East wall (refer to		West wall (refer to	
5	Figure 7-6)		Figure 7-6)	
6	6	3	4	2
7	3	1	1	3
8	5	2	6	2
9	1	2	7	2
10	5	2	8	3
11	6	3	6	3
12	4	1	5	1
13	South wall (inside) (refer		North wall (refer to	
14	to Figure 7-5)		Figure 7-5)	
15	5	1	6	2
16	6	3	8	3
17	2	1	2	1
18	7	3	7	2
19	4	1	6	3
20	7	3	3	3
21	5	1	7	1
22				

1 Table B-2. 303-K Storage Facility Random Sampling
2 Locations - 5 Percent of the Available
3 Sampling Locations are Selected.

4	303-K Floor (refer to		Ceiling (refer to	
5	Figure 7-2)		Figure 7-7)	
6	X Coordinate	Y Coordinate	X Coordinate	Y Coordinate
7	6	2	2	1
8	7	5	4	3
9	2	6	7	7
10	5	7	6	6
11	3	1	2	8
12	1	6	4	2
13	8	4	1	7
14	5	1	8	8
15	6	2	3	6
16	4	8	8	3
17	5	2	6	2
18	6	5	4	7

19

Table B-3. 303-K Storage Facility Random Sampling Locations Outside Storage Pads - 5 Percent of the Available Sampling Locations are Selected. (sheet 1 of 2)

Gravel area (refer to Figure 7-3)		Small concrete pad (refer to Figure 7-3)	
X Coordinate	Y Coordinate	X Coordinate	Y Coordinate
3	14	2	2
2	3	3	2
2	15	3	1
1	8	1	4
4	1	2	2
3	6	2	1
2	12	2	4
1	4	1	1
6	3	1	4
3	10	1	2
3	2		
4	14		
		Small Asphalt Pad (refer to Figure 7-3)	
		X Coordinate	Y Coordinate
		2	1

1 Table B-3. 303-K Storage Facility Random Sampling
2 Locations Outside Storage Pads - 5 Percent of the
3 Available Sampling Locations are Selected.
4 (sheet 2 of 2)

Large concrete pad (refer to Figure 7-3)	Large asphalt pad (refer to Figure 7-3)		
X Coordinate	Y Coordinate	X Coordinate	Y Coordinate
4	10	18	6
4	9	16	8
4	1	14	7
2	8	9	4
3	6	20	9
1	3	1	1
5	2	8	8
7	10	11	10
3	2	7	5
3	6	7	3
5	5	6	1
6	4	12	4
		9	1
		17	3
		16	1
		15	10

APPENDIX C

BILLET FIRE OCCURRENCE REPORT

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OCCURRENCE REPORT

CONTRACTOR UNC Nuclear Industries		FACILITY 303K Building		WORK AREA 300	
REPORT NO. 82-05	<input type="checkbox"/> PRELIMINARY	<input type="checkbox"/> INTERIM	<input checked="" type="checkbox"/> FINAL	DATE AND TIME OF OCCURRENCE 3-13-82 7:36 pm	
OCCURRENCE SUBJECT Uranium Concrete Billet Autoignition.					

1. DESCRIPTION OF OCCURRENCE AND DESIGNATION OF APPARENT CAUSE

DESIGN MATERIAL PERSONNEL PROCEDURE OTHER

At 7:36 pm on Saturday, March 13, Hanford Patrol observed a flashing beacon on their 303C remote camera monitor. After confirming the location of the alarm beacon on the roof of 3707G Building, Hanford Patrol notified HEDL personnel. The alarm beacon of the 303K Building roof indicates that the Hydrogen monitor in the building exhaust duct has exceeded the specified set point. The UNC coverage operator was then notified. The appropriate UNC supervisory personnel were contacted. Upon arrival at 8:30 pm, the UNC Materials Services supervisor observed that one pallet of concrete billet cans was on fire. All billets in 303K at the time were found to be on wooden pallets. A fire alarm was immediately called in by the coverage operator.

The Hanford Fire Department arrived on the scene at approximately 8:46 pm, and entered the radiation zone to fight the fire. UNC Radiation Monitoring personnel were contacted at approximately 10:00 pm, and arrived on the scene to relieve the HEDL monitor at 10:15 pm.

Air samples and radiation surveys taken in the general area indicated no contamination release. However, two of the fire fighters were contaminated on their face, hands, and clothes. In addition, nasal smears indicated potential internal contamination. The UNC monitor contacted the Battelle Exposure Evaluator's office to request a whole body count. Preliminary results of whole body counts, lung counts, and bioassay analyses indicate that the exposure of the two firemen was less than 5% of the annual dose limit.

The cause of the billet autoignition could not be defined with certainty. The investigation into this incident did reveal areas of the concretion operation which are believed to have contributed to the fire, and which need to be corrected. These corrections include revisions to process specifications and operating procedures, retraining of Operations personnel, and development of a system to verify all processing parameters for concretion campaigns. However, in addition to these, it has been recognized that there is always some risk of a billet fire in the 303K Building during the curing cycle, since this process subjects the billets to temperatures higher than they could ever see during shipment back to the feedsite for reprocessing. As such, it has been described as a "burning test".

(Continued on attachment.)

2. OPERATING CONDITIONS OF THE FACILITY AT TIME OF OCCURRENCE (IF APPLICABLE)

The 303K Building was operating under high temperature curing cycle conditions for uranium concrete billets. This involves establishing and maintaining an internal building temperature of approximately 61°C. There were approximately 12 pallets, each with 12 concrete billet cans, in the facility at the time of the incident. The concreted billets contained 0.95% enriched U-235.

3. IMMEDIATE EVALUATION, CORRECTIVE ACTION TAKEN AND RESULTS

After contacting supervisory personnel, the coverage operator turned off all building heat and verified operation of the exhaust system.

It was determined that one pallet of billets was involved in the fire. Two other pallets of billet cans were moved to the fenced outer radiation zone area to provide access to the burning pallet. One of the burning billet cans was pulled outside. It was later moved back inside the building. The burned debris was spread out over the floor area within 303K, the cans removed, and the fire extinguished with graphite microspheroids and Met-L-X.

A UNC management team convened on March 14, 1982, and developed a "First Stage Recovery Plan". These actions were accomplished primarily to remove all other combustibile materials from 303K.

4. RECOMMENDATIONS

A. TEMPORARY CORRECTIVE ACTION

A "Second Stage Recovery Plan" was developed by the UNC management team on March 15, 1982. These actions were performed and resulted in the burned debris removed and placed in temporary drum storage receptacles, the 303K Building decontaminated, and the remaining billets placed on metal pallets. All uranium concretion activities and concrete billet shipping were temporarily suspended until the UO investigation was completed.

B. PERMANENT CORRECTIVE ACTION

See attached.

C. IS DESIGN CHANGE NECESSARY*		IF YES, WHEN
<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	
D. IS FURTHER EVALUATION NECESSARY*		IF YES, BY WHOM
<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	WHEN
E. PERMANENT CORRECTIVE ACTION TO BE IMPLEMENTED BY:	NAME	DATE
	As indicated in attached.	

5. SIMILAR OCCURRENCE : BY REPORT NUMBER AND OCCURRENCE SUBJECT

UE 77-2 was written in response to a uranium concrete billet fire in the 304 Building August 8, 1977.

UO 79-27 was written in response to a uranium concrete billet fire in the 3712 Building August 2, 1979.

ORIGINATED BY	T. A. Galusto	TITLE	Manager, Fuels Engineering	DATE	4-12-82
REVIEWED BY	T. A. Galusto	TITLE	Manager, Fuels Engineering	DATE	4-12-82
	<i>W. L. ...</i>		Director, Quality Assurance and Control		4-13-82
	<i>D. ...</i>		Director, Safety and Environmental Engr.		4-13-82
	<i>W. E. Wood</i>		Manager, Rockwell Fire Department		4/13/82
APPROVED BY	<i>[Signature]</i>	TITLE	Director, Fuels Production Department	DATE	

UO INVESTIGATION COMMITTEE REPORTCommittee Members:

T. A. Galioto, Manager Fuels Engineering: Chairman
E. A. Weakley, Principal Engineer: Causal Factors Analyst and Technical Investigator
L. C. Horobowski, Engineer: Fire/Safety Investigator
L. E. Thurman, Supervisor R&WQC: Radiation Control Investigator
D. L. DeNeal, Fuels Operations Supervisor; Operations Investigator
G. E. Bentley, Quality Engineer; Quality Control Investigator

Committee Activities

The UO Investigation Committee was formed on March 16, 1982, at which time the investigation activities were identified. These included interviews with involved parties, examination of available Operations records, and determination of cause/corrective actions required.

Summary of Miscellaneous Incident Evaluations

Air samples taken by the PNL Environmental Evaluations Section on March 14, indicated no contamination above background. These were taken from sample stations located within the 300 Area and across the Columbia River to the northeast. These samples are currently undergoing final evaluation for uranium count.

A radiation survey of the exhaust system on the 303K roof indicated a maximum level of 600 cpm upstream of the HEPA filter, and no detectable levels downstream of the filter.

Material accountability for the uranium involved in the fire cannot be determined until the fire debris is re-concreted. At that time, a sample will be taken of the debris to determine percent of uranium, and coupled with total debris weight will provide a measure for accountability. Also, added to this debris will be the material recovered from the drain filter in 303K after the room was washed down. Actual loss of material as a result of the fire is expected to be insignificant. These losses will occur as a result of material not caught in the drain filter in 303K, and material on wipe rags and cleaning tools during building decontamination. A total of 763 pounds of uranium were contained in the 12 concrete billets that were burned.

Two Rockwell firemen showed evidence of external and internal contamination upon exiting the radiation zone subsequent to firefighting activities. From accounts given by other personnel at the scene, and from interviews with the firemen involved, this contamination most likely occurred due to inadequate dress/undress procedures. Breathing air apparatus was removed after exiting the 303K Building, and then the same masks were repositioned for a second building entrance by the firemen. Also, lack of sufficient care in undressing prior to exiting the zone could have contributed to the contamination. This was complicated by the undressing assistance that the firemen received from other personnel at the scene. A burning uranium concrete billet was pulled out of the 303K Building by firefighters (still within radiation zone perimeter) which could have potentially contributed to contamination spread.

Final results of the bioassay analyses for the two contaminated firemen will not be available for approximately one month. This is due in part to the need to evaluate the solubility of the contaminants (as determined from a smear sample taken from the wall of 303K on March 17, 1982).

UO 82-05

1. Description of Occurrence and Designation of Apparent Cause (continued)

With implementation of the corrective actions identified herein, the severity and frequency of future fires can be reduced, but elimination of fires cannot be guaranteed.

UO Investigation Committee Report - UO 82-05
Page 2

It was also learned that the Rockwell Fire Department uses pre-fire plans for buildings for training purposes only, and does not pull these plans when responding to an actual fire call. As a result, initial response to the 303K fire was somewhat hampered, with firefighters utilizing UNC management at the scene for information on building contents.

A new system is currently being installed in the Central Fire Station (100 Area) to provide firefighting information print-outs for every call received from master fire boxes. This will circumvent the need for having pre-fire plans at the scene. However, it will not be completed for sometime.

Evaluation of Cause

The investigating committee considered the following as potential causes to the autoignition incident. Each of these was then investigated in detail:

- a. Variation in standard billet casting practice requirements by Operations personnel.
- b. Inadequate process specifications and operating procedures.
- c. Inadequate casting/curing process requirements.

-
- a. Variation in standard billet casting practice requirements by Operations personnel.

Casting variables, such as mix time and the amounts of water and concrete used, are very important to the process in assuring properly cured billets for shipment. From interviews with Operations personnel, some variability occurs in these factors during the casting operation. No evidence was uncovered which would indicate an obvious variation in standard practice requirements for these variables during the casting campaign in question, but the possibility exists that some of these recommended practices were varied.

Wooden pallets were employed to hold the billets during the curing cycle. Use of the wooden pallets was intended to be for interior billet storage only (due to a shortage of available metal pallets). However, they were inadvertently placed in 303K for the high temperature curing cycle. In any event, the use of wooden pallets to hold billets is a deviation from procedures and standard practice. It has not occurred previously.

Although the operators were cooperative and seemed to be conscientious about their jobs, they did not appear to appreciate the importance of all casting process requirements. A number of operators considered their training to be insufficient for the responsibilities they had in this area. The deficiencies in specifications and procedures (discussed in b, below) may have contributed to this.

The casting campaign which involved these billets being cured in 303K was the first campaign which was not directly overviewed by the cognizant process engineer since the current process was developed in 1980. There was also no direct, continuous supervision available through Operations management, and no adequate means of verifying all process parameters.

b. Inadequate process specifications and operating procedures.

In review of the process specifications (DUN-5601, Manufacturing Process Specifications) and the operating procedure (UNI-M-57, No. 4-SP-534, Materials Operating Procedures), and from interviews with Operations personnel, it became apparent that the range of critical process variables was too wide to be useful as a controlling mechanism for the process. The variables were established at an early stage of development of the casting process, so were specified quite broad to cover all contingencies. Actual casting practices have been refined and established through direction of the cognizant engineer, but the specifications and procedures had not been modified to reflect these more stringent limitations.

The procedure needs to be refined as to quantities of materials used in the process, and in several other areas for clarification.

c. Inadequate casting/curing process requirements.

The adequacy of the process requirements was evaluated as established from the major testing program conducted in 1979-1980 (UNI-1454). This document, and subsequent correspondence to DOE-RL refers to the curing process variables as a "burning test" in order to assure safety of the billets for subsequent cross-country shipment. The process subjects the billets to temperatures greater than those considered possible in shipment. As such, the 303K facility is set up to contain billet fires, should they occur. (For this reason, all combustible materials are excluded from 303K by procedure.) Therefore, although a fire in the 303K must be considered unusual, it is not totally unexpected nor is it an indication of a defective curing process.

A total of approximately 1,650 concreted uranium billets have been cast or cured using the current process since it was established in 1980, and no other fires have occurred in the 1980-1982 time frame. These billets include 1,030 cast into metal cans and 620 cast into plastic cans.

Nothing was uncovered in the investigation which implies that the casting/curing process requirements are inadequate. It must be recognized, however, that there is some risk of a billet fire in 303K during the curing cycle.

Permanent Corrective Actions

1. DUN-5601, Manufacturing Process Specifications and UNI-M-57, Materials Operating Procedures, will be revised to reflect current accepted casting practice limits and in general to clarify requirements: T. A. Galoto, Fuels Engineering: April 30, 1982. J. W. Bloom, Fuels Operations: May 30, 1982.

UO Investigation Committee Report - UO 82-05

Page 4

2. All Operations personnel involved in the concretion process (curing, casting, storage, shipment) will be re-trained in the process requirements and the importance of these requirements: J. W. Bloom, Fuels Operations: June 15, 1982.
3. A detailed batch preparation sheet will be used for all uranium concretion activities which will specify the limits of the significant process steps. J. W. Bloom, Fuels Operations: May 30, 1982.
4. Fuels Quality Assurance will establish a program for greater frequency and depths of audits to assure that concretion operation requirements are being observed: S. E. Walker, Fuels Quality Assurance: April 15, 1982.
5. All concreted uranium billets cast in the batch located now in 303K (.95%) and in 304 (1.25%) are suspect to similar processing inadequacies as the billets which autoignited. These will require special handling during curing, including:
 - a. Spacing of billets on metal pallets so they do not contact adjacent billets during curing in the 303K Building.
 - b. The billets now in 303K must complete the entire high temperature (> 135°F) curing cycle again (10 days) prior to release. The billets now in 304 will go through the entire curing cycle as normal: J. W. Bloom, Fuels Operation; initiate by May 1, 1982.
6. Rockwell needs to place more emphasis on safety/contamination aspects of fighting fires within radiation zones (dress/undress procedures, removal of burning material from fire zones). This will be accomplished by Rockwell through review of established formal training/re-training program: D. E. Good, Rockwell Fire Department: April 30, 1982.
7. Rockwell will assure that available pre-fire plans are posted at each building and at the nearest master fire box for all 300 Area buildings: D. E. Good, Rockwell Fire Department: April 30, 1982.
8. UNC will have the current concretion process reviewed by an independent consultant to identify potential improvements: T. A. Galioto, Fuels Engineering; July 30, 1982.
9. UNC will verify with HEDL that all appropriate procedures were followed and all action were correct in regard to their involvement in the 303K fire: T. A. Galioto, Fuels Engineering; April 30, 1982.

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APPENDIX D

MATERIAL SAFETY DATA SHEETS

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MATERIAL SAFETY DATA SHEET		Number: 332 Page 1 of 5																																				
This MSDS applies to the following zirconium-tin alloys and/or Teledyne trademark products: Zircaloy-2, Zircaloy-4, Zircadyne 704, ASTM Grades B350-R60802, B350-R60804, B493-R60704																																						
SECTION 1 NAME	<u>24 Hour Emergency Assistance</u>																																					
PRODUCT: <u>Zircaloy 2 Tubing Raw Stock</u>	Teledyne Wah Chang Albany 503-926-4211																																					
SYNONYMS: <u>Zirc 2, Zr-2</u>	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">HAZARD RATING</td> <td style="width: 50px;"></td> <td style="width: 50px;"></td> </tr> <tr> <td>Minimal:</td> <td style="text-align: center;">0</td> <td style="text-align: center;">+</td> </tr> <tr> <td>Slight:</td> <td style="text-align: center;">1</td> <td style="text-align: center;">☠</td> </tr> <tr> <td>Moderate:</td> <td style="text-align: center;">2</td> <td style="text-align: center;">☀</td> </tr> <tr> <td>Serious:</td> <td style="text-align: center;">3</td> <td style="text-align: center;">☀</td> </tr> <tr> <td>Severe:</td> <td style="text-align: center;">4</td> <td style="text-align: center;">☀</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">Health</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">Fire</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">Reactivity</td> </tr> <tr> <td></td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> <tr> <td></td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> </tr> <tr> <td></td> <td style="text-align: center;">2</td> <td style="text-align: center;">0</td> </tr> </table>		HAZARD RATING			Minimal:	0	+	Slight:	1	☠	Moderate:	2	☀	Serious:	3	☀	Severe:	4	☀			Health			Fire			Reactivity		0	0		1	1		2	0
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CHEMICAL FAMILY: <u>Zirconium Metal Alloy</u>																																						
C.A.S. NUMBER: <u>11068-94-3</u>	FORMULA: <u>See Composition</u>																																					

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SECTION 2. INGREDIENTS

=====

Chemical Components	%	C.A.S. No.	Exposure Limits (mg/m ³)	
			OSHA PEL	ACGIH TLV
Zirconium, Min.	98.0	7440-67-7	5	5
Tin	1.5	7440-31-5	2	2
Iron	0.2	7439-89-6	10 (for iron oxide fume)	5 (for iron oxide fume)
Chromium	0.1	7440-47-3	0.5	0.5 for Metal 0.05 for water-soluble CR(VI) compounds

=====

SECTION 3. PHYSICAL DATA

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Boiling Point @ 760 mm Hg:	Vapor Density (Air = 1):
Approx. 4380°C	N.A.
Specific Gravity (H ₂ O = 1):	pH of Solutions:
6.57	N.A.
Freezing/Melting Point:	Solubility (Weight % In Water):
1849°C	Insoluble
Bulk Density:	% Volatile by Volume:
6.57	Non Volatile
Vapor Pressure:	Evaporation Rate:
0 @ 20°C	0
Heat of Solution:	Appearance and Odor:
N.A.	Similar to Stainless Steel

MATERIAL SAFETY DATA SHEET

Number: 332 Page

MSDS # 19373

===== SECTION 4. REACTIVITY DATA =====

Stability: Stable Hazardous Polymerization: Will Not Occur

Conditions to Avoid: See Section 9, Discussion of Pyrophoric Nature of Machining Fines.

Incompatibility (Materials to Avoid): Zirconium metal is rapidly dissolved by hydrofluoric acid or hydrofluoric-nitric acid mixtures.

Above 200°C, zirconium reacts exothermically with halogen gases, fluorine, chlorine, bromine, iodine, and halocarbons, including carbon tetrachloride, Freons™ and Teflon™.

Nitryl Fluoride, FNO₂, will initiate a reaction with zirconium metal at room temperature to produce a glowing or white incandescence.

Hazardous Decomposition Products: Zirconium metal does not decompose. The above reactions with incompatible materials will generate hazardous reaction products such as flammable hydrogen, toxic fumes of nitrogen oxides, or corrosive zirconium halide vapors.

===== SECTION 5. FIRE AND EXPLOSION HAZARD DATA =====

Flash Point and Methods Used: Solid metal will not ignite. High surface area material such as 10 micron powder may auto ignite at room temperature.

Flammable Limits in Air (% by Volume): N.A.

Extinguishing Media: Dry table salt. Type D fire extinguisher.

Fire Fighting Procedures: If metal fines become ignited it is advisable to allow the material to burn out. Fires can be controlled by smothering with dry table salt or using Type D dry-powder fire extinguishing material.

Unusual Fire and Explosion Hazards: Do not spray water on burning zirconium. Carbon dioxide is not effective in extinguishing burning zirconium.

If a fire starts in a mass of wet metal fines, the initial fire may be followed by an explosion. Therefore, when in doubt, personnel should retire and not attempt to extinguish the fire. The explosive characteristic of such material is caused by the steam and hydrogen generated within the burning mass.

MATERIAL SAFETY DATA SHEET

Number: 332 Page 3 of 5

Zircaloy 2

8021

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 SECTION 6. HEALTH HAZARD DATA
 =====

RTECS (NIOSH) Number: N.A.

Occupational Exposure Limits: See Comments

 MSDS # 19373

Routes of Entry:

Inhalation: No

Ingestion: No

Skin Absorption: No

Skin/Eye Contact: No

Target Organs: None

Toxicity Data: As a zirconium alloy, this material is non-toxic: Zirconium metal is non-toxic, and the chromium is dissolved in the zirconium matrix and does not exist as free chromium.

If the alloy is dissolved, vaporized or otherwise treated to release the alloying agents in chemically active form, then handling of such material should take into consideration the possible carcinogenicity of some chromium (VI) compounds.

Corrosive: No

Carcinogen: No

Sensitizer: No

Comments: As a result of studies covering several zirconium compounds, zirconium was concluded to be an element of low toxicity. A value of 5 mg and 10 mg zirconium (in zirconium compounds) per m³ were therefore recommended as the TLV and STEL, respectively.

Acute Effects from Exposure: None

Chronic Effects from Exposure: None

References:

AC/GIH - Documentation of the Threshold Limit Values.

NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards.

ILO - Encyclopedia of Occupational Health and Safety.

Patty's Industrial Hygiene and Toxicology, 3rd Ed., Vol. 2A

MATERIAL SAFETY DATA SHEET

MSDS # 19373

SECTION 7. EMERGENCY AND FIRST AID PROCEDURES

Inhalation: N.A.

Eye Contact: Normal procedure for foreign object.

Skin Contact: N.A.

Ingestion: N.A.

Notes to Physician (Including Antidotes): No special procedures.

SECTION 8. EMPLOYEE PROTECTION

Respiratory Protection: N.A.

Protective Clothing: Use of gloves advisable to avoid cuts.

Eye Protection: N.A.

Additional Protective Measures: N.A.

SECTION 9. SPECIAL PROCEDURES

Precautions to be Taken During Handling and Storage: Machining of zirconium may result in fine turnings, chips or dust. Any material with a dimension less than 0.002 inch is pyrophoric, keep away from any source of ignition.

Keep fine turnings completely dry, or very wet. If wet, the water content should be more than 25% by weight for maximum safety in handling. Severe explosions can result from ignition of zirconium powder or machining fines containing moisture in the concentration range of 5 to 10%.

Other Precautions: Do not accumulate large quantities of fines or machining residues. Dispose of these materials daily.

In some cases, when the chemical corrosion resistance of zirconium is exceeded, a corrosion product containing fine zirconium particulate can form on the surface of the metal which can be easily ignited. This film can be rendered non-flammable by simple oxidation treatments such as heating to 250°C for 1 hour or 100°C for 8 hours. Ref: Yau, T-L., "Methods to Treat Pyrophoric Film on Zirconium" Industrial Applications of Titanium and Zirconium: Third Conference. ASTM STP 830, 1984, pp 124-129.

SECTION 10. ENVIRONMENTAL PROTECTION

Spill or Leak Procedures: No special procedure.

Waste Disposal: Fine, non-recyclable scrap should be burned in small quantities under controlled conditions. The resulting zirconium oxide is inert and may be deposited in a landfill.

Environmental Hazards: None

MATERIAL SAFETY DATA SHEET	Number: 332	Page 5 of 5
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Zircaloy 2

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SECTION 11. TRANSPORTATION REQUIREMENTS MSDS # 19373

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|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Department of Transportation Classification | <input type="checkbox"/> Flammable Liquid
<input type="checkbox"/> Flammable Gas
<input type="checkbox"/> Poison, Class A
<input type="checkbox"/> Poison, Class B
<input type="checkbox"/> Irritating Material
<input checked="" type="checkbox"/> Not Hazardous by D.O.T. Regulations | <input type="checkbox"/> Flammable Solid
<input type="checkbox"/> Combustible Liquid
<input type="checkbox"/> Oxidizing Material
<input type="checkbox"/> Corrosive Material
<input type="checkbox"/> Non-Flammable Gas
<input type="checkbox"/> Other - Specify Below |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

D.O.T. Proper Shipping Name: Metals Alloy NOI	D.O.T. I.D. Number: N.A.
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SECTION 12. OTHER REGULATORY CONTROLS

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N.A.

TELEDYNE WAH CHANG ALBANY P.O. BOX 460 ALBANY, OREGON 97321	Date Prepared 3/27/86
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MATERIAL SAFETY DATA SHEET OHS24610

MSDS # 2329

 OCCUPATIONAL HEALTH SERVICES, INC. EMERGENCY CONTACT:
 450 SEVENTH AVENUE, SUITE 2407 JOHN S. BRANSFORD, JR. (615) 292-1180
 NEW YORK, NEW YORK 10123
 (800) 445-MSDS (212) 967-1100

SUBSTANCE IDENTIFICATION

CAS-NUMBER 7440-61-1
 RTEC-NUMBER YR3490000

SUBSTANCE: URANIUM

TRADE NAMES/SYNONYMS:

URANIUM, PYROPHORIC: URANIUM I: URANIUM METAL, PYROPHORIC: URANIUM
 238: U-238: STCC 4926186: NA 9175: OHS24610

CHEMICAL FAMILY:

METAL: RADIOACTIVE

MOLECULAR FORMULA: U

MOLECULAR WEIGHT: (238)

CERCLA RATINGS (SCALE 0-3): HEALTH=U FIRE=3 REACTIVITY=3 PERSISTENCE=3

NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=3 REACTIVITY=3

COMPONENTS AND CONTAMINANTS

COMPONENT: URANIUM

PERCENT: 100

OTHER CONTAMINANTS: NONE

EXPOSURE LIMIT:

URANIUM:
 0.25 MG/M3 OSHA TWA
 0.2 MG/M3 ACGIH TWA; 0.6 MG/M3 ACGIH STEL
 0.2 MG/M3 MSHA TWA.

OSHA PERMISSIBLE IONIZING RADIATION EXPOSURE IN REMS PER CALENDAR QUARTER
 AS SET FORTH IN 29CFR1910.96.

OVER 18 YEARS OF AGE

WHOLE BODY: HEAD AND TRUNK; ACTIVE
 BLOOD-FORMING ORGANS; LENS OF EYES;
 OR GONADS

1.25*

HANDS AND FOREARMS; FEET AND ANKLES

18.75*

SKIN OF WHOLE BODY

7.5*

* UNDER THE AGE OF 18 YEARS A DOSE IN EXCESS OF 10 PERCENT OF THE LIMITS
 SPECIFIED SHALL NOT BE PERMITTED.

THE PERMISSIBLE WHOLE BODY EXPOSURE, FOR INDIVIDUALS AT LEAST 18 YEARS OF AGE,
 MAY BE EXCEEDED PROVIDED ALL OF THE FOLLOWING PROVISIONS ARE MET:

- (1) THE DOSE SHALL NOT EXCEED 3 REMS DURING ANY CALENDAR QUARTER.
- (2) THE TOTAL ACCUMULATED OCCUPATIONAL DOSE TO THE WHOLE BODY SHALL NOT EXCEED
 5(N-18) REMS, WHERE "N" EQUALS THE INDIVIDUAL'S AGE IN YEARS AT HIS LAST

OF ALPHA PARTICLES PRODUCES SERIOUS BIOLOGICAL DAMAGE IN THE TISSUES WITH WHICH THE PARTICLES INTERACT.

DUE TO THE HIGH ENERGY LEVELS, INTERNALLY DEPOSITED ALPHA EMITTERS WILL KILL CELLS IMMEDIATELY ADJACENT TO THE SOURCE. CELLS DAMAGED MAY NOT RECOVER OR BE REPAIRED. THE SPECIFIC EFFECTS OF ALPHA EMITTERS WILL DEPEND ON THEIR CHEMICAL CHARACTERISTICS. EACH ISOTOPE WILL FOLLOW A FAIRLY SPECIFIC BIOLOGICAL PATHWAY IN THE BODY. SOME ISOTOPES ARE CONCENTRATED OR RETAINED IN A SPECIFIC ORGAN OR TISSUE; RATES OF ELIMINATION VARY CONSIDERABLY.

MSDS # 2329

FOLLOWING INHALATION, ALPHA EMITTERS MAY OR MAY NOT BE ABSORBED, DEPENDING ON SOLUBILITY. INSOLUBLE MATERIALS MAY REMAIN AT OR NEAR THE SITE OF DEPOSITION, AND CONSTITUTE AN INTERNAL RADIATION HAZARD. FOR INSTANCE, AN INSOLUBLE ALPHA EMITTER, INHALED AS AN AEROSOL, WILL BE DEPOSITED ALONG THE TRACHEOBRONCHIAL TREE. HEAVIER PARTICLES WILL BE BROUGHT UP TO THE THROAT BY CILIARY ACTION, AND MAY THEN BE SWALLOWED. THE LIGHTER PARTICLES MAY BE LODGED DEEP IN THE ALVEOLAR AIR SACS AND REMAIN. THIS RETAINED MATERIAL MAY PRESENT A HAZARD TO THE LUNG. A PORTION OF THIS RETAINED MATERIAL MAY BE PICKED UP BY THE LYMPHATIC SYSTEM DRAINING THE PULMONARY REGION, AND BE STORED IN THE LYMPH NODES OF THE LUNGS.

A SOLUBLE ALPHA EMITTER, WHEN INHALED, MAY RAPIDLY ENTER THE BLOODSTREAM AND SEEK A PARTICULAR ORGAN OR TISSUE, OR BECOME ELIMINATED IN EITHER THE URINE OR FECES. THE DAMAGE DUE TO THESE RADIOACTIVE COMPOUNDS DEPENDS ON HOW QUICKLY THEY ARE ELIMINATED, AND THE SUSCEPTIBILITY OF THE TISSUE IN WHICH THEY ARE STORED. A SINGLE LARGE DOSE OF RADIATION MAY LEAD TO RADIATION SICKNESS.

CHRONIC EXPOSURE- THE EFFECTS OF CHRONIC EXPOSURE BY INTERNALLY DEPOSITED ALPHA RADIATION IS DEPENDENT UPON THE DOSE AND TARGET ORGAN(S). THE EFFECTS OF INTERNAL SOURCES ARE NOT LIKELY TO CORRESPOND TO THE EFFECTS OF COMPARABLE DOSES OF PARTIAL BODY EXTERNAL IRRADIATION. A POSSIBLE PHENOMENON, PECULIAR TO INTERNAL EMITTERS, IS THE TRANSMUTATION EFFECT. MANY RADIONUCLIDES MAY BE INCORPORATED IN ESSENTIAL BIOLOGICAL MOLECULES LEADING TO THE FOLLOWING EFFECTS WHEN THEY DECAY: (1) ENERGY DEPOSITION FROM THE RADIOACTIVE PROCESS, (2) MOLECULAR DISRUPTION DUE TO POSSIBLE RECOIL EFFECTS, AND (3) MOLECULAR DISORIENTATION AS A RESULT OF NUCLEAR TRANSMUTATION. AS AN EXAMPLE OF THE THIRD CASE, A BIOLOGICAL MOLECULE SUCH AS DNA MAY BE DISRUPTED WHEN A RADIOACTIVE ELEMENT INCORPORATED IN IT DECAYS TO A DIFFERENT ELEMENT NOT NORMALLY FOUND IN DNA. IN SUCH A CASE, A POINT MUTATION WOULD OCCUR. MUTATIONS ARE USUALLY DELETERIOUS.

IN GENERAL, THE EFFECTS OF CHRONIC ALPHA IRRADIATION ARE DIFFICULT TO QUANTIFY. SOME POSSIBLE DISORDERS INCLUDE LUNG CANCER, STERILITY, ANEMIA, LEUKEMIA OR BONE CANCER. IF THE TOTAL DOSE OF RADIATION IS SUFFICIENT, RADIATION SICKNESS MAY OCCUR, WITH THE SYMPTOMS DESCRIBED BELOW.

RADIATION SICKNESS

THE SYMPTOMS OF RADIATION SICKNESS ARE DEPENDENT UPON THE DOSE, DOSE RATE, AREA OF THE BODY AFFECTED AND THE TIME AFTER EXPOSURE. RADIATION SICKNESS MAY RESULT FROM INTERNAL OR EXTERNAL SOURCES, AND ACUTE OR CHRONIC EXPOSURE. THE TOTAL DOSE RECEIVED IS THE DETERMINING FACTOR. RADIATION SICKNESS HAS THREE (3) CLEARLY DEFINED SYNDROMES: THE HEMATOPOIETIC, THE GASTROINTESTINAL AND THE CEREBRAL SYNDROMES.

THE HEMATOPOIETIC SYNDROME: THIS SYNDROME MAY OCCUR WHEN DOSAGES OF 200 TO 1000 RADS ARE RECEIVED AS A WHOLE BODY DOSE. IT IS CHARACTERIZED BY ANOREXIA, APATHY, NAUSEA AND VOMITING, AND MAY BECOME MAXIMAL WITHIN 6 TO 12 HOURS AFTER EXPOSURE. SYMPTOMS THEN SUBSIDE, SO THAT 24 TO 36 HOURS AFTER EXPOSURE THE SUBJECT IS ASYMPTOMATIC. DURING THIS PERIOD OF APPARENT WELL-BEING, THE LYMPH NODES, SPLEEN AND BONE MARROW BEGIN TO ATROPHY. THIS ATROPHY IS THE RESULT OF 2 DISTINCT PROCESSES: DIRECT KILLING OF RADIOSENSITIVE CELLS AND INHIBITION OF NEW CELL PRODUCTION. IN

THE PERIPHERAL BLOOD, LYMPHOPENIA COMMENCES IMMEDIATELY, BECOMING MAXIMAL WITHIN 24 TO 36 HOURS. NEUTROPENIA DEVELOPS MORE SLOWLY. THROMBOCYTOPENIA MAY BE PROMINENT WITHIN 3 TO 4 WEEKS. IF THE BONE MARROW DEPRESSION PROGRESSES TO A CRITICAL LEVEL SUCH THAT THE VICTIM IS NOT ABLE TO SEND SUFFICIENT NUMBERS OF GRANULOCYTES AND THROMBOCYTES TO THE CIRCULATING BLOOD, DEATH FROM OVERWHELMING INFECTION MAY OCCUR.

MSDS # 2329

THE GASTROINTESTINAL SYNDROME: THIS SYNDROME OCCURS WHEN 400 OR MORE RADS ARE RECEIVED AS A WHOLE BODY DOSE. IT IS CHARACTERIZED BY INTRACTABLE NAUSEA, VOMITING AND DIARRHEA THAT MAY LEAD TO SEVERE DEHYDRATION, DIMINISHED PLASMA VOLUME, VASCULAR COLLAPSE AND DEATH. THE GASTROINTESTINAL SYNDROME RESULTS FROM THE INITIAL "TOXEMIA" DUE TO NECROSIS OF TISSUE AND IS PERPETUATED BY PROGRESSIVE ATROPHY OF THE GASTROINTESTINAL MUCOSA. ULTIMATELY THE INTESTINAL VILLI ARE DENUDED, WITH MASSIVE LOSS OF PLASMA INTO THE INTESTINE. REGENERATION OF INTESTINAL EPITHELIAL CELLS MAY BE POSSIBLE AFTER LARGE DOSES OF RADIATION; MASSIVE PLASMA REPLACEMENT AND ANTIBIOTICS DURING THE FIRST 4 TO 6 DAYS MAY KEEP THE PATIENT ALIVE UNTIL THE EPITHELIUM REGENERATES. HOWEVER, EVEN IF THE PATIENT SURVIVES, THE RESPITE MAY BE TEMPORARY, SINCE HEMATOPOIETIC FAILURE MAY ENSUE, COMMENCING WITHIN 2 OR 3 WEEKS.

WITH ACUTE TOTAL BODY RADIATION DOSES OF >600 RADS, HEMATOPOIETIC OR GASTROINTESTINAL MALFUNCTION MAY BE FATAL. WITH RADIATION DOSES OF <600 RADS, THE POSSIBILITY OF SURVIVAL IS INVERSELY RELATED TO THE TOTAL DOSE.

THE CEREBRAL SYNDROME: THIS SYNDROME IS PRODUCED BY EXTREMELY HIGH TOTAL BODY DOSES OF RADIATION, USUALLY >3000 RADS, AND GENERALLY CAUSES DEATH. IT CONSISTS OF 3 PHASES: A PRODROMAL PERIOD OF NAUSEA AND VOMITING; THEN LISTLESSNESS AND DROWSINESS RANGING FROM APATHY TO PROSTRATION, POSSIBLY CAUSED BY NON-BACTERIAL INFLAMMATION FOCI OF THE BRAIN OR THE EFFECTS OF RADIATION-INDUCED TOXIC PRODUCTS; AND FINALLY, A MORE GENERALIZED COMPONENT CHARACTERIZED BY TREMORS, CONVULSIONS, ATAXIA AND DEATH WITHIN A FEW HOURS.

OTHER ACUTE EFFECTS:

THE SKIN IS MORE SUBJECT TO RADIATION EXPOSURE ESPECIALLY TO BETA OR X-RAYS THAN OTHER TISSUE. A SLIGHT EXPOSURE CAN RESULT IN ERYTHEMA, CHANGES IN PIGMENTATION, EPILATION, BLISTERING, NECROSIS, AND ULCERATION. THE GONADS ARE ALSO PARTICULARLY RADIOSENSITIVE. A SINGLE DOSE OF 30 RADS RESULTS IN TEMPORARY STERILITY AMONG MEN. IN WOMEN, LOSS OF FERTILITY IS INDICATED BY LOSS OF MENSTRUATION. THE EYES ARE ALSO VERY RADIOSENSITIVE; A SINGLE DOSE OF 100 RADS MAY CAUSE CONJUNCTIVITIS AND KERATITIS.

DELAYED OR CHRONIC EFFECTS OF RADIATION SICKNESS:

THE DELAYED EFFECTS OF RADIATION MAY BE DUE EITHER TO A SINGLE LARGE OVEREXPOSURE OR CONTINUING LOW-LEVEL OVEREXPOSURE. AMONG THE DELAYED EFFECTS ARE CANCER, GENETIC EFFECTS, SHORTENING OF LIFE SPAN, AND CATARACTS.

RADIATION-INDUCED CANCER IS OBSERVED MOST FREQUENTLY IN THE HEMOPOIETIC SYSTEM, THYROID, BONE, AND SKIN. LEUKEMIA IS AMONG THE MOST LIKELY FORMS OF MALIGNANCY RESULTING FROM OVEREXPOSURE TO TOTAL BODY RADIATION. BONE SEEKERS CAN DAMAGE THE RADIOSENSITIVE HEMOPOIETIC TISSUE IN THE BONE MARROW AND THEY ALL PRODUCED CANCER WHEN INJECTED INTO LABORATORY ANIMALS IN SUFFICIENT QUANTITY. LONG TERM CONTINUOUS RADIOACTIVE MATERIALS RESIDING IN THE LUNG MAY PRODUCE CANCER. THE GONADS ARE ALSO PARTICULARLY RADIOSENSITIVE. A SINGLE DOSE OF 30 RADS RESULTS IN TEMPORARY STERILITY AMONG MEN. IN WOMEN, LOSS OF FERTILITY IS INDICATED BY LOSS OF MENSTRUATION.

IONIZING RADIATION IS KNOWN TO PRODUCE A VARIETY OF TYPES OF GENETIC INJURY RANGING FROM POINT MUTATIONS TO SEVERE CHROMOSOME DAMAGE SUCH AS STRAND BREAKAGE, TRANSLOCATIONS, AND DELETIONS. MUTATIONS IN

SOMATIC CELLS MAY BE RESPONSIBLE, IN PART, FOR THE INITIATION OF RADIOGENIC CANCERS. IF THE GERM CELLS HAVE BEEN AFFECTED, THE EFFECTS OF THE MUTATION MAY NOT BECOME APPARENT UNTIL THE NEXT GENERATION, OR EVEN LATER.

MSDS # 2329

FIRST AID- REMOVE FROM EXPOSURE AREA TO A RESTRICTED AREA WITH FRESH AIR AS QUICKLY AS POSSIBLE. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION BY ADMINISTERING OXYGEN; MOUTH-TO-MOUTH RESUSCITATION SHOULD BE AVOIDED, TO PREVENT EXPOSURE TO THE PERSON RENDERING FIRST AID. ANY EVIDENCE OF SERIOUS CONTAMINATION INDICATES THAT TREATMENT MUST BE INSTITUTED. INHALATION OF RADIOACTIVE PARTICLES MAY INDICATE THAT OTHER PARTS OF THE BODY WERE ALSO CONTAMINATED, SUCH AS THE DIGESTIVE TRACT, SKIN AND EYES. IF TIME PERMITS, WIPE THE FACE WITH WET FILTER PAPER, FORCE COUGHING AND BLOWING OF THE NOSE. GET MEDICAL ATTENTION IMMEDIATELY (INTERNATIONAL ATOMIC ENERGY ASSOCIATION #3, PG.65).

!! WARNING!!

THE VICTIM MAY BE CONTAMINATED WITH RADIOACTIVE PARTICLES. THOROUGH DECONTAMINATION SHOULD BE STARTED BEFORE THE VICTIM IS MOVED TO THE MEDICAL AREA.

ANY PERSONNEL INVOLVED IN RENDERING FIRST AID MUST BE MONITORED FOR RADIOACTIVITY AND THOROUGHLY DECONTAMINATED IF NECESSARY (IAEA #3, PG.65).

SKIN CONTACT:

URANIUM:

RADIOACTIVE.

ACUTE EXPOSURE- THERE IS NO EVIDENCE THAT INSOLUBLE URANIUM COMPOUNDS CAN BE ABSORBED THROUGH THE SKIN; INSOLUBLE SALTS PRODUCED NO SIGNS OF POISONING AFTER SKIN CONTACT. URANIUM MAY IRRITATE THE SKIN.

CHRONIC EXPOSURE- PROLONGED SKIN CONTACT WITH INSOLUBLE URANIUM COMPOUNDS SHOULD BE AVOIDED BECAUSE OF POTENTIAL RADIATION DAMAGE TO BASAL CELLS. DERMATITIS HAS OCCURRED AS A RESULT OF HANDLING SOME INSOLUBLE URANIUM COMPOUNDS. SEE THE FOLLOWING SECTIONS REGARDING ALPHA RADIATION AND RADIATION SICKNESS.

ALPHA RADIATION:

ACUTE EXPOSURE- ALPHA RADIATION IS NOT USUALLY AN EXTERNAL HAZARD. THESE HEAVY PARTICLES DO NOT PENETRATE THE STRATUM CORNEUM OF THE SKIN. THE MAJOR DIFFICULTY ARISES WHEN THE SURFACE OF THE SKIN IS DAMAGED IN SOME WAY. WHEN AN INSOLUBLE ALPHA EMITTER ENTERS A PUNCTURE WOUND, LOCAL CELL DAMAGE AT THE SITE OF THE WOUND MAY OCCUR, THE SEVERITY OF WHICH IS DEPENDENT UPON THE DOSE. ENTRY OF A SOLUBLE ALPHA EMITTER INTO A PUNCTURE WOUND PRESENTS A DANGER OF MORE GENERALIZED CONTAMINATION AS THE ALPHA SOURCE BECOMES SPREAD THROUGH THE BODY. EITHER CASE MAY RESULT IN ALTERATION OF THE GENETIC MATERIAL, CANCER, AND THE OTHER SYMPTOMS OF RADIATION SICKNESS.

CHRONIC EXPOSURE- IF AN ALPHA EMITTER ENTERS THE BODY THROUGH A WOUND AND BECOMES DEPOSITED, THERE IS SOME DANGER THAT ITS CONTINUING DECAY COULD AFFECT THE ORGANS OR TISSUES IN WHICH IT IS DEPOSITED. ALPHA RADIATION IS VERY DAMAGING; AFFECTED CELLS MAY NOT RECOVER FROM ITS EFFECTS. SUCH LOCALIZED IRRADIATION OF TISSUES MAY RESULT IN GENETIC CHANGES AND MAY SUBSEQUENTLY LEAD TO CANCER, OR OTHER SYMPTOMS OF RADIATION SICKNESS. THE EXACT EFFECTS OF AN INTERNALLY DEPOSITED ALPHA EMITTER DEPENDS ON THE NATURE OF THE ISOTOPE, AND ITS SOLUBILITY.

RADIATION SICKNESS

THE CLINICAL COURSE OF RADIATION SICKNESS DEPENDS UPON THE DOSE, DOSE RATE, AREA OF THE BODY AFFECTED AND TIME AFTER EXPOSURE. EXTERNAL AND INTERNAL RADIOACTIVITY OF ANY TYPE MAY CAUSE RADIATION SICKNESS. RADIATION SICKNESS HAS THREE (3) CLEARLY DEFINED SYNDROMES WHICH ARE DESCRIBED IN DETAIL IN THE INHALATION SECTION.

MISLS # 2329

FIRST AID- REMOVE VICTIM TO A SUITABLE AREA FOR DECONTAMINATION AS QUICKLY AS POSSIBLE. REMOVE CLOTHING AND SHOES IMMEDIATELY. THOROUGHLY WASH THE VICTIM WITH SOAP AND WATER, PAYING PARTICULAR ATTENTION TO THE HEAD, FINGER NAILS AND PALMS OF THE HANDS. UPON COMPLETION OF WASHING, MONITOR THE VICTIM FOR RADIOACTIVITY. IT IS IMPERATIVE THAT THE SKIN SHOULD BE DECONTAMINATED AS QUICKLY AS POSSIBLE. MINUTE SKIN INJURIES GREATLY INCREASE THE DANGER OF ISOTOPE PENETRATION INTO THE VICTIM; SHAVING SHOULD NOT BE ATTEMPTED. IF WATER AND SOAP HAVE BEEN INADEQUATE IN REMOVING THE RADIOACTIVE COMPOUND, DECONTAMINATING COMPOUNDS CONSISTING OF SURFACTANTS AND ABSORBENT SUBSTANCES MAY BE EFFECTIVE. COMPLEXING REAGENTS MAY ALSO BE OF USE. THE USE OF ORGANIC SOLVENTS IS TO BE AVOIDED, AS THEY MAY INCREASE THE SOLUBILITY AND ABSORPTION OF THE RADIOACTIVE SUBSTANCE. SKIN CONTAMINATION WITH RADIATION MAY BE AN INDICATION THAT OTHER PARTS OF THE BODY HAVE BEEN EXPOSED (INTERNATIONAL ATOMIC AGENCY ASSO.#47 PG.9; INTERNATIONAL ATOMIC ENERGY ASSO. #3, PG. 62).

!! WARNING!!

CONTAMINATED CLOTHING MUST BE STORED IN A METAL CONTAINER FOR LATER DECONTAMINATION OR DISPOSAL. THE WATER USED TO WASH THE VICTIM MUST BE STORED IN METAL CONTAINERS FOR LATER DISPOSAL.

ANY PERSONNEL INVOLVED IN RENDERING FIRST AID TO THE VICTIM MUST BE MONITORED FOR RADIOACTIVITY AND DECONTAMINATED IF NECESSARY (IAEA #47, PG.9; IAEA #3, PG.62).

EYE CONTACT:

URANIUM:

RADIOACTIVE.

ACUTE EXPOSURE- DUST MAY BE IRRITATING TO THE EYES. A VARIETY OF SOLUBLE AND INSOLUBLE COMPOUNDS OF URANIUM WERE TESTED ON THE EYES OF RABBITS. THE INSOLUBLE COMPOUNDS CAUSED THE MILDEST DEGREE OF INJURY. THE EFFECTS OF EYE CONTACT WITH ANY URANIUM COMPOUND TEND TO BE NECROSIS OF THE CONJUNCTIVAE AND EYELIDS, AND ULCERATION OF THE CORNEA.

CHRONIC EXPOSURE- PROLONGED EXPOSURE TO URANIUM MAY PRODUCE CONJUNCTIVITIS, OR THE SYMPTOMS OF RADIATION INJURY, SUCH AS CATARACTS. SEE THE FOLLOWING SECTIONS REGARDING THE EFFECTS OF ALPHA RADIATION ON THE EYES, AND RADIATION SICKNESS.

ALPHA RADIATION:

ACUTE EXPOSURE- RADIATION AFFECTS THE EYE BY INDUCING ACUTE INFLAMMATION OF THE CONJUNCTIVA AND THE CORNEA. THE MOST SENSITIVE PART OF THE EYE IS THE CRYSTALLINE LENS. A LATE EFFECT OF EYE IRRADIATION IS CATARACT FORMATION. IT MAY BEGIN ANYWHERE FROM 6 MONTHS TO SEVERAL YEARS AFTER A SINGLE EXPOSURE. CATARACT FORMATION BEGINS AT THE POSTERIOR POLE OF THE LENS, AND CONTINUES UNTIL THE ENTIRE LENS HAS BEEN AFFECTED. GROWTH OF THE OPACITY MAY STOP AT ANY POINT. THE RATE OF GROWTH AND THE DEGREE OF OPACITY ARE DEPENDENT UPON THE DOSE OF RADIATION.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE TO ALPHA RADIATION MAY RESULT IN CATARACT FORMATION, AS DESCRIBED ABOVE. OF THE WELL-DOCUMENTED LATE EFFECTS OF RADIATION ON MAN, LEUKEMIA AND CATARACTS HAVE BEEN OBSERVED AT DOSES LOWER THAN THOSE PRODUCING SKIN SCARRING AND CANCER OR BONE TUMORS. THE LENS OF THE EYE SHOULD BE CONSIDERED TO BE A CRITICAL ORGAN.

RADIATION SICKNESS

THE EYES ARE VERY RADIOSENSITIVE; A SINGLE DOSE OF 100 RADS MAY CAUSE CONJUNCTIVITIS AND KERATITIS.

IT IS UNLIKELY THAT A DOSE SUFFICIENT TO CAUSE RADIATION SICKNESS WOULD OCCUR IF ONLY THE EYES WERE IRRADIATED. HOWEVER, IF EYE DAMAGE BY IONIZING RADIATION OCCURS, IT MAY BE BEST TO ASSUME THAT OTHER PARTS OF THE BODY HAVE

ALSO BEEN CONTAMINATED. SYMPTOMS OF RADIATION SICKNESS ARE DESCRIBED IN THE INHALATION SECTION.

MSDS # 2329

FIRST AID- REMOVE VICTIM TO A RESTRICTED AREA FOR DECONTAMINATION. THOROUGHLY WASH EYES WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING THE UPPER AND LOWER LIDS (APPROXIMATELY 15 MINUTES). FOLLOWING THE WATER TREATMENT, PROVIDE AN ISOTONIC SOLUTION. DO NOT USE EYEBATHS, RATHER PROVIDE A CONTINUOUS AND COPIOUS SUPPLY OF FLUID. MONITOR THE VICTIM FOR RADIOACTIVITY. IF ACTIVITY IS PRESENT, REWASH THE EYES, AND REMONITOR UNTIL LITTLE OR NO RADIOACTIVITY IS PRESENT. GET MEDICAL ATTENTION IMMEDIATELY (INTERNATIONAL ATOMIC ENERGY ASSO. #3, PG.65; #47, PG.35).

!! WARNING!!

ANY WATER USED TO WASH THE VICTIMS EYES MUST BE STORED IN A METAL CONTAINER FOR LATER DISPOSAL. ANY OTHER ARTICLES THAT ARE USED TO DECONTAMINATE THE VICTIM MUST ALSO BE STORED IN METAL CONTAINERS FOR LATER DECONTAMINATION OR DISPOSAL.

ANY PERSONNEL INVOLVED IN RENDERING FIRST AID TO THE VICTIM MUST BE MONITORED FOR RADIOACTIVITY AND DECONTAMINATED IF NECESSARY (IAEA #3, PG.65; #47, PG.35).

INGESTION:

URANIUM:

RADIOACTIVE/NEPHROTOXIN.

ACUTE EXPOSURE- FEEDING STUDIES ON ANIMALS INDICATE THAT INSOLUBLE URANIUM IS MUCH LESS TOXIC THAN SOLUBLE URANIUM COMPOUNDS. URANIUM ENTERING THE BLOODSTREAM WILL BECOME STORED IN THE BONE MARROW, BUT THE MAJORITY WILL BECOME LODGED IN THE KIDNEY, WHICH IS THE MAJOR SITE OF TOXICITY. MORE THAN A YEAR AND A HALF IS REQUIRED TO RID THE BODY OF AN ACCIDENTAL HIGH DOSE OF URANIUM, AFTER WHICH TIME MEASURABLE URANIUM IS PRESENT IN THE BONE AND KIDNEY.

CHRONIC EXPOSURE- THE TOXIC ACTION OF URANIUM RESIDES MORE IN ITS CHEMICAL ACTION ON THE RENAL TUBULES, RATHER THAN RADIATION EFFECTS. RATS INJECTED WITH URANIUM METAL IN THE FEMORAL MARROW DEVELOPED SARCOMAS, WHETHER THIS WAS DUE TO METALLOCARCINOGENIC OR RADIOCARCINOGENIC ACTION COULD NOT BE DETERMINED. SEE THE FOLLOWING SECTIONS REGARDING INGESTION OF ALPHA EMITTERS, AND RADIATION SICKNESS. ALSO SEE THE FIRST AID SECTION FOR URANIUM COMPOUNDS.

ALPHA RADIATION:

ACUTE EXPOSURE- THE FATE OF INGESTED ALPHA EMITTERS DEPENDS ON THEIR SOLUBILITY AND VALENCE. ONCE INSIDE THE BODY, RADIONUCLIDES ARE ABSORBED, METABOLIZED, AND DISTRIBUTED THROUGHOUT THE TISSUES AND ORGANS ACCORDING TO THE CHEMICAL PROPERTIES OF THE ELEMENTS AND COMPOUNDS IN WHICH THEY EXIST. THEIR EFFECTS ON ORGANS OR TISSUES DEPEND ON THE TYPE AND ENERGY OF THE RADIATION AND RESIDENCE TIME.

RADIOACTIVE ISOTOPES ARE ELIMINATED FROM THE BODY THROUGH VARIOUS CHANNELS. ISOTOPES THAT ARE OF LITTLE OR NO SOLUBILITY ARE ELIMINATED THROUGH THE LIVER AND DIGESTIVE SYSTEM. SOLUBLE ISOTOPES WHICH HAVE BEEN ABSORBED INTO THE BODY ARE ELIMINATED IN THE URINE.

ISOTOPES ARE MOST READILY REMOVED FROM NERVE AND MUSCLE TISSUE, AND MUCH MORE SLOWLY FROM THE KIDNEYS AND THE CELLS OF THE RETICULO-ENDOTHELIAL SYSTEM, AND MOST SLOWLY OF ALL FROM THE BONES. IN THE LYMPH NODES, RADIOACTIVE ISOTOPES ARE RETAINED FOR A COMPARITIVELY LONG PERIOD. PHYSIOLOGICAL CONDITION AND AGE OF THE PERSON, AS WELL AS THE TOTAL QUANTITY OF THE ISOTOPES DETERMINES THE ELIMINATION RATE.

WHILE BEING ELIMINATED, ALPHA EMITTERS MAY DECAY, IRRADIATING THE TISSUE ALONG ANY OF THE ABOVE ELIMINATION ROUTES WITH HIGH ENERGY RADIATION. THE EXTENT TO WHICH THIS OCCURS IS DEPENDENT UPON THE PHYSICAL AND BIOLOGICAL HALF-LIFE OF THE RADIONUCLIDE. HIGH DOSES OF RADIATION DELIVERED TO ANY TISSUE WILL RESULT IN DAMAGE, AND MAY LEAD TO THE SYMPTOMS OF RADIATION SICKNESS, OR THE LONG TERM EFFECTS DESCRIBED IN THE SECTION ON RADIATION SICKNESS.

CHRONIC EXPOSURE- REPEATED OR PROLONGED INGESTION OF ALPHA EMITTERS MAY LEAD TO RADIATION SICKNESS, OR DELAYED EFFECTS OF RADIATION EXPOSURE, AS DESCRIBED IN THAT SECTION.

MSDS # 2329

RADIATION SICKNESS

THE SYMPTOMS OF RADIATION SICKNESS DEPENDS UPON THE DOSE RECEIVED. IT MAY RESULT FROM ACUTE OR CHRONIC EXPOSURE TO ANY FORM OF RADIATION. THE SYMPTOMS ARE DESCRIBED IN THE INHALATION SECTION.

FIRST AID FOR URANIUM COMPOUNDS:

ALTHOUGH CHELATING AGENTS ACT ON URANIUM, THEY SHOULD NOT BE USED BECAUSE THE INCREASED MIGRANT FRACTION LEADS THROUGH RENAL PRECIPITATION TO A GREATER KIDNEY BURDEN THAN WOULD BE RECEIVED IF THERE WERE NO TREATMENT AT ALL; THERE IS THUS THE RISK OF SERIOUS TOXIC NEPHRITIS. THE BASIC TREATMENT SHOULD BE ADMINISTRATION OF A BICARBONATED SOLUTION GIVEN LOCALLY AND IN INTRAVENOUS PERFUSION (ONE BOTTLE OF 250 ML AT 1.4 %). FROM IAEA SAFETY SERIES # 47 - MANUAL ON EARLY MEDICAL TREATMENT OF POSSIBLE RADIATION INJURY - 1978. PG. 28.

FIRST AID: IN THE CASE OF INGESTION OF RADIOACTIVE SUBSTANCES, THE MOUTH SHOULD BE RINSED OUT IMMEDIATELY AFTER THE ACCIDENT, CARE BEING TAKEN NOT TO SWALLOW THE WATER USED FOR THIS PURPOSE. VOMITING SHOULD BE INDUCED EITHER MECHANICALLY, OR WITH SYRUP OF IPECAC. DO NOT INDUCE VOMITING IN AN UNCONSCIOUS PERSON. LAVAGE MAY BE USEFUL. CARE SHOULD BE TAKEN TO AVOID ASPIRATION. THE VOMITUS AND LAVAGE FLUIDS SHOULD BE SAVED FOR EXAMINATION AND MONITORING. FURTHER ACTION DEPENDS ON THE NATURE OF THE RADIOACTIVE SUBSTANCE. GET MEDICAL ATTENTION IMMEDIATELY (INTERNATIONAL ATOMIC ENERGY ASSO. #47, PG.9; #3, PP.59 AND 66).

!!WARNING!!

THE GASTRIC FLUIDS AND FLUIDS USED FOR LAVAGE MUST BE STORED IN METAL CONTAINERS FOR LATER DISPOSAL. THE VICTIM MUST BE MONITORED FOR RADIOACTIVITY AND DECONTAMINATED, IF NECESSARY, BEFORE BEING TRANSPORTED TO A MEDICAL FACILITY.

ANY PERSONNEL INVOLVED IN RENDERING FIRST AID TO THE VICTIM MUST BE MONITORED FOR RADIOACTIVITY AND DECONTAMINATED IF NECESSARY (IAEA #47, PG.9; #3, PP. 59 AND 66).

ANTIDOTE:

THE FOLLOWING ANTIDOTE HAS BEEN RECOMMENDED. HOWEVER, THE DECISION AS TO WHETHER THE SEVERITY OF POISONING REQUIRES ADMINISTRATION OF ANY ANTIDOTE AND ACTUAL DOSE REQUIRED SHOULD BE MADE BY QUALIFIED MEDICAL PERSONNEL.

THERE IS NO ANTIDOTE FOR RADIATION SICKNESS. TREATMENT SHOULD BE SYMPTOMATIC AND SUPPORTATIVE, REGARDLESS OF THE DOSE RECEIVED. IN ALL CASES, MEDICAL ATTENTION SHOULD BE OBTAINED IMMEDIATELY.

REACTIVITY SECTION

REACTIVITY:

URANIUM:

CLEAN URANIUM TURNINGS OR CHIPS OXIDIZE READILY IN AIR. IF CONFINED IN A CONTAINER WITHOUT AIR MOVEMENT, THEY CAN IGNITE SPONTANEOUSLY. MOISTURE INCREASES THIS REACTIVITY.

URANIUM TURNINGS STORED IN WATER WILL HYDRIDE AND IGNITE DURING WARM WEATHER

INCOMPATIBILITIES:

URANIUM:

CHLORINE: VIOLENT REACTION

AIR: VIOLENT REACTION

FLUORINE: VIOLENT REACTION

NITRIC ACID: REACTS EXPLOSIVELY OR WITH THE FORMATION OF AN EXPLOSIVE SURFACE COATING OR RESIDUE

NITROGEN OXIDE: IGNITES

DINITROGEN TETRAOXIDE: EXPLODES OR FORMS AN EXPLOSIVE SURFACE COATING OR RESIDUE

SELENIUM: REACTS VIOLENTLY OR INCANDESCES

SULFUR: REACTS VIOLENTLY OR INCANDESCES

WATER: VIOLENT REACTION HAZARD

AMMONIA: REACTS VIOLENTLY OR INCANDESCES AT DULL RED HEAT

BROMIUM TRIFLUORIDE: VIOLENT REACTION

TRICHLORO ETHYLENE: VIOLENT REACTION

NITRYL FLUORIDE: VIOLENT REACTION OR GLOWING OR WHITE INCANDESCENCE

CARBON DIOXIDE: AT 750 C INTERACTION IS SO RAPID THAT IGNITION WILL OCCUR WITH THE FINELY DIVIDED METAL, AND AT 500 C THE MASSIVE METAL WILL IGNITE.

CARBON TETRACHLORIDE: USE OF A CARBON TETRACHLORIDE FIRE EXTINGUISHER ON A SMALL URANIUM FIRE LED TO AN EXPLOSION.

CHLORINE: IGNITES AT 150-180 C

BROMINE VAPOR: IGNITES AT 210-240 C

IODINE VAPOR: IGNITES AT 260 C

ACIDS: REACTS WITH LIBERATION OF HYDROGEN AND FORMATION OF SALTS OF TETRAVALENT URANIUM.

MSDS # 2329

DECOMPOSITION:

THERMAL DECOMPOSITION MAY RELEASE TOXIC AND/OR HAZARDOUS GASES.

POLYMERIZATION:

NO DATA AVAILABLE.

CONDITIONS TO AVOID

MAY IGNITE ITSELF IF EXPOSED TO AIR. MAY BURN RAPIDLY WITH FLARE-BURNING EFFECT AND RE-IGNITE AFTER FIRE IS EXTINGUISHED.

SPILLS AND LEAKS

SOIL-RELEASE:

DO NOT HANDLE PACKAGES WITHOUT FULL PROTECTIVE EQUIPMENT.

OCCUPATIONAL-SPILL:

DO NOT TOUCH DAMAGED CONTAINERS OR SPILLED MATERIAL. DAMAGE TO OUTER CONTAINER MAY NOT AFFECT PRIMARY INNER CONTAINER. FOR SMALL LIQUID SPILLS,

TAKE UP WITH SAND, EARTH OR OTHER ABSORBENT MATERIAL. FOR LARGE SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. KEEP UNNECESSARY PEOPLE AT LEAST 150 FEET UPWIND; GREATER DISTANCES MAY BE NECESSARY IF ADVISED BY QUALIFIED RADIATION AUTHORITY. ISOLATE HAZARD AREA AND DENY ENTRY. ENTER SPILL AREA ONLY TO SAVE LIFE; LIMIT ENTRY TO SHORTEST POSSIBLE TIME. DETAIN UNINJURED PERSONS AND EQUIPMENT EXPOSED TO RADIOACTIVE MATERIAL UNTIL ARRIVAL OR INSTRUCTION OF QUALIFIED RADIATION AUTHORITY. DELAY CLEANUP UNTIL ARRIVAL OR INSTRUCTION OF QUALIFIED RADIATION AUTHORITY.

-----MSDS # 2329

PROTECTIVE EQUIPMENT SECTION

VENTILATION:

AT A MINIMUM, PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION. DEPENDING UPON THE SPECIFIC WORKPLACE ACTIVITY AND THE RADIOACTIVITY OF THE ISOTOPE, A MORE STRINGENT VENTILATION SYSTEM MAY BE NECESSARY TO COMPLY WITH EXPOSURE LIMITS SET FORTH BY LAW (10CFR20.103).

ONE METHOD OF CONTROLLING EXTERNAL RADIATION EXPOSURE IS TO PROVIDE ADEQUATE SHIELDING. THE ABSORBING MATERIAL USED AND THE THICKNESS REQUIRED TO ATTENUATE THE RADIATION TO ACCEPTABLE LEVELS DEPENDS ON THE TYPE OF RADIATION, ITS ENERGY, THE FLUX AND THE DIMENSIONS OF THE SOURCE.

ALPHA PARTICLES- FOR THE ENERGY RANGE OF ALPHA PARTICLES USUALLY ENCOUNTERED, A FRACTION OF A MILLIMETER OF ANY ORDINARY MATERIAL IS SUFFICIENT FOR ABSORBANCE. THIN RUBBER, ACRYLIC, STOUT PAPER, OR CARDBOARD WILL SUFFICE.

BETA PARTICLES- BETA PARTICLES ARE MORE PENETRATING THAN ALPHA, AND REQUIRE MORE SHEILDING. MATERIALS COMPOSED MOSTLY OF ELEMENTS OF LOW ATOMIC NUMBER SUCH AS ACRYLIC, ALUMINUM AND THICK RUBBER ARE MOST APPROPRIATE FOR THE ABSORPTION OF BETA PARTICLES. FOR EXAMPLE, 1/4 INCH OF ACRYLIC WILL ABSORB ALL BETA PARTICLES UP TO 1 MEV. WITH HIGH ENERGY BETA RADIATION FROM LARGE SOURCES, BREMSSTRAHLUNG (X RAY PRODUCTION) CONTRIBUTION MAY BECOME SIGNIFICANT AND IT MAY BE NECESSARY TO PROVIDE ADDITIONAL SHEILDING OF HIGH ATOMIC WEIGHT MATERIAL, SUCH AS LEAD, TO ATTENUATE THE BREMSSTRAHLUNG RADIATION.

GAMMA RAYS- THE MOST SUITABLE MATERIALS FOR SHIELDING GAMMA RADIATION ARE LEAD AND IRON. THE THICKNESS REQUIRED WILL DEPEND ON WHETHER THE SOURCE IS PRODUCING NARROW OR BROAD BEAM RADIATION. PRIMARY AND SECONDARY PROTECTIVE BARRIERS MAY BE REQUIRED TO BLOCK ALL RADIATION.

RESPIRATOR:

OSHA REQUIRED RESPIRATORY PROTECTION FOR URANIUM AND INSOLUBLE COMPOUNDS (AS URANIUM): ONLY NIOSH OR MSHA APPROVED EQUIPMENT SHOULD BE USED.

PARTICULATE CONCENTRATION
2.5 MG/M3 OR LESS

MINIMUM PROTECTION

- ANY FUME RESPIRATOR OR HIGH EFFICIENCY PARTICULATE FILTER RESPIRATOR APPROVED FOR RADON DAUGHTERS OR RADIONUCLIDES.
- ANY SUPPLIED-AIR RESPIRATOR.
- ANY SELF-CONTAINED BREATHING APPARATUS

12.5 MG/M3 OR LESS

- A HIGH EFFICIENCY PARTICULATE FILTER RESPRIATOR WITH A FULL FACEPIECE.
- ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE, HELMET OR HOOD.
- ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

30 MG/M3 OR LESS

- A POWERED AIR-PURIFYING RESPIRATOR

WITH A FULL FACEPIECE AND HIGH-EFFICIENCY PARTICULATE FILTER.
-A TYPE-C SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE MODE OR WITH A FULL FACEPIECE, HELMET OR HOOD OPERATED IN CONTINUOUS-FLOW MODE.

GREATER THAN 30 MG/M3 OR ENTRY AND ESCAPE FROM UNKNOWN CONCENTRATIONS

-SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.
-A COMBINATION RESPIRATOR WHICH INCLUDE A TYPE-C SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE OR CONTINUOUS MODE AND AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

MSDS # 2329

FIRE FIGHTING

-A HIGH EFFICIENCY PARTICULATE FILTER RESPIRATOR.
-ANY ESCAPE SELF-CONTAINED BREATHING APPARATUS.

THIS INFORMATION FROM THE OSHA/NIOSH GUIDELINES, SEPTEMBER, 1978.

THESE RECOMMENDED RESPIRATORS SHOULD PROVIDE PROTECTION FOR THE RESPIRATORY TRACT AGAINST MOST OF THE RADIOACTIVE PARTICLES ENCOUNTERED IN THE WORK PLACE. THESE RESPIRATORS WILL NOT OFFER PROTECTION AGAINST BETA AND GAMMA RADIATION, BUT MAY BLOCK ALPHA PARTICLES. FROM 10CFR20.103 APPENDIX A. RESPIRATORY EQUIPMENT MUST BE CERTIFIED BY NIOSH/MSHA.

TYPE 'C' SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE OR WITH A FULL FACEPIECE, HELMET OR HOOD OPERATED IN CONTINUOUS-FLOW MODE.

SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:

DIPOSABLE OVERGARMENTS, INCLUDING HEAD COVERINGS AND FOOT COVERING, SHOULD BE WORN BY ANY EMPLOYEE ENGAGED IN HANDLING ANY RADIOACTIVE SUBSTANCE. THESE GARMENTS ARE ALSO RECOMMENDED EVEN IF THE EMPLOYEE IS WORKING WITH A "GLOVE BOX" CONTAINMENT SYSTEM. CERTAIN CLOTHING FIBERS MAY BE USEFUL IN DOSIMETRY

SO CLOTHING SHOULD BE KEPT.
IN THE EVENT OF AN ACCIDENT, LARGE SCALE RELEASE OR A LARGE SCALE CLEAN-UP
FULL PROTECTIVE CLOTHING WILL BE NECESSARY.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS
SUBSTANCE.

WARNING!
USED GLOVES MAY PRESENT A RADIATION HAZARD AND SHOULD BE DISPOSED OF
AS RADIOACTIVE WASTE.

MSDS # 2329

EYE PROTECTION:
EMPLOYEE MUST WEAR APPROPRIATE EYE PROTECTION THAT WILL NOT ALLOW THE
INTRODUCTION OF PARTICLES INTO THE EYES. CONTACT LENSES SHOULD NOT BE WORN.

CLOTHING, GLOVE, AND EYE PROTECTION EQUIPMENT WILL PROVIDE PROTECTION
AGAINST ALPHA PARTICLES, AND SOME PROTECTION AGAINST BETA PARTICLES, DEPENDING
ON THICKNESS, BUT WILL NOT SHIELD GAMMA RADIATION.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.

CREATION DATE: 09/23/86

REVISION DATE: 11/17/89

MSDS # 2329-----
PHYSICAL DATA

DESCRIPTION: GRAYISH WHITE, DENSE, SILVERY, RADIOACTIVE SOLID THAT IS STRONGLY ELECTROPOSITIVE. ON VIGOROUS SHAKING THE METALLIC PARTICLES EXHIBIT LUMINESCENCE. IT IS DUCTILE AND MALLEABLE AND IGNITES SPONTANEOUSLY IN AIR.

BOILING POINT: 6904 F (3818 C) MELTING POINT: 2070 F (1132 C)

SPECIFIC GRAVITY: 19.0 SOLUBILITY IN WATER: INSOLUBLE

OTHER SOLVENTS (SOLVENT - SOLUBILITY):
SOLUBLE IN ACETONE, IN ACIDS AND INSOLUBLE IN ALKALIES
AND ALCOHOL.

OTHER PHYSICAL DATA

NATURAL URANIUM IS 99.27 % U-238, WHICH HAS A HALF-LIFE OF 4.51 E 9 YEARS,
AND DECAYS BY ALPHA EMISSION.

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD

DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

DANGEROUS EXPLOSION HAZARD WHEN EXPOSED TO HEAT OR FLAME.

FLASH POINT: FLAMMABLE SOLID

FIREFIGHTING MEDIA:

DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY OR STANDARD FOAM
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY OR FOG (FLOODING AMOUNTS)
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:

MOVE CONTAINERS FROM FIRE AREA IF POSSIBLE. COOL FIRE-EXPOSED CONTAINERS WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM STORAGE TANK ENDS (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, GUIDE PAGE 65).

DO NOT MOVE DAMAGED CONTAINERS. MOVE UNDAMAGED CONTAINERS OUT OF FIRE ZONE. FOR MASSIVE FIRE IN STORAGE AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES. FIGHT FIRE FROM MAXIMUM DISTANCE. STAY AWAY FROM STORAGE TANK ENDS (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, GUIDE PAGE 63).

CONTACT THE LOCAL, STATE, OR DEPARTMENT OF ENERGY RADIOLOGICAL RESPONSE TEAM. USE SUITABLE AGENT FOR SURROUNDING FIRE. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER, APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING

DUSTS OR VAPORS, KEEP UPWIND. KEEP UNNECESSARY PEOPLE OUT OF AREA UNTIL DECLARED SAFE BY RADIOLOGICAL RESPONSE TEAM.

MSDS # 2329

 TRANSPORTATION

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49CFR172.101:
 RADIOACTIVE MATERIAL

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND SUBPART E:
 RADIOACTIVE AND FLAMMABLE SOLID.

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.418
 EXCEPTIONS: NONE

 TOXICITY

URANIUM:

CARCINOGEN STATUS: NONE.

THE TOXICITY OF URANIUM METAL HAS NOT BEEN QUANTIFIED. URANIUM MAY BE A SKIN, EYE, AND MUCOUS MEMBRANE IRRITANT, AS WELL AS A NEPHROTOXIN. URANIUM METAL USUALLY DOES NOT CONSTITUTE AN EXTERNAL RADIATION EXPOSURE HAZARD SINCE IT EMITS MAINLY ALPHA-RADIATION AT A LOW ENERGY LEVEL. IT MAY CONSTITUTE AN INTERNAL RADIATION HAZARD IF IT IS ABSORBED INTO THE BODY, THUS DELIVERING ALPHA EMISSION ONTO TISSUES IN WHICH IT IS STORED.

 HEALTH EFFECTS AND FIRST AID

INHALATION:

URANIUM:

RADIOACTIVE/NEPHROTOXIN. 30 MG/M3 IMMEDIATELY DANGEROUS TO LIFE AND HEALTH.

ACUTE EXPOSURE- URANIUM MAY ENTER THE BODY THROUGH INHALATION OF FINE PARTICLES THAT ARE APPROXIMATELY 1 MICRON IN DIAMETER. URANIUM POISONING IS CHARACTERIZED BY GENERALIZED HEALTH IMPAIRMENT. IT MAY CAUSE CHANGES IN THE KIDNEYS, LIVER, LUNGS, AND CARDIOVASCULAR, NERVOUS, AND HEMOPOIETIC SYSTEMS, AND DISORDERS OF PROTEIN AND CARBOHYDRATE METABOLISM. SYMPTOMS MAY INCLUDE OLIGURIA, HEMATURIA, ALBUMINURIA, AND JAUNDICE.

CHRONIC EXPOSURE- WORKERS EXPOSED TO HIGH AVERAGE LEVELS OF URANIUM DUST IN A PLANT AT OAK RIDGE HAVE NOT HAD INCREASED MORTALITY RATES FROM LUNG CANCER, LEUKEMIA, BONE CANCER, OR DISEASES OF THE RESPIRATORY AND GENITOURINARY SYSTEMS. LUNG CANCER IN URANIUM MINERS IS PROBABLY THE RESULT OF INHALATION OF RADON DAUGHTERS FOUND IN THESE MINES. CHRONIC POISONING GIVES CHEST FINDINGS OF PNEUMOCONIOSIS, PRONOUNCED BLOOD CHANGES AND GENERALIZED INJURY. CANCER OF LYMPHATIC AND BLOOD FORMING TISSUES MAY RESULT. SEE THE FOLLOWING SECTIONS REGARDING THE EFFECTS OF INHALATION OF AN ALPHA EMITTER, AND RADIATION SICKNESS.

ALPHA RADIATION:

ACUTE EXPOSURE- ALPHA RADIATION EMITTED FROM RADIONUCLIDES HAS WELL-DEFINED AND CHARACTERISTIC ENERGIES. AS IT IS DOUBLY CHARGED HELIUM IONS, WHICH MOVE RELATIVELY SLOWLY, IT IS DENSELY IONIZING WITH VERY HIGH ENERGY, BUT HAS EXTREMELY LIMITED PENETRATION. THE HIGH ENERGY AND SHORT PATH LENGTH

BIRTHDAY.
(3) THE EMPLOYER MAINTAINS ADEQUATE PAST AND CURRENT EXPOSURE RECORDS WHICH SHOW THAT THE ADDITION OF SUCH A DOSE WILL NOT EXCEED THESE AMOUNTS.

LIMITS FOR URANIUM COMPOUNDS - FROM 10CFR.103 APPENDIX B, PAGE 281.
THESE ARE AIRBORNE CONCENTRATIONS IN MICROCURIES FOR THE QUARTER (13 WEEKS):

	PERSONS OVER 18	PERSONS YOUNGER THAN 18
URANIUM-230		
SOLUBLE	0.189	0.0189
INSOLUBLE	0.063	0.0063
URANIUM-232		
SOLUBLE	0.063	0.0063
INSOLUBLE	0.019	0.0019
URANIUM-233		
SOLUBLE	0.315	0.0315
INSOLUBLE	0.063	0.0063
URANIUM-234		
SOLUBLE	0.378	0.0378
INSOLUBLE	0.063	0.0063
URANIUM-235		
SOLUBLE	0.315	0.0315
INSOLUBLE	0.063	0.0063
URANIUM-236		
SOLUBLE	0.378	0.0378
INSOLUBLE	0.063	0.0063
URANIUM-238		
SOLUBLE	0.044	0.0044
INSOLUBLE	0.063	0.0063
URANIUM-240		
SOLUBLE	12.600	1.2600
INSOLUBLE	12.600	1.2600
URANIUM-NATURAL		
SOLUBLE	0.063	0.0063
INSOLUBLE	0.063	0.0063

MSDS # 2329

FROM IAEA # 9 - ANNUAL LIMITS ON INTAKES (ALI) 1982 - IN BECQUERELS (BQ) TO OBTAIN CURIES (CI), DIVIDE BY 3.7 E 10.

	ORAL		INHALATION		
	A	B	A	B	C
URANIUM-230	1 E 5	2 E 6	2 E 4	1 E 4	1 E 4
URANIUM-231	2 E 8	2 E 8	3 E 8	2 E 8	2 E 8
URANIUM-232	8 E 4	2 E 6	8 E 3	1 E 4	3 E 2
URANIUM-233	4 E 5	7 E 6	4 E 4	3 E 4	1 E 3
URANIUM-234	4 E 5	7 E 6	5 E 4	3 E 4	1 E 3
URANIUM-235	5 E 5	7 E 6	5 E 4	3 E 4	2 E 3
URANIUM-236	5 E 5	8 E 6	5 E 4	3 E 4	1 E 3
URANIUM-237	6 E 7	6 E 7	1 E 8	6 E 7	6 E 7
URANIUM-238	5 E 5	8 E 6	5 E 4	3 E 4	2 E 3
URANIUM-239	2 E 9	2 E 9	7 E 9	6 E 9	6 E 9
URANIUM-240	5 E 7	5 E 7	1 E 8	1 E 8	9 E 7

NOTATION SUCH AS "1 E 6" MEANS "ONE TIMES TEN TO THE SIXTH".

- A. FOR WATER-SOLUBLE INORGANIC COMPOUNDS OF URANIUM (HEXAVALENT URANIUM).
- B. FOR RELATIVELY INSOLUBLE COMPOUNDS SUCH AS UF4, UO2, U3O8, IN WHICH THE URANIUM IS USUALLY TETRAVALENT.
- C. UF6, UO2F2, UO2(NO3)2.
- D. UO3, UF4, UCL4.
- E. UO2, U3O8.

FROM: HEALTH-RECORDS 1004

DATE: 1988

P. 1

MSDS # 10179

Material Safety Data Sheet

May be used to comply with
OSHA's Hazard Communication Standard,
29 CFR 1910.1200. Standard must be
consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072



IDENTITY (As Used on Label and List)

ABSORBS-IT (Product Code #01037)

Note: Blank spaces are not permitted. If any item is not applicable, or no
information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name

EXCEL-MINERAL COMPANY, INC.

Emergency Telephone Number

(805) 683-5321

Address (Number, Street, City, State, and ZIP Code)

111 S. La Patera Lane, Goleta, CA 93117

Telephone Number for Information

(805) 683-5321

P.O. Box 878

Date Prepared

October 30, 1988

Goleta, CA 93116

Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))

OSHA PEL

ACGIH TLV

Other Limits
Recommended

% (optional)

sedimentary opal clay --

Based on PEL/TLV for crystalline silica.

a natural earth material containing

respirable dust exposure should be maintained

on the average of less than 10%

below 1 mg/m³

crystalline silica

(SiO₂ CAS #14808607)

**The Threshold Limit Value-Time Weighted Average (TLV-TWA)—the time-weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

**Threshold Limit Values for Chemical Substances in the Work Environment adopted by ACQUA, 1968-67, page 3, paragraph 2)

Section III — Physical/Chemical Characteristics

Boiling Point	N/A	Specific Gravity (H ₂ O = 1)	2.2
Vapor Pressure (mm Hg)	N/A	Melting Point	N/A
Vapor Density (AIR = 1)	N/A	Evaporation Rate (Butyl Acetate = 1)	N/A
Solubility in Water	Less than 1.5%		
Appearance and Odor	Buff granular mineral - odorless		

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)	Non-flammable	Flammable Limits	LEL	UEL
		Non-flammable	---	---
Extinguishing Media	N/A (product itself may be used as an extinguisher)			
Special Fire Fighting Procedures	None			
Unusual Fire and Explosion Hazards	None			

(Reproduce locally)

OSHA 174, Sept. 1985

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid
	Stable	X	

Incompatibility (Materials to Avoid) Hydrofluoric Acid

Hazardous Decomposition or Byproducts

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	

Section VI — Health Hazard Data

Routes of Entry: Inhalation? Skull? Ingestion?
Inhalation is only significant route.

Health Hazards (Acute and Chronic)
 Acute: No known effect below 10 mg/m³ Chronic: Exposure above PEL/TLV that continues for many years may cause lung fibrosis.

Carcinogenicity: NTP? None IARC Monographs? 2A OSHA Regulated? None

Based on limited evidence, IARC has placed crystalline silica in Group 2A (probable).

Signs and Symptoms of Exposure
Cough, shortness of breath & x-ray findings of lung fibrosis after years of heavy exposure.

Medical Conditions
 Generally Aggravated by Exposure Dust may aggravate reactive airway disease and asthma.

Emergency and First Aid Procedures N/A

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled
Sweep up or vacuum.

Use approved dust respirator if airborne concentration exceeds the PEL/TLV.

Waste Disposal Method
Dispose in accordance with current federal, state & local regulations for the liquid absorbed in the material.

Precautions to Be Taken in Handling and Storing
Control airborne concentrations to levels below the PEL/TLV (1 mg/m³).

Other Precautions
Store in dry area or under cover.

Section VIII — Control Measures

Respiratory Protection (Specify Type)
Use NIOSH approved respiratory protection if dust concentration exceeds PEL/TLV.

Ventilation	Local Exhaust	X	Special
	Mechanical (General)		Other

Protective Gloves None Eye Protection As appropriate for dust exposure.

Other Protective Clothing or Equipment

Work/Hygienic Practices
Use good housekeeping & work practices so that airborne dust does not exceed PEL/TLV.

Judgements as to the suitability of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of such information, EXCEL-MINERAL COMPANY, INC. extends no warranties, makes no representations and assumes no responsibility as to accuracy or suitability of such information for application to purchaser's intended purposes or for consequences of its use.

1

PAGE 1

OHS22900

MATERIAL SAFETY DATA SHEET

OCCUPATIONAL HEALTH SERVICES, INC.
 11 WEST 42ND STREET, 12TH FLOOR
 NEW YORK, NEW YORK 10036
 1-800-445-MSDS (1-800-445-6737) OR
 1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
 CONTACT: 1-615-366-2000

MSDS #1418

SUBSTANCE IDENTIFICATION

SUBSTANCE: TETRACHLOROETHYLENE

CAS-NUMBER 127-18-4

TRADE NAMES/SYNONYMS:

ETHENE, TETRACHLORO-; ETHYLENE, TETRACHLORO-; ANKILOSTIN; DIDAKEN; NEMA;
 ETHYLENE TETRACHLORIDE; PERCHLOROETHYLENE; PERC; PERCHLOROETHENE; PERCLEN; 1,1,2,2-TETRACHLOROETHYLENE; TETRACAP; TETRACHLOROETHENE; PCE; RCRA U210; NCI-C04580; ENT 1,860; STCC 4940355; UN 1897; C2CL4; OHS22900

CHEMICAL FAMILY:

HALOGEN COMPOUND, ALIPHATIC

MOLECULAR FORMULA: CL₂-C-C-CL₂

MOLECULAR WEIGHT: 165.83

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=0 PERSISTENCE=2
 NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=0 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: TETRACHLOROETHYLENE
 CAS# 127-18-4

PERCENT: 100.0

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

TETRACHLOROETHYLENE (PERCHLOROETHYLENE):

25 PPM (170 MG/M3) OSHA TWA

50 PPM (339 MG/M3) ACGIH TWA; 200 PPM (1357 MG/M3) ACGIH STEL

LOWEST FEASIBLE LIMIT NIOSH RECOMMENDED EXPOSURE CRITERIA

50 PPM (339 MG/M3) DFG MAK TWA;

100 PPM (678 MG/M3) DFG MAK 30 MINUTE PEAK, AVERAGE VALUE, 4 TIMES/SHIFT

MEASUREMENT METHOD: CHARCOAL TUBE; CARBON DISULFIDE; GAS CHROMATOGRAPHY WITH
 FLAME IONIZATION DETECTION; (NIOSH VOL. III # 1003, HALOGENATED
 HYDROCARBONS).

100 POUND CERCLA SECTION 103 REPORTABLE QUANTITY

SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

SUBJECT TO CALIFORNIA PROPOSITION 65 CANCER AND/OR REPRODUCTIVE TOXICITY

WARNING AND RELEASE REQUIREMENTS- (APRIL 1, 1988)

PHYSICAL DATA

DESCRIPTION: CLEAR, COLORLESS, VOLATILE LIQUID WITH A MILD ETHER-LIKE ODOR.
BOILING POINT: 250 F (121 C) MELTING POINT: -2 F (-19 C)
SPECIFIC GRAVITY: 1.6227 VOLATILITY: 100% VAPOR PRESSURE: 14 MMHG @ 20 C
EVAPORATION RATE: (BUTYL ACETATE=1) 2.8 SOLUBILITY IN WATER: 0.015%
ODOR THRESHOLD: 50 PPM VAPOR DENSITY: 5.83
SOLVENT SOLUBILITY: SOLUBLE IN ALCOHOL, ETHER, BENZENE, CHLOROFORM, OILS,
HEXANE.

FIRE AND EXPLOSION DATAMSDS # 1418

FIRE AND EXPLOSION HAZARD:
NEGLIGIBLE FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

FIREFIGHTING MEDIA:
DRY CHEMICAL OR CARBON DIOXIDE
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FIREFIGHTING:
APPLY COOLING WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED TO FLAMES UNTIL
WELL AFTER FIRE IS OUT. STAY AWAY FROM ENDS OF TANKS. ISOLATE FOR 1/2 MILE IN
ALL DIRECTIONS IF TANK, RAIL CAR OR TANK TRUCK IS INVOLVED IN FIRE (1990
EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5, GUIDE PAGE 74).

EXTINGUISH USING AGENT(S) SUITABLE FOR TYPE OF SURROUNDING FIRE. AVOID
CONTAMINATION OF WATER SOURCES AND SEWERS. BUILD DIKES TO CONTAIN FLOW. AVOID
BREATHING VAPORS; KEEP UPWIND.

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101:
ORM-A

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND
SUBPART E:
NONE

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.605
EXCEPTIONS: 49 CFR 173.505

 TOXICITY
 MSDS #1418

TETRACHLOROETHYLENE (PERCHLOROETHYLENE):

IRRITATION DATA: 810 MG/24 HOURS SKIN-RABBIT SEVERE; 500 MG/24 HOURS SKIN-RABBIT MILD; 162 MG EYE-RABBIT MILD; 500 MG/24 HOURS EYE-RABBIT MILD.

TOXICITY DATA: 96 PPM/7 HOURS INHALATION-HUMAN TCLO; 280 PPM/2 HOURS INHALATION-MAN TCLO; 600 PPM/10 MINUTES INHALATION-MAN TCLO; 34,200 MG/M³. 3 HOURS INHALATION-RAT LC50; 5200 PPM/4 HOURS INHALATION-MOUSE LC50; >10,000 MG/KG SKIN-RABBIT LD50 (DOW MSDS); 2629 MG/KG ORAL-RAT LD50; 8100 MG/KG ORAL-MOUSE LD50; 5000 MG/KG ORAL-RABBIT LDLO; 4000 MG/KG ORAL-CAT LDLO; 4000 MG/KG ORAL-DOG LDLO; 2200 MG/KG SUBCUTANEOUS-RABBIT LDLO; 65 GM/KG SUBCUTANEOUS-MOUSE LD50; 85 MG/KG INTRAVENOUS-DOG LDLO; 4678 MG/KG INTRAPERITONEAL-RAT LD50; 2100 MG/KG INTRAPERITONEAL-DOG LD50; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS); TUMORIGENIC DATA (RTECS).

CARCINOGEN STATUS: ANTICIPATED HUMAN CARCINOGEN (NTP); HUMAN INADEQUATE EVIDENCE, ANIMAL SUFFICIENT EVIDENCE (IARC GROUP-2B). IN MICE, ORAL ADMINISTRATION AND INHALATION PRODUCED HEPATOCELLULAR CARCINOMAS IN BOTH SEXES. EXPOSURE OF RATS BY INHALATION PRODUCED AN INCREASED INCIDENCE OF MONONUCLEAR CELL LEUKEMIA IN BOTH SEXES.

LOCAL EFFECTS: IRRITANT- INHALATION, SKIN, EYES.

ACUTE TOXICITY LEVEL: MODERATELY TOXIC BY INHALATION, INGESTION; SLIGHTLY TOXIC BY SKIN ABSORPTION.

TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSANT. POISONING MAY ALSO AFFECT THE LIVER AND KIDNEYS.

AT INCREASED RISK FROM EXPOSURE: PERSONS WITH PRE-EXISTING SKIN, EYE, LIVER, KIDNEY, CARDIOVASCULAR OR NEUROLOGICAL DISORDERS.

ADDITIONAL DATA: ALCOHOL MAY ENHANCE THE TOXIC EFFECTS. STIMULANTS SUCH AS EPINEPHRINE MAY INDUCE VENTRICULAR FIBRILLATION. MAY BE EXCRETED IN BREAST MILK. ONE STUDY SHOWS AN INCREASED RISK OF LEUKEMIA FOR CHILDREN WHOSE FATHERS HAD OCCUPATIONAL EXPOSURE TO CHLORINATED SOLVENTS AFTER THE BIRTH OF THE CHILD.

 HEALTH EFFECTS AND FIRST AID

INHALATION:

TETRACHLOROETHYLENE (PERCHLOROETHYLENE):

IRRITANT/NARCOTIC/CARCINOGEN.

ACUTE EXPOSURE- VAPOR CONCENTRATIONS FROM 100-400 PPM MAY CAUSE IRRITATION OF THE NOSE, THROAT AND MUCOUS MEMBRANES, FLUSHED FACE AND NECK, SINUS CONGESTION, NASAL DISCHARGE, HEADACHE, DIZZINESS, LIGHTHEADEDNESS, DROWSINESS, THICK TONGUE, TIGHTNESS AROUND THE MOUTH, SLURRED SPEECH, CONFUSION, INCOORDINATION, NAUSEA, AND REVERSIBLE LIVER AND KIDNEY CHANGES; 400-600 PPM MAY CAUSE SALIVATION, METALLIC TASTE, PERSPIRATION OF THE HANDS, AND LOSS OF INHIBITIONS; 1000-2000 PPM MAY CAUSE MARKED UPPER RESPIRATORY IRRITATION, ANESTHESIA OF THE LIPS AND NOSE, CONGESTED EUSTACHIAN TUBES, ACHING FACIAL MUSCLES, INEBRIATION, EXHILARATION, MENTAL SLUGGISHNESS, LASSITUDE, GAGGING, FAINTNESS, TINNITUS, DYSPNEA UPON EXERTION, NARCOSIS, AND LIVER AND KIDNEY DAMAGE. OTHER REPORTED SYMPTOMS INCLUDE WEAKNESS, ATAXIA, COUGHING, CHEST PAINS, RAPID, WEAK PULSE, BLURRED VISION, IRRITABILITY, ANOREXIA, VOMITING, HALLUCINATIONS, DISTORTED PERCEPTIONS, ACIDOSIS, LATENT JAUNDICE AND ABNORMAL LIVER

1

PAGE 4

MSDS #1418

FUNCTION TESTS, ALBUMINURIA, HEMATURIA, ANURIA, AND PREMATURE VENTRICULAR BEATS. MASSIVE EXPOSURES MAY CAUSE PULMONARY EDEMA, UNCONSCIOUSNESS, COMA AND DEATH FROM ANESTHESIA OR RESPIRATORY ARREST. IN ONE FATAL CASE, PATHOLOGIC FINDINGS INCLUDED CENTRAL FATTY NECROSIS AND FATTY INFILTRATION OF THE LIVER AND MODERATE CLOUDY SWELLING OF THE RENAL TUBULAR EPITHELIUM. EPINEPHRINE-INDUCED CARDIAC ARRHYTHMIAS HAVE OCCURRED WITH SOME HYDROCARBONS, BUT TESTING OF TETRACHLOROETHYLENE IN DOGS HAS BEEN NEGATIVE.

CHRONIC EXPOSURE- WORKERS EXPOSED TO 1-40 PPM OVER 7.5 YEARS SHOWED ALTERED ELECTRODIAGNOSTIC AND NEUROLOGICAL RATING SCORES; 4 OF 16 EXPOSED TO 60-450 PPM FOR 2-20 YEARS HAD ABNORMAL EEG'S. REPEATED EXPOSURE MAY ALSO CAUSE RESPIRATORY TRACT IRRITATION, CENTRAL NERVOUS SYSTEM DEPRESSION WITHOUT NARCOSIS, CONFUSION, HEADACHE, FATIGUE, DIZZINESS, INEBRIATION, INSOMNIA, NAUSEA, ANOREXIA, ABDOMINAL PAIN, CONSTIPATION, BLURRED VISION, MULTIPLE PREMATURE VENTRICULAR BEATS, AND PERIPHERAL NEUROPATHY WITH NUMBNESS IN THE FINGERS, TREMBLING, NEURITIS, AND MEMORY DEFECTS. HEPATIC DAMAGE MAY OCCUR AND BE PERSISTENT. EXPOSURE TO LEVELS AROUND 250 PPM FOR 4 MONTHS HAS BEEN REPORTED TO HAVE CAUSED HEMOPTYSIS, COUGHING, SWEATING ATTACKS, JAUNDICE, OLIGURIA, HEMATEMESIS, CARDIOVASCULAR FAILURE AND DEATH. OCCASIONAL IDIOSYNCRATIC REACTIONS HAVE BEEN REPORTED INCLUDING PULMONARY EDEMA, BRONCHIAL ASTHMA, DEPENDENCY, AND HYPERSENSITIVITY. CHRONIC STUDIES IN RATS HAVE PRODUCED LIVER AND KIDNEY DAMAGE. IN STUDIES OF WOMEN WORKING IN THE DRY CLEANING INDUSTRY, ONE STUDY SHOWED HIGHER INCIDENCES OF MENSTRUAL DISORDERS, INDICATING AN EFFECT ON THE HORMONE SYSTEM. ANOTHER STUDY REVEALED AN ASSOCIATION BETWEEN EXPOSURE DURING EARLY PREGNANCY AND A SIGNIFICANTLY INCREASED INCIDENCE OF SPONTANEOUS ABORTIONS. REPRODUCTIVE EFFECTS HAVE ALSO BEEN REPORTED IN ANIMALS. INHALATION STUDIES INDICATE AN INCREASED INCIDENCE OF LIVER CARCINOMAS IN MICE AND MONONUCLEAR CELL LEUKEMIA IN RATS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. ADMINISTRATION OF OXYGEN SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:

TETRACHLOROETHYLENE (PERCHLOROETHYLENE):
IRRITANT.

ACUTE EXPOSURE- BRIEF IMMERSION OF THE HANDS IN THE LIQUID USUALLY CAUSES ONLY MILD IRRITATION. HOWEVER, THE LIQUID ON THE SKIN FOR 40 MINUTES RESULTED IN A PROGRESSIVELY SEVERE BURNING SENSATION, BEGINNING WITHIN 5-10 MINUTES, AND MARKED ERYTHEMA, WHICH SUBSIDED AFTER 1-2 HOURS.

SEVERE EXPOSURES MAY RESULT IN VESICULATION AND POSSIBLY BURNS.

ABSORPTION MAY OCCUR BUT IS PROBABLY NOT A SIGNIFICANT ROUTE OF EXPOSURE. CHRONIC EXPOSURE- REPEATED OR PROLONGED SKIN CONTACT MAY PRODUCE DERMATITIS WITH DRY, SCALY, FISSURED SKIN.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL

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PAGE 5

ATTENTION IMMEDIATELY.

MSDS #1418

EYE CONTACT:
TETRACHLOROETHYLENE (PERCHLOROETHYLENE):
IRRITANT.

ACUTE EXPOSURE- VAPOR CONCENTRATIONS FROM 100-200 MAY CAUSE MILD IRRITATION. HIGHER LEVELS OR DIRECT CONTACT MAY CAUSE PAIN, LACRIMATION, AND BURNING, BUT SERIOUS INJURY IS UNLIKELY. AT 1500 PMM, THE IRRITATION IS ALMOST INTOLERABLE. TWO STUDIES OF DIRECT APPLICATION TO RABBIT EYES RESULTED IN CONJUNCTIVITIS AND EFFECTS ON THE CORNEAL EPITHELIUM; RECOVERY WAS COMPLETE IN 2 DAYS TO 2 WEEKS.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE CONJUNCTIVITIS. ONE STUDY HAS REPORTED AN INCREASED INCIDENCE OF LACRIMAL DUCT DISEASE IN EXPOSED WORKERS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
TETRACHLOROETHYLENE (PERCHLOROETHYLENE):
NARCOTIC/CARCINOGEN.

ACUTE EXPOSURE- MAY CAUSE SEVERE GASTROINTESTINAL IRRITATION WITH NAUSEA, VOMITING, ABDOMINAL CRAMPS AND DIARRHEA, POSSIBLY WITH BLOODY STOOLS. NARCOTIC EFFECTS MAY INCLUDE HEADACHE, DIZZINESS, EXHILARATION, INEBRIATION AND OTHER EFFECTS AS IN ACUTE INHALATION. A DOSE OF 500 MG/KG HAS BEEN INGESTED AND SURVIVED. DOGS GIVEN LETHAL DOSES EXHIBITED CARDIAC AND RESPIRATORY DEPRESSION; AUTOPSY REVEALED FATTY INFILTRATION OF THE HEART AND LIVER AND MARKED INFLAMMATION AND SHRIVELING OF THE SMALL INTESTINE. CHRONIC EXPOSURE- LONGTERM INGESTION OF 50 MG/KG PRODUCED LIVER AND KIDNEY DAMAGE IN MICE. CHRONIC INGESTION HAS PRODUCED HEPATOCELLULAR CARCINOMAS IN MICE.

FIRST AID- IF THE PERSON IS CONSCIOUS AND NOT CONVULSING, INDUCE EMESIS BY GIVING SYRUP OF IPECAC (KEEPING THE HEAD BELOW THE HIPS TO PREVENT ASPIRATION), FOLLOWED BY WATER. REPEAT IN 20 MINUTES IF NOT EFFECTIVE INITIALLY. IN PATIENTS WITH DEPRESSED RESPIRATION OR IF EMESIS IS NOT PRODUCED, PERFORM GASTRIC LAVAGE CAUTIOUSLY (DREISBACH, HANDBOOK OF POISONING, 12TH ED.). TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GASTRIC LAVAGE SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:
TETRACHLOROETHYLENE (PERCHLOROETHYLENE):
ALUMINUM: MAY FORM EXPLOSIVE MIXTURE.

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PAGE 6

BARIUM: FORMS A DETONABLE MIXTURE.
BASES: MAY FORM EXPLOSIVE MIXTURE.
BERYLLIUM: POSSIBLE EXPLOSIVE MIXTURE.
DINITROGEN TETRAOXIDE: EXPLOSIVE WHEN SUBJECTED TO EXTREME SHOCK.
METALS (LIGHT): VIOLENT REACTION.
OXYGEN (LIQUID): INCOMPATIBLE.
PLASTICS, RUBBER, AND COATINGS: MAY BE ATTACKED.
POTASSIUM HYDROXIDE: MAY FORM EXPLOSIVE MIXTURE.
SODIUM HYDROXIDE: MAY FORM EXPLOSIVE MIXTURE.

MSDS #1418

DECOMPOSITION:

THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE HIGHLY TOXIC FUMES OF PHOSGENE, TOXIC AND CORROSIVE FUMES OF CHLORIDES, AND OXIDES OF CARBON.

POLYMERIZATION:

HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

STORAGE

STORE IN A COOL, DRY, WELL-VENTILATED LOCATION, AWAY FROM ANY AREA WHERE THE FIRE HAZARD MAY BE ACUTE (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

DISPOSAL

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40CFR 262. EPA HAZARDOUS WASTE NUMBER U210.

TETRACHLOROETHYLENE - REGULATORY LEVEL: 0.7 MG/L

MATERIALS WHICH CONTAIN THE ABOVE SUBSTANCE AT OR ABOVE THE REGULATORY LEVEL MEET THE EPA CHARACTERISTIC OF TOXICITY, AND MUST BE DISPOSED OF IN ACCORDANCE WITH 40 CFR PART 262. EPA HAZARDOUS WASTE NUMBER D039.

CONDITIONS TO AVOID

MAY BURN BUT DOES NOT IGNITE READILY. CONTAINER MAY EXPLODE IN HEAT OF FIRE.

SPILL AND LEAK PROCEDURES

SOIL SPILL:

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PAGE 7

DIG A HOLDING AREA SUCH AS A PIT, POND OR LAGOON TO CONTAIN SPILL AND DIKE SURFACE FLOW USING BARRIER OF SOIL, SANDBAGS, FOAMED POLYURETHANE OR FOAMED CONCRETE. ABSORB LIQUID MASS WITH FLY ASH OR CEMENT POWDER.

MSDS #1418

AIR SPILL:

APPLY WATER SPRAY TO KNOCK DOWN AND REDUCE VAPORS. KNOCK-DOWN WATER IS CORROSIVE AND TOXIC AND SHOULD BE DIKED FOR CONTAINMENT AND LATER DISPOSAL.

WATER SPILL:

IF DISSOLVED, AT A CONCENTRATION OF 10 PPM OR GREATER, APPLY ACTIVATED CARBON AT TEN TIMES THE AMOUNT THAT HAS BEEN SPILLED.

USE SUCTION HOSES TO REMOVE TRAPPED SPILL MATERIAL.

THE CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (PROPOSITION 65) PROHIBITS CONTAMINATING ANY KNOWN SOURCE OF DRINKING WATER WITH SUBSTANCES KNOWN TO CAUSE CANCER AND/OR REPRODUCTIVE TOXICITY.

OCCUPATIONAL SPILL:

SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. FOR SMALL LIQUID SPILLS, TAKE UP WITH SAND, EARTH OR OTHER ABSORBENT MATERIAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY.

REPORTABLE QUANTITY (RQ): 1 POUND

THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT

VENTILATION:

PROCESS ENCLOSURE RECOMMENDED TO MEET PUBLISHED EXPOSURE LIMITS.

RESPIRATOR:

THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS; NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29 CFR 1910 SUBPART Z.

THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

TETRACHLOROETHYLENE:

AT ANY DETECTABLE CONCENTRATION:

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN

MSDS # 1418

PAGE 8

PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.
SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE OPERATED IN
PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION
WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED
IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE,
FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ANY APPROPRIATE ESCAPE-TYPE, SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS
OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

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 BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND
OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT
TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS
SUBSTANCE.

EYE PROTECTION:

EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT
EYE CONTACT WITH THIS SUBSTANCE.

EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY
BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH
FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED BY: OCCUPATIONAL HEALTH SERVICES, INC.
CREATION DATE: 10/25/84 REVISION DATE: 05/02/91

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127-18-4
TETRACHLOROETHYLENE

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1

PAGE 1

OHS23850

MATERIAL SAFETY DATA SHEET

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FOR EMERGENCY SOURCE INFORMATION
 CONTACT: 1-615-366-2000

MSDS #1567

SUBSTANCE IDENTIFICATION

CAS-NUMBER 79-01-6

SUBSTANCE: TRICHLOROETHYLENE

TRADE NAMES/SYNONYMS:

ACETYLENE TRICHLORIDE; ETHYLENE TRICHLORIDE; ALGYLEN;
 1-CHLORO-2,2-DICHLOROETHYLENE; 1,1-DICHLORO-2-CHLOROETHYLENE; TCE; ANAMETH;
 ETHINYL TRICHLORIDE; TRICHLOROETHENE; 1,1,2-TRICHLOROETHYLENE;
 ETHYLENE, TRICHLORO-; CHLORYLEN; 1,1,2-TRICHLOROETHENE; ETHENE, TRICHLORO-;
 NEU-TRI (R) SOLVENT (DOW CHEMICAL); BLACO-TRI (BARON-BLAKESLEE); UN 1710;
 RCRA U228; STCC 4941171; C2HCL3; OHS23850

CHEMICAL FAMILY:

HALOGEN COMPOUND, ALIPHATIC

MOLECULAR FORMULA: CL-C-H-C-CL2

MOLECULAR WEIGHT: 131.39

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=1 REACTIVITY=0 PERSISTENCE=3

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=1 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: TRICHLOROETHYLENE
 CAS# 79-01-6

PERCENT: >99

OTHER CONTAMINANTS: TRACES OF AMINES OR EPOXIDES AS INHIBITORS.

EXPOSURE LIMITS:

TRICHLOROETHYLENE:

50 PPM (269 MG/M3) OSHA TWA; 200 PPM (1070 MG/M3) OSHA STEL
 50 PPM (269 MG/M3) ACGIH TWA; 200 PPM (1070 MG/M3) ACGIH STEL
 25 PPM (134 MG/M3) NIOSH RECOMMENDED TWA
 50 PPM (269 MG/M3) DFG MAK TWA;
 250 PPM (1344 MG/M3) DFG MAK 30 MINUTE PEAK, AVERAGE VALUE, 2 TIMES/SHIFT

MEASUREMENT METHOD: CHARCOAL TUBE; CARBON DISULFIDE; GAS CHROMATOGRAPHY WITH
 FLAME IONIZATION DETECTION; (NIOSH VOL. III # 1022).

100 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY
 SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING
 SUBJECT TO CALIFORNIA PROPOSITION 65 CANCER AND/OR REPRODUCTIVE TOXICITY

1

PAGE 2

WARNING AND RELEASE REQUIREMENTS- (APRIL 1, 1988)

PHYSICAL DATA

DESCRIPTION: COLORLESS LIQUID WITH A MILD CHLOROFORM-LIKE ODOR.

BOILING POINT: 189 F (87 C) MELTING POINT: -99 F (-73 C)

SPECIFIC GRAVITY: 1.4642 VAPOR PRESSURE: 58 MMHG @ 20 C

EVAPORATION RATE: (CARBON TETRACHLORIDE=1) 0.69 SOLUBILITY IN WATER: 0.1%

ODOR THRESHOLD: 21 PPM VAPOR DENSITY: 4.53

SOLVENT SOLUBILITY: SOLUBLE IN ALCOHOL, ETHER, ACETONE, CHLOROFORM,
BENZENE AND VEGETABLE OILS.MSDS # 1567-----
FIRE AND EXPLOSION DATAFIRE AND EXPLOSION HAZARD:
SLIGHT FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

UPPER EXPLOSIVE LIMIT: 52% @ 100 C LOWER EXPLOSIVE LIMIT: 7.8% @ 100 C

AUTOIGNITION TEMP.: 770 F (410 C)

FIREFIGHTING MEDIA:
DRY CHEMICAL OR CARBON DIOXIDE
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).FOR LARGER FIRES, USE WATER SPRAY, FOG OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).FIREFIGHTING:
APPLY COOLING WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED TO FLAMES UNTIL
WELL AFTER FIRE IS OUT. STAY AWAY FROM ENDS OF TANKS. ISOLATE FOR 1/2 MILE IN
ALL DIRECTIONS IF TANK, RAIL CAR OR TANK TRUCK IS INVOLVED IN FIRE (1990
EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5, GUIDE PAGE 74).USE AGENT SUITABLE FOR TYPE OF FIRE. AVOID BREATHING TOXIC VAPORS, KEEP
UPWIND.-----
TRANSPORTATION DATADEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101:
ORM-ADEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND
SUBPART E:
NONE

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.605
EXCEPTIONS: 49 CFR 173.505

TOXICITY

MSDS # 1567

TRICHLOROETHYLENE:

IRRITATION DATA: 2 MG/24 HOURS SKIN-RABBIT SEVERE; 20 MG/24 HOURS
EYE-RABBIT MODERATE.

TOXICITY DATA: 6900 MG/M3/10 MINUTES INHALATION-HUMAN TCLO; 160 PPM/83 MINUTES
INHALATION-HUMAN TCLO; 812 MG/KG INHALATION-HUMAN TDLO; 110 PPM/8 HOURS
INHALATION-MAN TCLO; 2900 PPM INHALATION-MAN LCLO; 8000 PPM/4 HOURS
INHALATION-RAT LCLO; 8450 PPM/4 HOURS INHALATION-MOUSE LC50; 11,000 PPM
INHALATION-RABBIT LCLO; 32,500 MG/M3/2 HOURS INHALATION-CAT LCLO;
37,200 PPM/40 MINUTES INHALATION-GUINEA PIG LCLO; 7 GM/KG ORAL-HUMAN LDLO;
2143 MG/KG ORAL-MAN TDLO; 2402 MG/KG ORAL-MOUSE LD50; 7330 MG/KG
ORAL-RABBIT LDLO; 5864 MG/KG ORAL-CAT LDLO; 16 GM/KG
SUBCUTANEOUS-MOUSE LD50; 1800 MG/KG SUBCUTANEOUS-RABBIT LDLO; 150 MG/KG
SUBCUTANEOUS-DOG LDLO; 33,900 UG/KG INTRAVENOUS-MOUSE LD50; 150 MG/KG
INTRAVENOUS-DOG LDLO; 1282 MG/KG INTRAPERITONEAL-RAT LD50; 1900 MG/KG
INTRAPERITONEAL-DOG LD50; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA
(RTECS); TUMORIGENIC DATA (RTECS).

CARCINOGEN STATUS: HUMAN INADEQUATE EVIDENCE, ANIMAL LIMITED EVIDENCE
(IARC GROUP-3). REPEATED ORAL ADMINISTRATION PRODUCED HEPATOCELLULAR
CARCINOMAS IN MALE AND FEMALE MICE; HEPATOCELLULAR ADENOMAS IN FEMALE MICE;
LUNG TUMORS IN MALE AND FEMALE MICE; TUBULAR CELL NEOPLASMS OF THE KIDNEY
AND INTERSTITIAL CELL NEOPLASMS OF THE TESTIS IN RATS. INHALATION EXPOSURES
RESULTED IN INCREASED INCIDENCES OF LIVER AND LUNG TUMORS IN MALE AND FEMALE
MICE AND LOW INCIDENCES OF ADENOCARCINOMAS OF THE RENAL TUBULES IN RATS.

LOCAL EFFECTS: IRRITANT- SKIN, EYE, INHALATION.

ACUTE TOXICITY LEVEL: MODERATELY TOXIC BY INGESTION.

TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSANT. POISONING MAY AFFECT THE
LIVER, KIDNEYS, LUNG AND HEART.

AT INCREASED RISK FROM EXPOSURE: PERSON WITH PRE-EXISTING HEART DISEASE.

ADDITIONAL DATA: THE PRESENCE OF TETRACHLOROETHANE AS AN IMPURITY, OR THE
CONSUMPTION OF ALCOHOLIC BEVERAGES, CAFFEINE, OR OTHER DRUGS MAY ENHANCE THE
SYSTEMIC TOXICITY. EPINEPHRINE OR OTHER STIMULANTS MAY INDUCE VENTRICULAR
ARRHYTHMIAS. MAY CROSS THE PLACENTA. ONE STUDY SHOWS AN INCREASED RISK OF
LEUKEMIA FOR CHILDREN WHOSE FATHERS HAD OCCUPATIONAL EXPOSURE TO CHLORINATED
SOLVENTS AFTER THE BIRTH OF THE CHILD.

HEALTH EFFECTS AND FIRST AID

INHALATION:

TRICHLOROETHYLENE:

IRRITANT/NARCOTIC.

1000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.

ACUTE EXPOSURE- MAY CAUSE MILD IRRITATION OF THE RESPIRATORY TRACT. LEVELS
OF 250-1000 PPM HAVE CAUSED IMPAIRED JUDGEMENT AND COORDINATION.

1000-5000 PPM HAS CAUSED EXCITATION FOLLOWED BY CENTRAL NERVOUS SYSTEM
DEPRESSION WITH DROWSINESS, DIZZINESS, HEADACHE, NAUSEA, VOMITING,
UNCONSCIOUSNESS AND COMA. IF CONSCIOUSNESS IS REGAINED, NAUSEA AND
VOMITING MAY FOLLOW FOR SEVERAL HOURS. PSYCHOTIC EFFECTS MAY INCLUDE

1

MSDS #1567

PAGE 4

EUPHORIA, DISORIENTATION, VISUAL DISTURBANCES AND HALLUCINATIONS, AND DELUSIONS. OTHER EFFECTS MAY INCLUDE WEAKNESS, ABDOMINAL CRAMPS, PALLOR, DYSYPNEA, TACHYPNEA, IRREGULAR PULSE AND HEARTBEAT, PULMONARY EDEMA, HYPOTENSION, ANESTHESIA, TREMORS, PROFUSE PERSPIRATION, CYANOSIS, AND RARELY CONVULSIONS. DEATH MAY OCCUR FROM RESPIRATORY ARREST OR VENTRICULAR FIBRILLATION RESULTING IN PRIMARY CARDIAC FAILURE. LIVER AND KIDNEY DAMAGE MAY ALSO OCCUR. ANIMAL STUDIES HAVE ALSO SHOWN SPLEEN DAMAGE. TRIGEMINAL NERVE DAMAGE AND HEPATOTOXIC EFFECTS HAVE BEEN ATTRIBUTED TO EXPOSURE TO THE IMPURE SUBSTANCE OR TO THE DECOMPOSITION PRODUCTS.

CHRONIC EXPOSURE- REPEATED EXPOSURE TO LEVELS BELOW 300 PPM MAY CAUSE NAUSEA, VOMITING, HEADACHE, ABDOMINAL CRAMPS, SLEEPINESS, DRUNKENNESS, FLUSHING, ANOREXIA, SWELLING OF THE EYES, FACE AND HANDS, AND MILD CARDIAC ARRHYTHMIAS. OTHER SYMPTOMS MAY INCLUDE WHEEZING, WEIGHT LOSS, ANOREXIA, JOINT AND MUSCLE PAIN, ANEMIA, CRANIAL AND PERIPHERAL NEUROPATHIES, ANEMIA, CHEMICAL HEPATITIS, CIRRHOSIS, AND RARELY JAUNDICE. INTOLERANCE TO ALCOHOL AND TOBACCO, TREMOR, GIDDINESS, ANXIETY AND CARDIAC ARRHYTHMIAS HAVE BEEN FOUND IN WORKERS CHRONICALLY EXPOSED TO 5-630 PPM. LIVER, KIDNEY AND BRAIN DAMAGE MAY ALSO OCCUR. REPRODUCTIVE EFFECTS HAVE BEEN REPORTED IN ANIMALS. ADMINISTRATION TO MICE WAS ASSOCIATED WITH AN INCREASED INCIDENCE OF LIVER AND LUNG TUMORS AND ADENOCARCINOMAS OF THE RENAL TUBULES IN RATS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:

TRICHLOROETHYLENE:
IRRITANT/SENSITIZER.

ACUTE EXPOSURE- MAY CAUSE IRRITATION AND CONTACT DERMATITIS. MAY CAUSE SENSITIZATION IN PREVIOUSLY EXPOSED INDIVIDUALS AND RESULT IN GENERALIZED EXFOLIATIVE OR PAPULOVESICULAR DERMATITIS, AND ERYTHRODERMA. SKIN CONTACT WITH SOAKED CLOTHING FOR A LONG PERIOD OF TIME MAY RESULT IN BLISTERING. MAY BE ABSORBED THROUGH THE SKIN, HOWEVER, DERMAL ABSORPTION IS NOT LIKELY TO BE OF TOXICOLOGICAL SIGNIFICANCE UNDER NORMAL USE.

CHRONIC EXPOSURE- MAY CAUSE A DEFATTING TYPE OF DERMATITIS RESULTING IN ROUGHNESS, CHAPPING, VESICULATION AND SECONDARY INFECTION. REPEATED CONTACT MAY RESULT IN PARALYSIS OF THE FINGERS. SENSITIZATION MAY OCCUR. REPEATED LOW LEVEL EXPOSURE MAY CAUSE INEBRIATION, IRRITABILITY, AND PERSONALITY CHANGES. CHRONIC ABSORPTION MAY ALSO PRODUCE WEIGHT LOSS, NAUSEA, ANOREXIA, FATIGUE, VISUAL IMPAIRMENT, JOINT PAIN AND WHEEZING. JAUNDICE IS RARE.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:

TRICHLOROETHYLENE:
IRRITANT.

ACUTE EXPOSURE- DIRECT CONTACT WITH VAPOR OR LIQUID MAY CAUSE BURNS OF THE LIDS, CONJUNCTIVA AND CORNEA WITH SYMPTOMS OF REDNESS, TEARING AND BLURRED

1

PAGE 5

VISION. A SPLASH IN THE EYE MAY CAUSE SMARTING PAIN AND INJURY TO THE CORNEAL EPITHELIUM WHICH MAY REGENERATE WITH COMPLETE RECOVERY. CHRONIC EXPOSURE- REPEATED AND PROLONGED EXPOSURE MAY CAUSE CONJUNCTIVITIS, CORNEAL INFLAMMATION, OPTIC NEURITIS, DOUBLE VISION, NYSTAGMUS, CHANGES IN COLOR PERCEPTION AND BLINDNESS.

MSDS #1567

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:

TRICHLOROETHYLENE:

NARCOTIC/LIMITED ANIMAL CARCINOGEN.

ACUTE EXPOSURE- MAY CAUSE SEVERE BURNING SENSATION IN THE MOUTH, THROAT, ESOPHAGUS, AND STOMACH, DIARRHEA, INEBRIATION, CONFUSION, TACHYCARDIA, AND CENTRAL NERVOUS SYSTEM DEPRESSION WITH DIZZINESS, NAUSEA, VOMITING, HEADACHE, COLLAPSE, CONVULSIONS, AND COMA FOLLOWED BY DEATH FROM RESPIRATORY, CARDIAC OR HEPATORENAL FAILURE. LOW-LEVEL CONCENTRATIONS MAY CAUSE HEADACHE, AMNESIA, NUMBNESS, WEAKNESS OF THE EXTREMITIES, HEMIPARESIS AND PSYCHOSIS.

CHRONIC EXPOSURE- MAY CAUSE IRRITATION OF MUCOUS MEMBRANES, HEADACHE, DROWSINESS, FATIGUE, GIDDINESS, EXCITABILITY, INDIGESTION, NAUSEA, DISTURBANCES OF SENSATIONS IN THE EXTREMITIES AND OTHER SYMPTOMS NOTED IN CHRONIC INHALATION. REPRODUCTIVE EFFECTS HAVE BEEN REPORTED IN ANIMALS. REPEATED ORAL ADMINISTRATION PRODUCED LIVER AND LUNG TUMORS IN MICE. TUBULAR CELL NEOPLASMS OF THE KIDNEY AND INTERSTITIAL CELL NEOPLASMS OF THE TESTIS WERE OBSERVED IN RATS.

FIRST AID- REMOVE BY GASTRIC LAVAGE OR EMESIS. MAINTAIN BLOOD PRESSURE AND AIRWAY. GIVE OXYGEN IF RESPIRATION IS DEPRESSED. DO NOT PERFORM GASTRIC LAVAGE OR EMESIS IF VICTIM IS UNCONSCIOUS. GET MEDICAL ATTENTION IMMEDIATELY (DREISBACH, HANDBOOK OF POISONING, 11TH ED.). ADMINISTRATION OF GASTRIC LAVAGE OR OXYGEN SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL.

ANTIDOTE:

NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:

STABLE UNDER NORMAL TEMPERATURES AND PRESSURES IN A CLOSED CONTAINER. UNINHIBITED MATERIAL, ON HEATING OR EXPOSURE TO LIGHT, MAY DECOMPOSE OR POLYMERIZE, RELEASING HYDROGEN CHLORIDE.

INCOMPATIBILITIES:

TRICHLOROETHYLENE:

ALKALI: FORMS EXPLOSIVE MIXTURE.

ALUMINUM + DILUTE HYDROCHLORIC ACID: VIOLENT POLYMERIZATION.

ALUMINUM: VIOLENT DECOMPOSITION MAY OCCUR ON CONTACT WITH ALUMINUM POWDER OR FRESHLY FORMED SURFACES.

MSDS # 1567

BARIUM: POSSIBLE DETONATION.
 BERYLLIUM: FORMS IMPACT-SENSITIVE MIXTURE.
 BORON: FORMS EXPLOSIVE OR IGNITABLE COMPOUND.
 1-CHLORO-2,3-EPOXYPROPANE: FORMS EXPLOSIVE MIXTURE.
 2,4-BIS(4(2',3'-EPOXYPROPOXY)PHENYL)PROPANE: FORMS EXPLOSIVE MIXTURE.
 DI-2,3-EPOXYPROPYL ETHER OF 1,4-BUTANEDIOL: FORMS EXPLOSIVE MIXTURE.
 EPOXIDES: POSSIBLE EXPLOSION.
 LITHIUM: FORMS IMPACT-SENSITIVE MIXTURE.
 MAGNESIUM: FORMS IMPACT-SENSITIVE MIXTURE.
 METALS (POWDERED): FORMS EXPLOSIVE OR IGNITABLE COMPOUND.
 MONO-2,3-EPOXYPROPYL ETHER OF 1,4-BUTANEDIOL: FORMS EXPLOSIVE MIXTURE.
 NITROGEN TETRAOXIDE: FORMS EXPLOSIVE MIXTURE.
 OXIDIZERS (STRONG): FIRE AND EXPLOSION HAZARD.
 OXYGEN (LIQUID): EXPLODES WHEN INITIATED WITH A BLASTING CAP.
 OXYGEN (GAS): EXPLODES UNDER PRESSURE AT ROOM TEMPERATURE.
 PERCHLORIC ACID: VIOLENT REACTION.
 POTASSIUM: FORMS EXPLOSIVE CHLOROACETYLENES.
 POTASSIUM HYDROXIDE: FORMS EXPLOSIVE DICHLOROACETYLENE WHEN HEATED.
 SODIUM: FORMS EXPLOSIVE CHLOROACETYLENES.
 SODIUM HYDROXIDE: FORMS EXPLOSIVE CHLOROACETYLENES.
 TITANIUM (POWDER): FORMS IMPACT-SENSITIVE MIXTURE.

DECOMPOSITION:
 THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE HIGHLY TOXIC FUMES OF PHOSGENE,
 TOXIC AND CORROSIVE FUMES OF CHLORIDES, AND OXIDES OF CARBON.

POLYMERIZATION:
 MAY POLYMERIZE WHEN CATALYZED BY ALUMINUM CHLORIDE IN A SELF-SUSTAINING
 REACTION WHICH MAY DEVELOP TEMPERATURES UP TO 1350 C. A STABILIZER IS
 REQUIRED TO PREVENT POLYMERIZATION WHEN HEATED OR EXPOSED TO SUNLIGHT.

 STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING
 OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE
 ENVIRONMENTAL PROTECTION AGENCY.

****STORAGE****

STORE IN A COOL, DRY, WELL-VENTILATED LOCATION, AWAY FROM ANY AREA WHERE THE
 FIRE HAZARD MAY BE ACUTE (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

****DISPOSAL****

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF
 HAZARDOUS WASTE, 40CFR 262. EPA HAZARDOUS WASTE NUMBER U228.

TRICHLOROETHYLENE - REGULATORY LEVEL: 0.5 MG/L
 MATERIALS WHICH CONTAIN THE ABOVE SUBSTANCE AT OR ABOVE THE REGULATORY

1

PAGE 7

LEVEL MEET THE EPA CHARACTERISTIC OF TOXICITY, AND MUST BE DISPOSED OF IN ACCORDANCE WITH 40 CFR PART 262. EPA HAZARDOUS WASTE NUMBER D040.

 CONDITIONS TO AVOID

MSDS # 1567

MAY BURN BUT DOES NOT IGNITE READILY. CONTAINER MAY EXPLODE IN HEAT OF FIRE.

 SPILL AND LEAK PROCEDURES

SOIL SPILL:

DIG A HOLDING AREA SUCH AS A PIT, POND OR LAGOON TO CONTAIN SPILL AND DIKE SURFACE FLOW USING BARRIER OF SOIL, SANDBAGS, FOAMED POLYURETHANE OR FOAMED CONCRETE. ABSORB LIQUID MASS WITH FLY ASH OR CEMENT POWDER.

AIR SPILL:

APPLY WATER SPRAY TO KNOCK DOWN AND REDUCE VAPORS. KNOCK-DOWN WATER IS CORROSIVE AND TOXIC AND SHOULD BE DIKED FOR CONTAINMENT.

WATER SPILL:

USE ACTIVATED CARBON TO ABSORB SPILLED SUBSTANCE THAT IS DISSOLVED.

USE SUCTION HOSES TO REMOVE TRAPPED SPILL MATERIAL.

USE MECHANICAL DREDGES OR LIFTS TO EXTRACT IMMOBILIZED MASSES OF POLLUTION AND PRECIPITATES.

THE CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (PROPOSITION 65) PROHIBITS CONTAMINATING ANY KNOWN SOURCE OF DRINKING WATER WITH SUBSTANCES KNOWN TO CAUSE CANCER AND/OR REPRODUCTIVE TOXICITY.

OCCUPATIONAL SPILL:

SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. FOR SMALL LIQUID SPILLS, TAKE UP WITH SAND, EARTH OR OTHER ABSORBENT MATERIAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY.

REPORTABLE QUANTITY (RQ): 100 POUNDS

THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

 PROTECTIVE EQUIPMENT

VENTILATION:

PROVIDE LOCAL EXHAUST VENTILATION SYSTEM TO MEET PUBLISHED EXPOSURE LIMITS.

RESPIRATOR:

MSDS # 1567

PAGE 8

THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS; NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29 CFR 1910 SUBPART Z.

THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

TRICHLOROETHYLENE:

AT ANY DETECTABLE CONCENTRATION:

- ANY SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE AND OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.
- ANY SUPPLIED-AIR RESPIRATOR WITH A FULLFACE-PIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE-ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

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 BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:

EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE.

EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.
CREATION DATE: 10/24/84 REVISION DATE: 06/14/91

OHS23850
79-01-6
TRICHLOROETHYLENE

MSDS # 1567

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OHS14370

PAGE 1

1

MATERIAL SAFETY DATA SHEET **MSDS# 15766**

OCCUPATIONAL HEALTH SERVICES, INC.
11 WEST 42ND STREET, 12TH FLOOR
NEW YORK, NEW YORK 10036
1-800-445-MSDS (1-800-445-6737) OR
1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000

SUBSTANCE IDENTIFICATION

CAS-NUMBER 71-55-6

SUBSTANCE: METHYL CHLOROFORM

TRADE NAMES/SYNONYMS:

1,1,1-TRICHLOROETHANE; ALPHA-TRICHLOROETHANE; AEROTHENE TT;
METHYLTRICHLOROMETHANE; METHYLCHLOROFORM; TRICHLOROMETHYLMETHANE;
TRICHLOROETHANE; ETHANE, 1,1,1-TRICHLORO-; CHLORTEN; 1,1,1-TRICHLOROETHANE
TRICHLOROETHANE 111 DEGREASE COLD/VAPOR (ASHLAND);
ST-1000A CLEANER (STRESSCOAT); BLACO-THANE (BARON-BLAKESLEE);
PERM ETHANE DG (DETREX CHEMICALS); SAFETY SOLVENT (LOCTITE CORPORATION);
ACTIVATOR 711, 702, 703 (LOCTITE CORPORATION); STCC 4941176; RCRA U226;
UN 2831; C2H3CL3; OHS14370

CHEMICAL FAMILY:

HALOGEN COMPOUND, ALIPHATIC

MOLECULAR FORMULA: C-H3-C-CL3

MOLECULAR WEIGHT: 133.40

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=1 REACTIVITY=0 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=1 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: METHYL CHLOROFORM PERCENT: 100.0
CAS# 71-55-6

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

METHYL CHLOROFORM (1,1,1-TRICHLOROETHANE):
350 PPM (1900 MG/M3) OSHA TWA; 450 PPM (2450 MG/M3) OSHA STEL
350 PPM (1900 MG/M3) ACGIH TWA; 450 PPM (2450 MG/M3) ACGIH STEL
350 PPM NIOSH RECOMMENDED 15 MINUTE CEILING

1000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY
SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

PHYSICAL DATA

DESCRIPTION: CLEAR, COLORLESS LIQUID WITH A MILD CHLOROFORM-LIKE ODOR.

BOILING POINT: 165 F (74 C) MELTING POINT: -26 F (-32 C)

SPECIFIC GRAVITY: 1.3390 VAPOR PRESSURE: 100 MMHG @ 20 C

1

MSDS# 1566

PAGE 2

EVAPORATION RATE: (BUTYL ACETATE=1) 5.0 SOLUBILITY IN WATER: 0.078% @ 25 C

ODOR THRESHOLD: 44-100 PPM VAPOR DENSITY: 4.55

SOLVENT SOLUBILITY: SOLUBLE IN ACETONE, BENZENE, CHLOROFORM, METHANOL,
ETHANOL, CARBON DISULFIDE, ETHER, CARBON TETRACHLORIDE, N-HEPTANE.

VISCOSITY: 0.858 CPS @ 20 C

FIRE AND EXPLOSION DATAFIRE AND EXPLOSION HAZARD:
SLIGHT FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

UPPER EXPLOSIVE LIMIT: 12.5% LOWER EXPLOSIVE LIMIT: 7.5%

AUTOIGNITION TEMP.: 998 F (537 C)

FIREFIGHTING MEDIA:
DRY CHEMICAL OR CARBON DIOXIDE
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).FOR LARGER FIRES, USE WATER SPRAY, FOG OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).FIREFIGHTING:
APPLY COOLING WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED TO FLAMES UNTIL
WELL AFTER FIRE IS OUT. STAY AWAY FROM ENDS OF TANKS. ISOLATE FOR 1/2 MILE IN
ALL DIRECTIONS IF TANK, RAIL CAR OR TANK TRUCK IS INVOLVED IN FIRE (1990
EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5, GUIDE PAGE 74).EXTINGUISH USING AGENTS FOR SURROUNDING FIRE. COOL FIRE-EXPOSED CONTAINERS
WITH FLOODING AMOUNTS OF WATER APPLIED FROM AS FAR A DISTANCE AS POSSIBLE.
DO NOT ALLOW RUN-OFF WATER INTO SEWERS AND WATER SOURCES. AVOID BREATHING
VAPORS.-----
TRANSPORTATION DATADEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101:
ORM-ADEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND
SUBPART E:
NONEDEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.605
EXCEPTIONS: 49 CFR 173.505

TOXICITY

MSDS# 1566

METHYL CHLOROFORM (1,1,1-TRICHLOROETHANE):
 1 IRRITATION DATA: 450 PPM/8 HOURS EYE-MAN; 5 GM/12 DAYS INTERMITTENT
 SKIN-RABBIT MILD; 20 MG/24 HOURS SKIN-RABBIT MODERATE;
 100 MG EYE-RABBIT MILD; 2 MG/24 HOURS EYE-RABBIT SEVERE.
 TOXICITY DATA: 27 GM/M3/10 MINUTES INHALATION-MAN LCLO;
 350 PPM INHALATION-MAN TCLO; 200 PPM/4 HOURS INHALATION-MAN TCLO;
 920 PPM/70 MINUTES INHALATION-HUMAN TCLO; 18000 PPM/4 HOURS INHALATION-RAT

PAGE 3

LC50; 3911 PPM/2 HOURS INHALATION-MOUSE LC50; 24400 MG/M3 INHALATION-CAT
 LC50; 15800 MG/KG SKIN-RABBIT LD50 (EPA-600/8-82-003F, 1984); 1 GM/KG
 SKIN-RABBIT LDLO; 670 MG/KG ORAL-HUMAN TDLO; 10300 MG/KG ORAL-RAT LD50;
 11240 MG/KG ORAL-MOUSE LD50; 5660 MG/KG ORAL-RABBIT LD50;
 9470 MG/KG ORAL-GUINEA PIG LD50; 750 MG/KG ORAL-DOG LD50;
 16 GM/KG SUBCUTANEOUS-MOUSE LD50; 500 MG/KG SUBCUTANEOUS-RABBIT LDLO;
 95 MG/KG INTRAVENOUS-DOG LDLO; 3593 MG/KG INTRAPERITONEAL-RAT LD50;
 3636 MG/KG INTRAPERITONEAL-MOUSE LD50; 3100 MG/KG INTRAPERITONEAL-DOG LD50;
 MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS).
 CARCINOGEN STATUS: ANIMAL INADEQUATE EVIDENCE (IARC GROUP-3).
 LOCAL EFFECTS: IRRITANT- INHALATION, SKIN, EYE.
 ACUTE TOXICITY LEVEL: SLIGHTLY TOXIC BY INHALATION, DERMAL ABSORPTION AND
 INGESTION.
 TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSANT. POISONING MAY ALSO AFFECT
 THE HEART, LIVER AND KIDNEYS.
 AT INCREASED RISK FROM EXPOSURE: PERSONS WITH PRE-EXISTING SKIN DISORDERS,
 LIVER DISEASE OR CARDIOVASCULAR DISEASE.
 ADDITIONAL DATA: ALCOHOL MAY ENHANCE THE TOXIC EFFECTS. STIMULANTS SUCH
 AS EPINEPHRINE MAY INDUCE VENTRICULAR FIBRILLATION.

 HEALTH EFFECTS AND FIRST AID

INHALATION:

METHYL CHLOROFORM (1,1,1-TRICHLOROETHANE):

IRRITANT/NARCOTIC. 1000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.

ACUTE EXPOSURE- EXPOSURE TO 500 PPM FOR 60 MINUTES SHOULD CAUSE NO EFFECT
 EXCEPT FOR A DISTINCTIVE ODOR WHILE 900-1000 PPM FOR 20 MINUTES MAY CAUSE
 MILD RESPIRATORY TRACT IRRITATION AND PROMPT BUT MINIMAL IMPAIRMENT OF
 EQUILIBRIUM WHICH MAY BE ACCOMPANIED BY HEADACHE, LASSITUDE AND ATAXIA.
 IMPAIRED PERFORMANCE OF BEHAVIORAL TESTS WAS ALSO REPORTED AT 1000 PPM.
 HIGHER LEVELS OF 2000-5000 PPM MAY CAUSE INCOORDINATION, ANESTHESIA,
 EUPHORIA, LOSS OF CONSCIOUSNESS, COMA AND DEATH DUE TO CENTRAL NERVOUS
 SYSTEM DEPRESSION, RESPIRATORY ARREST, OR CARDIAC ARRHYTHMIA.
 CARDIAC SENSITIZATION MAY BE A CONTRIBUTING FACTOR. OTHER EFFECTS MAY
 INCLUDE NAUSEA, VOMITING, DIARRHEA, DROWSINESS, CONVULSIONS, FALL OF BLOOD
 PRESSURE, LIVER AND KIDNEY DAMAGE, BRADYCARDIA AND BLOOD CLOTTING CHANGES.
 CHRONIC EXPOSURE- NO ADVERSE EFFECTS RELATED TO EXPOSURE WERE REPORTED IN
 VOLUNTEERS EXPOSED TO 500 PPM FOR 7 HOURS A DAY FOR 5 DAYS, OR IN
 WORKERS EXPOSED TO 200 PPM FOR SEVERAL MONTHS TO 6 YEARS. THERE IS SOME
 EVIDENCE FROM HUMAN CASE REPORTS THAT REPEATED EXPOSURE TO HIGH
 CONCENTRATIONS MAY CAUSE LASTING DAMAGE TO THE HEART. EXPOSURE OF
 ANIMALS FOR 3 MONTHS AT CONCENTRATIONS FROM 1000 TO 10,000 PPM CAUSED
 SYMPTOMS OF CENTRAL NERVOUS SYSTEM DEPRESSION AND SOME PATHOLOGICAL
 CHANGES IN THE LIVERS AND LUNGS OF SOME SPECIES. REPRODUCTIVE EFFECTS

HAVE BEEN REPORTED IN ANIMALS.

- 1 FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. ADMINISTRATION OF OXYGEN SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

MSDS# 1526

SKIN CONTACT:

METHYL CHLOROFORM (1,1,1-TRICHLOROETHANE):
IRRITANT.

ACUTE EXPOSURE- DIRECT CONTACT MAY CAUSE IRRITATION AND REDNESS. VAPORS ARE POORLY ABSORBED, BUT THE LIQUID, ESPECIALLY IF CONFINED UNDER AN

PAGE 4

IMPERMEABLE BARRIER MAY BE ABSORBED TO SOME EXTENT. THIS ALONE IS UNLIKELY TO RESULT IN TOXIC EFFECTS, BUT MAY ADD TO THE EFFECTS OF INHALATION EXPOSURE.

CHRONIC EXPOSURE- REPEATED SKIN CONTACT MAY PRODUCE A DRY, SCALY, FISSURED DERMATITIS DUE TO THE DEFATTING PROPERTIES OF THE LIQUID, AND POSSIBLY BURNS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:

METHYL CHLOROFORM (1,1,1-TRICHLOROETHANE):
IRRITANT.

ACUTE EXPOSURE- EXPOSURE TO 500 PPM MAY CAUSE IRRITATION AND REDNESS.

DIRECT CONTACT WITH THE LIQUID MAY CAUSE TEMPORARY INJURY WITH COMPLETE RECOVERY EXPECTED IN 48 HOURS. DIRECT APPLICATION TO THE EYES OF RABBITS HAS CAUSED CONJUNCTIVAL IRRITATION, BUT NO CORNEAL DAMAGE.

CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT MAY CAUSE CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:

METHYL CHLOROFORM (1,1,1-TRICHLOROETHANE):
NARCOTIC.

ACUTE EXPOSURE- MAY CAUSE NAUSEA, VOMITING, DIARRHEA, GASTROINTESTINAL DISTURBANCES AND ABDOMINAL PAIN FOLLOWED BY CENTRAL NERVOUS SYSTEM DEPRESSION WITH HEADACHE, DIZZINESS, WEAKNESS, INCOORDINATION, MENTAL CONFUSION AND UNCONSCIOUSNESS. DEATH MAY OCCUR FROM CHRONIC RESPIRATORY FAILURE. OTHER SYMPTOMS AS DESCRIBED IN ACUTE INHALATION MAY ALSO OCCUR. MYOCARDIAL SENSITIZATION TO EPINEPHRINE AND SUBSEQUENT DEATH DUE TO CARDIAC ARREST MAY OCCUR. ASPIRATION MAY RESULT IN PULMONARY EDEMA OR CHEMICAL PNEUMONITIS.

CHRONIC EXPOSURE- REPRODUCTIVE EFFECTS HAVE BEEN REPORTED IN ANIMALS.

1 FIRST AID- IF THE PERSON IS CONSCIOUS AND NOT CONVULSING, INDUCE EMESIS BY GIVING SYRUP OF IPECAC (KEEPING THE HEAD BELOW THE HIPS TO PREVENT ASPIRATION), FOLLOWED BY WATER. REPEAT IN 20 MINUTES IF NOT EFFECTIVE INITIALLY. IN PATIENTS WITH DEPRESSED RESPIRATION OR IF EMESIS IS NOT PRODUCED, PERFORM GASTRIC LAVAGE CAUTIOUSLY (DREISBACH, HANDBOOK OF POISONING, 12TH ED.). TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GASTRIC LAVAGE SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

ANTIDOTE:

NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

MSDS# 1566-----
REACTIVITY

REACTIVITY:

SLOWLY DECOMPOSES OVER TIME YIELDING HYDROGEN CHLORIDE. AN INHIBITOR MAY BE ADDED TO SCAVENGE THE ACID THAT IS FORMED AND PREVENT CORROSION TO METALS. WATER MAY REACT WITH THE INHIBITOR AND ALLOW THE NATURAL DECOMPOSITION TO OCCUR.

PAGE 5

INCOMPATIBILITIES:

METHYL CHLOROFORM (1,1,1-TRICHLOROETHANE):

ACETONE: EXOTHERMIC REACTION.

ALKALI (STRONG): POSSIBLE VIOLENT REACTION.

ALUMINUM AND ALLOYS: MAY DECOMPOSE VIOLENTLY.

BARIUM: FIRE AND EXPLOSION HAZARD.

MAGNESIUM: VIOLENT DECOMPOSITION WITH EVOLUTION OF HYDROGEN CHLORIDE.

METALS (POWDERED): FIRE AND EXPLOSION HAZARD.

NITROGEN TETROXIDE: FORMS EXPLOSIVE MIXTURE.

OXIDIZERS (STRONG): POSSIBLE VIOLENT REACTION.

OXYGEN (GAS): POSSIBLE EXPLOSION WHEN HEATED @ 100 C.

OXYGEN (LIQUID): POSSIBLE VIOLENT EXPLOSION.

POTASH: FORMS FLAMMABLE OR EXPLOSIVE PRODUCT.

POTASSIUM AND ALLOYS: FORMS SHOCK-SENSITIVE MIXTURE.

POTASSIUM HYDROXIDE: FORMATION OF SPONTANEOUSLY FLAMMABLE PRODUCT.

RUBBER, PLASTICS, COATINGS: MAY BE ATTACKED.

SODIUM AND ALLOYS: FIRE AND EXPLOSION HAZARD.

SODIUM HYDROXIDE: FORMS SPONTANEOUSLY FLAMMABLE PRODUCT.

SODIUM-POTASSIUM ALLOY: POSSIBLE EXPLOSION.

TIN AND ALLOYS: INCOMPATIBLE.

ZINC AND ALLOYS: INCOMPATIBLE.

DECOMPOSITION:

THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC AND CORROSIVE FUMES OF CHLORIDES, TOXIC FUMES OF PHOSGENE AND CHLOROACETYLENES, AND OXIDES OF CARBON.

POLYMERIZATION:

HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE AND DISPOSAL

APP D-43

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

MSDS# 15266

****STORAGE****

STORE IN A COOL, DRY, WELL-VENTILATED LOCATION, AWAY FROM ANY AREA WHERE THE FIRE HAZARD MAY BE ACUTE (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

****DISPOSAL****

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40CFR 262. EPA HAZARDOUS WASTE NUMBER U226.

CONDITIONS TO AVOID

MAY BURN BUT DOES NOT IGNITE READILY. CONTAINER MAY EXPLODE IN HEAT OF FIRE.

SPILL AND LEAK PROCEDURES

SOIL SPILL:

PAGE 6

DIG A HOLDING AREA SUCH AS A PIT, POND OR LAGOON TO CONTAIN SPILL AND DIKE SURFACE FLOW USING BARRIER OF SOIL, SANDBAGS, FOAMED POLYURETHANE OR FOAMED CONCRETE. ABSORB LIQUID MASS WITH FLY ASH OR CEMENT POWDER.

WATER SPILL:

LIMIT SPILL MOTION AND DISPERSION WITH NATURAL BARRIERS OR OIL SPILL CONTROL BOOMS.

TRAP SPILLED MATERIAL AT BOTTOM IN DEEP WATER POCKETS, EXCAVATED HOLDING AREAS OR WITHIN SAND BAG BARRIERS.

USE SUCTION HOSES TO REMOVE TRAPPED SPILL MATERIAL.

THE CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (PROPOSITION 65) PROHIBITS CONTAMINATING ANY KNOWN SOURCE OF DRINKING WATER WITH SUBSTANCES KNOWN TO CAUSE CANCER AND/OR REPRODUCTIVE TOXICITY.

OCCUPATIONAL SPILL:

SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. FOR SMALL LIQUID SPILLS, TAKE UP WITH SAND, EARTH OR OTHER ABSORBENT MATERIAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY.

REPORTABLE QUANTITY (RQ): 1000 POUNDS

THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE

AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT

MSDS# 1506

VENTILATION:

PROVIDE GENERAL DILUTION VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS.

RESPIRATOR:

THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS; NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29 CFR 1910 SUBPART Z.

THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

METHYL CHLOROFORM (1,1,1-TRICHLOROETHANE):

1000 PPM- ANY SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE.
ANY SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS

PAGE 7

OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

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 BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT ANY POSSIBILITY OF SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:

EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

EMERGENCY WASH FACILITIES: APP D-45

1

WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.
CREATION DATE: 10/25/84 REVISION DATE: 02/21/91

OHS14370
71-55-6
METHYL CHLOROFORM

MSDS# 1526

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OHS25070

MATERIAL SAFETY DATA SHEET

OCCUPATIONAL HEALTH SERVICES, INC.
 11 WEST 42ND STREET, 12TH FLOOR
 NEW YORK, NEW YORK 10036
 1-800-445-MSDS (1-800-445-6737) OR
 1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
 CONTACT: 1-615-366-2000

MSDS #2073

SUBSTANCE IDENTIFICATION

CAS-NUMBER 75-35-4

SUBSTANCE: VINYLIDENE CHLORIDE

TRADE NAMES/SYNONYMS:

1,1-DICHLOROETHENE; 1,1-DICHLOROETHYLENE; VDC; VINYLIDENE CHLORIDE MONOMER;
 VINYLIDENE DICHLORIDE; RCRA U078; UN 1303; OHS25070

CHEMICAL FAMILY:

HALOGEN

MOLECULAR FORMULA: C₂H₂CL₂

MOLECULAR WEIGHT: 96.64

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=2 PERSISTENCE=1
 NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=4 REACTIVITY=2

COMPONENTS AND CONTAMINANTS

COMPONENT: VINYLIDENE CHLORIDE
 CAS# 75-35-4

PERCENT: >99.9

OTHER CONTAMINANTS: 200 PPM HYDROQUINONE MONOMETHYLETHER ADDED AS AN
 INHIBITOR.

EXPOSURE LIMITS:

VINYLIDENE CHLORIDE:

1 PPM (4 MG/M³) OSHA TWA
 5 PPM (20 MG/M³) ACGIH TWA; 20 PPM (80 MG/M³) ACGIH STEL
 2 PPM (8 MG/M³) DFG MAK TWA;
 4 PPM (16 MG/M³) DFG MAK 30 MINUTE PEAK, AVERAGE VALUE, 4 TIMES/SHIFT

100 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY
 SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

VINYL HALIDES:

LOWEST DETECTABLE LIMIT NIOSH RECOMMENDED EXPOSURE CRITERIA

PHYSICAL DATA

DESCRIPTION: VOLATILE, COLORLESS LIQUID WITH A MILD SWEET ODOR, WHICH ON LONG

1

PAGE 2

STANDING MAY FORM WHITE DEPOSITS OF READILY EXPLOSIVE PEROXIDE.
BOILING POINT: 86-90 F (30-32 C) MELTING POINT: -188 F (-122 C)
SPECIFIC GRAVITY: 1.213 VAPOR PRESSURE: 400 MMHG @ 14.8 C
EVAPORATION RATE: NOT AVAILABLE SOLUBILITY IN WATER: 0.04% @ 20 C
ODOR THRESHOLD: 500 PPM VAPOR DENSITY: 3.4
SOLVENT SOLUBILITY: ORGANIC SOLVENTS

MSDS #2073

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH BACK.

VAPOR-AIR MIXTURES ARE EXPLOSIVE ABOVE FLASH POINT.

CYLINDER MAY EXPLODE IN HEAT OF FIRE.

FLASH POINT: 14 F (-10 C) UPPER EXPLOSIVE LIMIT: 11.4%

LOWER EXPLOSIVE LIMIT: 5.6% AUTOIGNITION TEMP.: 856 F (457 C)

FLAMMABILITY CLASS(OSHA): IA

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO IT WITHOUT RISK. APPLY COOLING WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED TO FLAMES UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM ENDS OF TANKS. FOR MASSIVE FIRE IN CARGO AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES; IF THIS IS IMPOSSIBLE, WITHDRAW FROM AREA AND LET FIRE BURN. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF TANK DUE TO FIRE. ISOLATE FOR 1/2 MILE IN ALL DIRECTIONS IF TANK, RAIL CAR OR TANK TRUCK IS INVOLVED IN FIRE (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5, GUIDE PAGE 27).

EXTINGUISH ONLY IF FLOW CAN BE STOPPED; USE FLOODING AMOUNTS OF WATER AS A FOG, SOLID STREAMS MAY BE INEFFECTIVE. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER, APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING VAPORS, KEEP UPWIND.

1

PAGE 3

WATER MAY BE INEFFECTIVE EXCEPT AS A BLANKET (NFPA 325M, FIRE HAZARD PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND VOLATILE SOLIDS, 1984)

TRANSPORTATION DATA

MSDS # 2073

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND
SUBPART E:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.119
EXCEPTIONS: 49 CFR 173.118

TOXICITY

VINYLDENE CHLORIDE:

TOXICITY DATA: 25 PPM INHALATION-HUMAN TCLO; 6350 PPM/4 HOURS INHALATION-RAT LC50; 200 MG/KG ORAL-RAT LD50; 194 MG/KG ORAL-MOUSE LD50; 5750 MG/KG ORAL-DOG LDLO; 3700 MG/KG SUBCUTANEOUS-RABBIT LDLO; 225 MG/KG INTRAVENOUS-DOG LDLO; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS); TUMORIGENIC DATA (RTECS).

CARCINOGEN STATUS: HUMAN INADEQUATE EVIDENCE, ANIMAL LIMITED EVIDENCE (IARC GROUP-3). THE AVAILABLE EXPERIMENTAL EVIDENCE INDICATES THAT VINYLDENE CHLORIDE PRODUCES MALIGNANT TUMORS IN MICE AND RATS BY INHALATION AND THAT SOME OF THE TUMORS ARE SIMILAR TO THOSE PRODUCED BY VINYL CHLORIDE. THE AVAILABLE DATA WAS NOT ADEQUATE AN EVALUATION OF HUMAN CARCINOGENICITY.

LOCAL EFFECTS: IRRITANT- INHALATION, SKIN, EYE.

ACUTE TOXICITY LEVEL: TOXIC BY INGESTION; MODERATELY TOXIC BY INHALATION.
TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSANT; HEPATOTOXIN.

HEALTH EFFECTS AND FIRST AID

INHALATION:

VINYLDENE CHLORIDE:

IRRITANT/NARCOTIC/HEPATOTOXIN/LIMITED ANIMAL CARCINOGEN.

ACUTE EXPOSURE- INHALATION MAY IRRITATE THE NOSE AND RESPIRATORY SYSTEM AND CAUSE LUNG CONGESTION. HIGH CONCENTRATIONS (AROUND 4000 PPM) MAY CAUSE CENTRAL NERVOUS SYSTEM DEPRESSION WITH SYMPTOMS OF INEBRIATION, WHICH MAY PROGRESS TO CONVULSIONS, SPASMS, AND UNCONSCIOUSNESS, AND POSSIBLY DEATH. IF NOT FATAL, COMPLETE RECOVERY OCCURS IF EXPOSURE IS STOPPED.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE HAS PRODUCED A SIGNIFICANT INCREASE IN KIDNEY ADENOCARCINOMAS, MAMMARY CARCINOMAS AND PULMONARY ADENOMAS IN MICE. WORKERS EXPOSED FOR UP TO 6 YEARS REVEALED A HIGH INCIDENCE OF HEPATOTOXICITY. A 4 HOUR EXPOSURE OF 200 PPM PRODUCED EXTENSIVE HEMORRHAGIC CENTROLOBULAR LIVER NECROSIS IN RATS 6 HOURS AFTER EXPOSURE. MAY ALSO CAUSE KIDNEY DAMAGE, AND REPRODUCTIVE EFFECTS HAVE BEEN REPORTED IN ANIMALS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING

1

PAGE 4

HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
VINYLIDENE CHLORIDE:
IRRITANT.

MSDS #2073

ACUTE EXPOSURE- THE LIQUID MAY IRRITATE THE SKIN. WHERE LEAKS OCCUR, VINYLIDENE CHLORIDE MAY EVAPORATE AND THE HYDROQUINONE MONOMETHYLETHER INHIBITOR MAY ACCUMULATE UNTIL IT REACHES A CONCENTRATION CAPABLE OF CAUSING LOCAL BURNS.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE TO IRRITANTS MAY CAUSE DERMATITIS. AS EVALUATED BY RTECS, ADMINISTRATION TO MICE BY SKIN CONTACT RESULTED IN A STATISTICALLY SIGNIFICANT INCREASE IN THE INCIDENCE OF NEOPLASTIC TUMORS OF THE RESPIRATORY TRACT AND SKIN.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
VINYLIDENE CHLORIDE:
IRRITANT.

ACUTE EXPOSURE- CONTACT WITH THE EYE MAY CAUSE PAIN, CONJUNCTIVAL IRRITATION, AND TRANSIENT CORNEAL INJURY. HIGH LEVELS OF THE PHENOLIC INHIBITOR MAY POSSIBLY CAUSE BURNS.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE TO IRRITANTS MAY CAUSE CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
VINYLIDENE CHLORIDE:
NARCOTIC/HEPATOTOXIN/TOXIC.

ACUTE EXPOSURE- IT MAY CAUSE CENTRAL NERVOUS SYSTEM DEPRESSION. COUGHING, DIZZINESS, DULLNESS, AND UNCONSCIOUSNESS. IT MAY CAUSE HISTOLOGICAL CHANGES IN THE LIVER AND KIDNEYS.

CHRONIC EXPOSURE- REPEATED OR PROLONGED INGESTION MAY CAUSE KIDNEY OR LIVER DAMAGE.

FIRST AID- TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY. IF VOMITING OCCURS, KEEP HEAD LOWER THAN HIPS TO PREVENT ASPIRATION.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:

1

PAGE 5

VINYLDENE CHLORIDE IN THE PRESENCE OF AIR OR OXYGEN WITH THE INHIBITOR REMOVED, FORMS A COMPLEX PEROXIDE COMPOUND AT TEMPERATURES BETWEEN -40 AND +25 C. THE PEROXIDE IS VIOLENTLY EXPLOSIVE. LOSS OF INHIBITOR OR EXCESSIVE HEAT OR LIGHT MAY CAUSE SPONTANEOUS POLYMERIZATION RESULTING IN VIOLENT CONTAINER RUPTURE.

MSDS # 2073

INCOMPATIBILITIES:

VINYLDENE CHLORIDE:

AIR: WITH THE INHIBITOR REMOVED AND ON LONG STANDING IT FORMS EXPLOSIVE PEROXIDES.

ALUMINUM: CAN CATALYZE POLYMERIZATION.

CHLOROSULFONIC ACID: VIOLENT REACTION.

COPPER: CAN CATALYZE POLYMERIZATION.

NITRIC ACID: VIOLENT REACTION.

OLEUM: VIOLENT REACTION.

OXIDIZING AGENTS: INCOMPATIBLE.

DECOMPOSITION:

THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE HIGHLY TOXIC FUMES OF PHOSGENE, TOXIC AND CORROSIVE FUMES OF CHLORIDES, AND OXIDES OF CARBON.

POLYMERIZATION:

VINYLDENE CHLORIDE:

LOSS OF INHIBITOR OR EXCESSIVE HEAT OR LIGHT MAY CAUSE SPONTANEOUS POLYMERIZATION RESULTING IN VIOLENT CONTAINER RUPTURE. POLYMERIZATION MAY OCCUR IN THE PRESENCE OF ALUMINUM OR COPPER OR THEIR ALLOYS OR AIR.

STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

****DISPOSAL****

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40CFR 262. EPA HAZARDOUS WASTE NUMBER U078.

1,1-DICHLOROETHYLENE - REGULATORY LEVEL: 0.7 MG/L

MATERIALS WHICH CONTAIN THE ABOVE SUBSTANCE AT OR ABOVE THE REGULATORY LEVEL MEET THE EPA CHARACTERISTIC OF TOXICITY, AND MUST BE DISPOSED OF IN ACCORDANCE WITH 40 CFR PART 262. EPA HAZARDOUS WASTE NUMBER D029.

CONDITIONS TO AVOID

AVOID CONTACT WITH HEAT, SPARKS, FLAMES, OR OTHER SOURCES OF IGNITION. VAPORS MAY BE EXPLOSIVE. AVOID OVERHEATING OF CONTAINERS; CONTAINERS MAY VIOLENTLY RUPTURE IN HEAT OF FIRE. AVOID CONTAMINATION OF WATER SOURCES.

1

PAGE 6

SPILL AND LEAK PROCEDURES

MSDS # 2073

SOIL SPILL:

DIG A HOLDING AREA SUCH AS PIT, POND OR LAGOON TO CONTAIN SPILL AND DIKE SURFACE FLOW WITH BARRIER OF SOIL, SANDBAGS, FOAMED POLYURETHANE OR FOAMED CONCRETE.

ABSORB BULK LIQUID WITH FLY ASH, CEMENT POWDER, SAWDUST, OR COMMERCIAL SORBENTS.

APPLY FLUOROCARBON-WATER FOAM TO REDUCE VAPOR AND FIRE HAZARD.

AIR SPILL:

KNOCK DOWN VAPORS WITH WATER SPRAY. KEEP UPWIND.

COMBUSTION PRODUCTS INCLUDE CORROSIVE OR TOXIC VAPORS.

WATER SPILL:

USE NATURAL DEEP WATER POCKETS, EXCAVATED LAGOONS, OR SAND BAG BARRIERS TO TRAP MATERIAL AT BOTTOM.

APPLY UNIVERSAL GELLING AGENT TO IMMOBILIZE TRAPPED SPILL AND INCREASE EFFICIENCY OF REMOVAL.

USE MECHANICAL DREDGES OR LIFTS TO EXTRACT IMMOBILIZED MASSES OF POLLUTION AND PRECIPITATES.

OCCUPATIONAL SPILL:

SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA. KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND RESTRICT ENTRY.

REPORTABLE QUANTITY (RQ): 100 POUNDS

THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT

VENTILATION:

PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION TO MEET THE PUBLISHED EXPOSURE LIMITS. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

RESPIRATOR:

THE FOLLOWING RESPIRATORS ARE RECOMMENDED BASED ON INFORMATION FOUND IN THE PHYSICAL DATA, TOXICITY AND HEALTH EFFECTS SECTIONS. THEY ARE RANKED IN ORDER FROM MINIMUM TO MAXIMUM RESPIRATORY PROTECTION.

1

MSDS # 2073 PAGE 7

THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST BE BASED ON THE SPECIFIC OPERATION, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND MUST BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

ANY TYPE 'C' SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE OR WITH A FULL FACEPIECE, HELMET OR HOOD OPERATED IN CONTINUOUS-FLOW MODE.

ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

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 BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:

EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE.

EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.
CREATION DATE: 03/02/87 REVISION DATE: 04/11/91

OHS25070
75-35-4
VINYLIDENE CHLORIDE

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1

PAGE 1

OHS05125

MATERIAL SAFETY DATA SHEET

MSDS # 2015

OCCUPATIONAL HEALTH SERVICES, INC.
 11 WEST 42ND STREET, 12TH FLOOR
 NEW YORK, NEW YORK 10036
 1-800-445-MSDS (1-800-445-6737) OR
 1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
 CONTACT: 1-615-366-2000

SUBSTANCE IDENTIFICATION

CAS-NUMBER 156-59-2

SUBSTANCE: CIS-1,2-DICHLOROETHYLENE

TRADE NAMES/SYNONYMS:

CIS-ACETYLENE DICHLORIDE; 1,2-DICHLOROETHYLENE; UN 1150; OHS05125

CHEMICAL FAMILY:

HALOGEN COMPOUND, ALIPHATIC

MOLECULAR FORMULA: C₂H₂CL₂

MOLECULAR WEIGHT: 96.94

CERCLA RATINGS (SCALE 0-3): HEALTH=2 FIRE=3 REACTIVITY=2 PERSISTENCE=1
 NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=3 REACTIVITY=2

COMPONENTS AND CONTAMINANTS

COMPONENT: CIS-1,2-DICHLOROETHYLENE
 CAS# 156-59-2

PERCENT: 100

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

1,2-DICHLOROETHYLENE (ALL ISOMERS):

200 PPM (793 MG/M³) OSHA TWA200 PPM (793 MG/M³) ACGIH TWA200 PPM (793 MG/M³) NIOSH RECOMMENDED TWA200 PPM (793 MG/M³) DFG MAK TWA;400 PPM (1586 MG/M³) DFG MAK 30 MINUTE PEAK, AVERAGE VALUE, 4 TIMES/SHIFT

MEASUREMENT METHOD: CHARCOAL TUBE/CARBON DISULFIDE; GAS CHROMATOGRAPHY WITH
 FLAME IONIZATION DETECTION; (NIOSH VOL. III # 1003, HALOGENATED
 HYDROCARBONS).

SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

PHYSICAL DATA

DESCRIPTION: COLORLESS LIQUID WITH A PLEASANT ODOR.

1

PAGE 2

BOILING POINT: 140 F (60 C) MELTING POINT: -114 F (-81 C)

SPECIFIC GRAVITY: 1.2837 VAPOR PRESSURE: 400 MMHG @ 41 C

SOLUBILITY IN WATER: INSOLUBLE VAPOR DENSITY: 3.34

SOLVENT SOLUBILITY: ACETONE, BENZENE, ETHER, ALCOHOL

MSDS # 2015

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

VAPOR-AIR MIXTURES ARE EXPLOSIVE ABOVE FLASH POINT.

VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH BACK.

FLASH POINT: 39 F (4 C) (CC) UPPER EXPLOSIVE LIMIT: 12.8

LOWER EXPLOSIVE LIMIT: 9.7 FLAMMABILITY CLASS(OSHA): IB

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO IT WITHOUT RISK. APPLY COOLING WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED TO FLAMES UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM ENDS OF TANKS. FOR MASSIVE FIRE IN CARGO AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES; IF THIS IS IMPOSSIBLE, WITHDRAW FROM AREA AND LET FIRE BURN. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF TANK DUE TO FIRE. ISOLATE FOR 1/2 MILE IN ALL DIRECTIONS IF TANK, RAIL CAR OR TANK TRUCK IS INVOLVED IN FIRE (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5, GUIDE PAGE 27).

EXTINGUISH ONLY IF FLOW CAN BE STOPPED; USE FLOODING AMOUNTS OF WATER AS A FOG, SOLID STREAMS MAY BE INEFFECTIVE. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER, APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING VAPORS, KEEP UPWIND.

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND
SUBPART E:
FLAMMABLE LIQUID

1

PAGE 3

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.119
EXCEPTIONS: 49 CFR 173.118

TOXICITY

MSDS # 2015

CIS-1,2-DICHLOROETHYLENE:

65000 MG/M3/2 HOURS INHALATION-MOUSE LCLO; 20000 MG/M3/6 HOURS INHALATION-CAT LCLO; MUTAGENIC DATA (RTECS); CARCINOGEN STATUS: NONE.

CIS-1,2-DICHLOROETHYLENE IS A CENTRAL NERVOUS SYSTEM DEPRESSANT AND AN EYE, MUCOUS MEMBRANE, AND SKIN IRRITANT. STIMULANTS SUCH AS EPINEPHRINE AND EPHEDRINE MAY ENHANCE THE TOXICITY OF SOME HALOGENATED HYDROCARBONS. PERSONS WITH CHRONIC RESPIRATORY DISEASE MAY BE AT AN INCREASED RISK FROM EXPOSURE.

HEALTH EFFECTS AND FIRST AID

INHALATION:

1,2-DICHLOROETHYLENE (ALL ISOMERS):

IRRITANT/NARCOTIC. 4000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.

ACUTE EXPOSURE- VAPOR EXPOSURE MAY CAUSE MUCOUS MEMBRANE IRRITATION, NAUSEA, VOMITING, DIZZINESS, WEAKNESS, TREMOR, AND EPIGASTRIC CRAMPS. HIGHER LEVELS MAY CAUSE CENTRAL NERVOUS SYSTEM DEPRESSION RANGING FROM DROWSINESS TO UNCONSCIOUSNESS. THE CIS- AND TRANS- ISOMERS TOGETHER HAVE BEEN USED AS AN ANESTHETIC IN MAN. A HUMAN DEATH HAS BEEN REPORTED FROM INDUSTRIAL EXPOSURE. AN 8 HOUR EXPOSURE TO THE TRANS- ISOMER AT 200 PPM LOWERED THE LEUKOCYTE COUNT IN RATS; 1000 PPM CAUSED A FALL IN THE BLOOD SERUM ALBUMIN, UREA NITROGEN, ALKALINE PHOSPHATASE ACTIVITY, AND THE NUMBER OF ERYTHROCYTES. NARCOSIS WAS NOT PRODUCED AT THESE LEVELS. 3000 PPM PRODUCED FIBROUS SWELLING OF THE CARDIAC MUSCLE AND HYPEREMIA WHICH PERSISTED FOR 14 HOURS AFTER EXPOSURE. THE CIS- ISOMER DID NOT ANESTHETIZE RATS IN 4 HOURS AT 8000 PPM, BUT AT 16,000 PPM THEY WERE ANESTHETIZED IN 8 MINUTES AND KILLED IN 4 HOURS. REVERSIBLE SUPERFICIAL CORNEAL TURBIDITY HAS BEEN OBSERVED IN SOME ANESTHETIZED DOGS.

CHRONIC EXPOSURE- VARIATIONS IN DATA EXIST ON THE CHRONIC TOXICITY OF THE CIS- AND TRANS- ISOMERS. RATS EXPOSED TO 200 PPM OF THE TRANS- ISOMER FOR 8 HOURS/DAY, 5 DAYS/WEEK FOR 16 WEEKS SHOWED HISTOLOGICAL EVIDENCE OF SLIGHT TO SEVERE FATTY DEGENERATION OF LIVER LOBULES AND KUPFFER CELLS, MARKED PULMONARY HYPEREMIA, ALVEOLAR SEPTAL DISTENSION AND FIBROUS SWELLING OF THE CARDIAC MUSCLE. SIMILAR EXPOSURES WITH RATS, GUINEA PIGS, RABBITS AND DOGS EXPOSED TO 500 PPM OR 1000 PPM 7 HOURS/DAY, 5 DAYS/WEEK FOR 6 MONTHS TO A MIXTURE OF 60% CIS- AND 40% TRANS- ISOMERS RESULTED IN NO ADVERSE EFFECTS DETECTED. CATS AND RABBITS WERE REPEATEDLY EXPOSED TO VAPOR CONCENTRATIONS OF 0.16-0.19% IN AIR. THE CIS- ISOMER CAUSED ANOREXIA, DECREASED BODY WEIGHT AND PATHOLOGICAL CHANGES IN THE LUNGS, LIVER, AND KIDNEYS. THE TRANS- ISOMER CAUSED ANOREXIA AND SOME RESPIRATORY IRRITATION, BUT NO HISTOPATHOLOGICAL CHANGES IN ORGANS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

MSDS # 2015

SKIN CONTACT:

1,2-DICHLOROETHYLENE (ALL ISOMERS):
IRRITANT.

ACUTE EXPOSURE- DIRECT CONTACT MAY CAUSE IRRITATION. SKIN ABSORPTION MAY OCCUR DUE TO LIPID SOLUBILITY.
CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT MAY CAUSE DERMATITIS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:

1,2-DICHLOROETHYLENE (ALL ISOMERS):
IRRITANT.

ACUTE EXPOSURE- DIRECT CONTACT, OR THE VAPOR IN SUFFICIENT CONCENTRATION, MAY CAUSE IRRITATION. THE TRANS- ISOMER CAUSED BURNING OF THE EYES AT 2000 PPM. REVERSIBLE SUPERFICIAL CORNEAL TURBIDITY HAS BEEN REPORTED AS A SYSTEMIC EFFECT IN DOGS FOLLOWING INHALATION EXPOSURE.
CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT WITH IRRITANTS MAY CAUSE CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:

1,2-DICHLOROETHYLENE (ALL ISOMERS):
NARCOTIC.

ACUTE EXPOSURE- DEPENDING ON EXPOSURE, SYMPTOMS MAY VARY FROM SLIGHT CENTRAL NERVOUS SYSTEM DEPRESSION TO DEEP NARCOSIS.
CHRONIC EXPOSURE- USED AS A LOW TEMPERATURE EXTRACTING AGENT FOR HEAT SENSITIVE SUBSTANCES SUCH AS CAFFEINE IN COFFEE, PERFUMES, AND OILS AND FATS FROM FISH AND MEAT. MICE EXPOSED TO 22 MG/KG OR 220 MG/KG OF TRANS-1,2 DICHLOROETHYLENE BY GAVAGE FOR 14 CONSECUTIVE DAYS SHOWED A TREND TOWARD SUPPRESSION OF THE HUMORAL IMMUNE RESPONSE, BUT NO EFFECT ON THE CELL-MEDIATED IMMUNE RESPONSE.

FIRST AID- REMOVE BY GASTRIC LAVAGE OR EMESIS. MAINTAIN BLOOD PRESSURE AND AIRWAY. GIVE OXYGEN IF RESPIRATION IS DEPRESSED. DO NOT PERFORM GASTRIC LAVAGE OR EMESIS IF VICTIM IS UNCONSCIOUS. GET MEDICAL ATTENTION IMMEDIATELY (DREISBACH, HANDBOOK OF POISONING, 11TH ED.). ADMINISTRATION OF GASTRIC LAVAGE OR OXYGEN SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL.

ANTIDOTE:

NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:

MAY FORM EXPLOSIVE PEROXIDES IN AIR.
UNLESS INHIBITED, GRADUAL DECOMPOSITION BY AIR, LIGHT, ULTRAVIOLET LIGHT AND

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PAGE 5

MOISTURE MAY RELEASE CORROSIVE HYDROGEN CHLORIDE.

MSDS # 2015

INCOMPATIBILITIES:

1,2-DICHLOROETHYLENE (ALL ISOMERS):

CAUSTIC ALKALIES (SOLID OR CONCENTRATED SOLUTIONS): MAY FORM EXPLOSIVE, SPONTANEOUSLY FLAMMABLE CHLOROACETYLENE.

COPPER OR COPPER ALLOYS: MAY FORM EXPLOSIVE, SPONTANEOUSLY FLAMMABLE CHLOROACETYLENE.

DIFLUOROMETHYLENE DIHYPOFLUORITE (WITH TRANS-ISOMER): VIOLENT EXPLOSION AT ROOM TEMPERATURE.

FREE RADICAL INITIATOR: OXIDATION FORMS CORROSIVE CHLOROACETYL CHLORIDE VIA EPOXIDE INTERMEDIATES.

METAL (HOT): GRADUAL DECOMPOSITION WITH RELEASE OF CORROSIVE HYDROGEN CHLORIDE.

NITROGEN TETROXIDE: EXPLOSIVE, ESPECIALLY WHEN SHOCKED.

OZONE: FORM EXPLOSIVE PRODUCT.

PERCHLORYL FLUORIDE: EXPLOSIVE REACTION ON HEATING.

POTASSIUM HYDROXIDE (SOLID OR CONCENTRATED SOLUTION): MAY FORM EXPLOSIVE, SPONTANEOUSLY FLAMMABLE CHLOROACETYLENE.

PLASTICS, RUBBER AND COATINGS: MAY BE ATTACKED.

SODIUM: MAY FORM EXPLOSIVE, SPONTANEOUSLY FLAMMABLE CHLOROACETYLENE.

SODIUM HYDROXIDE (SOLID OR CONCENTRATED SOLUTION): MAY FORM EXPLOSIVE, SPONTANEOUSLY FLAMMABLE CHLOROACETYLENE.

SULFURIC ACID (CONCENTRATED): OXIDATION FORMS CORROSIVE CHLOROACETYL CHLORIDE VIA EPOXIDE INTERMEDIATES.

STRONG OXIDIZERS: VIGOROUS REACTION OR POSSIBLE FIRE AND EXPLOSION HAZARD.

DECOMPOSITION:

THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE HIGHLY TOXIC FUMES OF PHOSGENE, TOXIC AND CORROSIVE FUMES OF CHLORIDES, AND OXIDES OF CARBON.

POLYMERIZATION:

SLIGHTLY SUSCEPTIBLE TO POLYMERIZATION, BUT NOT LIKELY UNLESS THE MATERIAL BECOMES CONTAMINATED. BOTH ISOMERS DIMERIZE TO TETRACHLOROBUTENE IN THE PRESENCE OF ORGANIC PEROXIDES. THE POLYMERIZATION REACTION IS NOT VIGOROUS.

STORAGE AND DISPOSAL

STORAGE: PROTECT AGAINST PHYSICAL DAMAGE. OUTSIDE OR DETACHED STORAGE IS PREFERABLE. INSIDE STORAGE SHOULD BE IN A STANDARD FLAMMABLE LIQUIDS STORAGE ROOM OR CABINET. SEPARATE FROM OXIDIZING MATERIALS (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

CONDITIONS TO AVOID

AVOID CONTACT WITH HEAT, SPARKS, FLAMES, OR OTHER SOURCES OF IGNITION. VAPORS MAY BE EXPLOSIVE. AVOID OVERHEATING OF CONTAINERS; CONTAINERS MAY VIOLENTLY RUPTURE IN HEAT OF FIRE. AVOID CONTAMINATION OF WATER SOURCES.

SPILL AND LEAK PROCEDURES

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PAGE 6

MSDS # 2015**OCCUPATIONAL SPILL:**

SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA. KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND RESTRICT ENTRY.

PROTECTIVE EQUIPMENT**VENTILATION:**

PROVIDE LOCAL EXHAUST OR GENERAL DILUTION VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

RESPIRATOR:

THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS; NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29 CFR 1910 SUBPART Z.

THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

1,2-DICHLOROETHYLENE (ALL ISOMERS):

1000 PPM- ANY POWERED AIR-PURIFYING RESPIRATOR WITH ORGANIC VAPOR CARTRIDGES.
ANY CHEMICAL CARTRIDGE RESPIRATOR WITH AN ORGANIC VAPOR CANISTER AND A FULL FACEPIECE.

4000 PPM- ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.
ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

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 BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

1

PAGE 7

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS
SUBSTANCE.

MSDS # 2015

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A
FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

EMERGENCY WASH FACILITIES:
WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE
EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN
AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.
CREATION DATE: 03/12/86 REVISION DATE: 03/18/91
OHS05125
156-59-2
CIS-1,2-DICHLOROETHYLENE

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OHS23670

MATERIAL SAFETY DATA SHEET

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FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000

MSDS# 2176

SUBSTANCE IDENTIFICATION

CAS-NUMBER 156-60-5

SUBSTANCE: TRANS-1,2-DICHLOROETHYLENE

TRADE NAMES/SYNONYMS:

TRANS-ACETYLENE DICHLORIDE; TRANS-DICHLOROETHYLENE;
TRANS-1,2-DICHLOROETHENE; RCRA U079; OHS23670

CHEMICAL FAMILY:

HALOGEN COMPOUND, ALIPHATIC

MOLECULAR FORMULA: C2-H2-CL2

MOLECULAR WEIGHT: 96.94

CERCLA RATINGS (SCALE 0-3): HEALTH=2 FIRE=3 REACTIVITY=2 PERSISTENCE=1
NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=3 REACTIVITY=2

COMPONENTS AND CONTAMINANTS

COMPONENT: TRANS-1,2-DICHLOROETHYLENE
CAS# 156-60-5

PERCENT: 100

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

TRANS-1,2-DICHLOROETHYLENE:
200 PPM OSHA TWA
200 PPM (790 MG/M3) ACGIH TWA

1000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY

PHYSICAL DATA

DESCRIPTION: COLORLESS LIQUID WITH A PLEASANT ODOR.

BOILING POINT: 118 F (48 C) MELTING POINT: -58 F (-50 C)

SPECIFIC GRAVITY: 1.2565 VAPOR PRESSURE: 400 MM HG @ 87 F

SOLUBILITY IN WATER: SLIGHTLY SOLUBLE ODOR THRESHOLD: NOT ESTABLISHED

1

PAGE 2

VAPOR DENSITY: 3.34

SOLVENT SOLUBILITY: ETHANOL, ETHYL ETHER

FIRE AND EXPLOSION DATAFIRE AND EXPLOSION HAZARD:
DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.MSDS#2176

VAPOR-AIR MIXTURES ARE EXPLOSIVE ABOVE FLASH POINT.

VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH BACK.

FLASH POINT: 36 F (2 C) (CC) UPPER EXPLOSIVE LIMIT: 12.8%

LOWER EXPLOSIVE LIMIT: 9.7% AUTOIGNITION TEMP.: 860 F (460 C)

FLAMMABILITY CLASS(OSHA): IB

FIREFIGHTING MEDIA:

DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).FOR LARGER FIRES, USE WATER SPRAY, FOG OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FIREFIGHTING:

MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO IT WITHOUT RISK. APPLY COOLING WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED TO FLAMES UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM ENDS OF TANKS. FOR MASSIVE FIRE IN CARGO AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES; IF THIS IS IMPOSSIBLE, WITHDRAW FROM AREA AND LET FIRE BURN. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF TANK DUE TO FIRE. ISOLATE FOR 1/2 MILE IN ALL DIRECTIONS IF TANK, RAIL CAR OR TANK TRUCK IS INVOLVED IN FIRE (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5, GUIDE PAGE 27).

EXTINGUISH ONLY IF FLOW CAN BE STOPPED; USE FLOODING AMOUNTS OF WATER AS A FOG, SOLID STREAMS MAY BE INEFFECTIVE. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER, APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING VAPORS, KEEP UPWIND.

TRANSPORTATION DATADEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101:
FLAMMABLE LIQUIDDEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND
SUBPART E:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.119

EXCEPTIONS: 49 CFR 173.118

TOXICITY

MSDS# 2176

TRANS-1,2-DICHLOROETHYLENE:
4800 MG/M3/10 MINUTES INHALATION-HUMAN TCLO; 43000 MG/M3/6 HOURS
INHALATION-CAT LCLO; 75000 MG/M3/2 HOURS INHALATION-MOUSE LCLO; 2122 MG/KG
ORAL-MOUSE LD50; 4019 INTRAPERITONEAL-MOUSE LD50; 7536 MG/KG
INTRAPERITONEAL-RAT LD50; MUTAGENIC DATA (RTECS); CARCINOGEN STATUS: NONE.

TRANS-1,2-DICHLOROETHYLENE IS A CENTRAL NERVOUS SYSTEM DEPRESSANT AND A
SKIN, EYE, AND MUCOUS MEMBRANE IRRITANT. STIMULANTS SUCH AS EPINEPHRINE AND
EPHEDRINE MAY ENHANCE THE TOXICITY OF SOME HALOGENATED HYDROCARBONS. PERSONS
WITH CHRONIC RESPIRATORY DISEASE MAY BE AT AN INCREASED RISK FROM EXPOSURE.

HEALTH EFFECTS AND FIRST AID

INHALATION:

1,2-DICHLOROETHYLENE (ALL ISOMERS):

IRRITANT/NARCOTIC. 4000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.

ACUTE EXPOSURE- VAPOR EXPOSURE MAY CAUSE MUCOUS MEMBRANE IRRITATION, NAUSEA,
VOMITING, DIZZINESS, WEAKNESS, TREMOR, AND EPIGASTRIC CRAMPS. HIGHER
LEVELS MAY CAUSE CENTRAL NERVOUS SYSTEM DEPRESSION RANGING FROM DROWSINESS
TO UNCONSCIOUSNESS. THE CIS- AND TRANS- ISOMERS TOGETHER HAVE BEEN USED AS
AN ANESTHETIC IN MAN. A HUMAN DEATH HAS BEEN REPORTED FROM INDUSTRIAL
EXPOSURE. AN 8 HOUR EXPOSURE TO THE TRANS- ISOMER AT 200 PPM LOWERED THE
LEUKOCYTE COUNT IN RATS; 1000 PPM CAUSED A FALL IN THE BLOOD SERUM
ALBUMIN, UREA NITROGEN, ALKALINE PHOSPHATASE ACTIVITY, AND THE NUMBER OF
ERYTHROCYTES. NARCOSIS WAS NOT PRODUCED AT THESE LEVELS. 3000 PPM PRODUCED
FIBROUS SWELLING OF THE CARDIAC MUSCLE AND HYPEREMIA WHICH PERSISTED FOR
14 HOURS AFTER EXPOSURE. THE CIS- ISOMER DID NOT ANESTHETIZE RATS IN
4 HOURS AT 8000 PPM, BUT AT 16,000 PPM THEY WERE ANESTHETIZED IN 8 MINUTES
AND KILLED IN 4 HOURS. REVERSIBLE SUPERFICIAL CORNEAL TURBIDITY HAS BEEN
OBSERVED IN SOME ANESTHETIZED DOGS.

CHRONIC EXPOSURE- VARIATIONS IN DATA EXIST ON THE CHRONIC TOXICITY OF THE
CIS- AND TRANS- ISOMERS. RATS EXPOSED TO 200 PPM OF THE TRANS- ISOMER
FOR 8 HOURS/DAY, 5 DAYS/WEEK FOR 16 WEEKS SHOWED HISTOLOGICAL EVIDENCE
OF SLIGHT TO SEVERE FATTY DEGENERATION OF LIVER LOBULES AND KUPFFER CELLS,
MARKED PULMONARY HYPEREMIA, ALVEOLAR SEPTAL DISTENSION AND FIBROUS
SWELLING OF THE CARDIAC MUSCLE. SIMILAR EXPOSURES WITH RATS, GUINEA PIGS,
RABBITS AND DOGS EXPOSED TO 500 PPM OR 1000 PPM 7 HOURS/DAY, 5 DAYS/WEEK
FOR 6 MONTHS TO A MIXTURE OF 60% CIS- AND 40% TRANS- ISOMERS RESULTED IN
NO ADVERSE EFFECTS DETECTED. CATS AND RABBITS WERE REPEATEDLY EXPOSED TO
VAPOR CONCENTRATIONS OF 0.16-0.19% IN AIR. THE CIS- ISOMER CAUSED
ANOREXIA, DECREASED BODY WEIGHT AND PATHOLOGICAL CHANGES IN THE LUNGS,
LIVER, AND KIDNEYS. THE TRANS- ISOMER CAUSED ANOREXIA AND SOME RESPIRATORY
IRRITATION, BUT NO HISTOPATHOLOGICAL CHANGES IN ORGANS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING
HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST.
TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

1

PAGE 4

MSDS# 2170

SKIN CONTACT:

1,2-DICHLOROETHYLENE (ALL ISOMERS):
IRRITANT.ACUTE EXPOSURE- DIRECT CONTACT MAY CAUSE IRRITATION. SKIN ABSORPTION MAY OCCUR DUE TO LIPID SOLUBILITY.
CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT MAY CAUSE DERMATITIS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:

1,2-DICHLOROETHYLENE (ALL ISOMERS):
IRRITANT.ACUTE EXPOSURE- DIRECT CONTACT, OR THE VAPOR IN SUFFICIENT CONCENTRATION, MAY CAUSE IRRITATION. THE TRANS- ISOMER CAUSED BURNING OF THE EYES AT 2000 PPM. REVERSIBLE SUPERFICIAL CORNEAL TURBIDITY HAS BEEN REPORTED AS A SYSTEMIC EFFECT IN DOGS FOLLOWING INHALATION EXPOSURE.
CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT WITH IRRITANTS MAY CAUSE CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:

1,2-DICHLOROETHYLENE (ALL ISOMERS):
NARCOTIC.ACUTE EXPOSURE- DEPENDING ON EXPOSURE, SYMPTOMS MAY VARY FROM SLIGHT CENTRAL NERVOUS SYSTEM DEPRESSION TO DEEP NARCOSIS.
CHRONIC EXPOSURE- USED AS A LOW TEMPERATURE EXTRACTING AGENT FOR HEAT SENSITIVE SUBSTANCES SUCH AS CAFFEINE IN COFFEE, PERFUMES, AND OILS AND FATS FROM FISH AND MEAT. MICE EXPOSED TO 22 MG/KG OR 220 MG/KG OF TRANS-1,2 DICHLOROETHYLENE BY GAVAGE FOR 14 CONSECUTIVE DAYS SHOWED A TREND TOWARD SUPPRESSION OF THE HUMORAL IMMUNE RESPONSE, BUT NO EFFECT ON THE CELL-MEDIATED IMMUNE RESPONSE.

FIRST AID- REMOVE BY GASTRIC LAVAGE OR EMESIS. MAINTAIN BLOOD PRESSURE AND AIRWAY. GIVE OXYGEN IF RESPIRATION IS DEPRESSED. DO NOT PERFORM GASTRIC LAVAGE OR EMESIS IF VICTIM IS UNCONSCIOUS. GET MEDICAL ATTENTION IMMEDIATELY (DREISBACH, HANDBOOK OF POISONING, 11TH ED.). ADMINISTRATION OF GASTRIC LAVAGE OR OXYGEN SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL.

ANTIDOTE:

NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:

MAY FORM EXPLOSIVE PEROXIDES IN AIR.
UNLESS INHIBITED, GRADUAL DECOMPOSITION BY AIR, LIGHT, ULTAVIOLET LIGHT AND

MOISTURE MAY RELEASE CORROSIVE HYDROGEN CHLORIDE.

MSDS# 2176

INCOMPATIBILITIES:

1,2-DICHLOROETHYLENE (ALL ISOMERS):

CAUSTIC ALKALIES (SOLID OR CONCENTRATED SOLUTIONS): MAY FORM EXPLOSIVE, SPONTANEOUSLY FLAMMABLE CHLOROACETYLENE.

COPPER OR COPPER ALLOYS: MAY FORM EXPLOSIVE, SPONTANEOUSLY FLAMMABLE CHLOROACETYLENE.

DIFLUOROMETHYLENE DIHYPOFLUORITE (WITH TRANS-ISOMER): VIOLENT EXPLOSION AT ROOM TEMPERATURE.

FREE RADICAL INITIATOR: OXIDATION FORMS CORROSIVE CHLOROACETYL CHLORIDE VIA EPOXIDE INTERMEDIATES.

METAL (HOT): GRADUAL DECOMPOSITION WITH RELEASE OF CORROSIVE HYDROGEN CHLORIDE.

NITROGEN TETROXIDE: EXPLOSIVE, ESPECIALLY WHEN SHOCKED.

OZONE: FORM EXPLOSIVE PRODUCT.

PERCHLORYL FLUORIDE: EXPLOSIVE REACTION ON HEATING.

POTASSIUM HYDROXIDE (SOLID OR CONCENTRATED SOLUTION): MAY FORM EXPLOSIVE, SPONTANEOUSLY FLAMMABLE CHLOROACETYLENE.

PLASTICS, RUBBER AND COATINGS: MAY BE ATTACKED.

SODIUM: MAY FORM EXPLOSIVE, SPONTANEOUSLY FLAMMABLE CHLOROACETYLENE.

SODIUM HYDROXIDE (SOLID OR CONCENTRATED SOLUTION): MAY FORM EXPLOSIVE, SPONTANEOUSLY FLAMMABLE CHLOROACETYLENE.

SULFURIC ACID (CONCENTRATED): OXIDATION FORMS CORROSIVE CHLOROACETYL CHLORIDE VIA EPOXIDE INTERMEDIATES.

STRONG OXIDIZERS: VIGOROUS REACTION OR POSSIBLE FIRE AND EXPLOSION HAZARD.

DECOMPOSITION:

THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE HIGHLY TOXIC FUMES OF PHOSGENE, TOXIC AND CORROSIVE FUMES OF CHLORIDES, AND OXIDES OF CARBON.

POLYMERIZATION:

SLIGHTLY SUSCEPTIBLE TO POLYMERIZATION, BUT NOT LIKELY UNLESS THE MATERIAL BECOMES CONTAMINATED. BOTH ISOMERS DIMERIZE TO TETRACHLOROBUTENE IN THE PRESENCE OF ORGANIC PEROXIDES. THE POLYMERIZATION REACTION IS NOT VIGOROUS.

STORAGE AND DISPOSAL

STORAGE: PROTECT AGAINST PHYSICAL DAMAGE. OUTSIDE OR DETACHED STORAGE IS PREFERABLE. INSIDE STORAGE SHOULD BE IN A STANDARD FLAMMABLE LIQUIDS STORAGE ROOM OR CABINET. SEPARATE FROM OXIDIZING MATERIALS (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

CONDITIONS TO AVOID

AVOID CONTACT WITH HEAT, SPARKS, FLAMES OR OTHER IGNITION SOURCES. VAPORS MAY BE EXPLOSIVE. MATERIAL IS CORROSIVE; AVOID CONTACT WITH SKIN OR EYES. DO NOT ALLOW CONTAMINATION OF WATER SOURCES.

SPILL AND LEAK PROCEDURES

1

PAGE 6

OCCUPATIONAL SPILL:

SHUT OFF IGNITION SOURCES. DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. DO NOT GET WATER INSIDE CONTAINER. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA. KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND DENY ENTRY.

REPORTABLE QUANTITY (RQ): 1000 POUNDS

THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

 PROTECTIVE EQUIPMENT

MSDS# 2176

VENTILATION:

PROVIDE LOCAL EXHAUST OR GENERAL DILUTION VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

RESPIRATOR:

THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS; NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29 CFR 1910 SUBPART Z.

THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

1,2-DICHLOROETHYLENE (ALL ISOMERS):

1000 PPM- ANY POWERED AIR-PURIFYING RESPIRATOR WITH ORGANIC VAPOR CARTRIDGES.

ANY CHEMICAL CARTRIDGE RESPIRATOR WITH AN ORGANIC VAPOR CANISTER AND A FULL FACEPIECE.

4000 PPM- ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.
 ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
 ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
 ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
 ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

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 BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:

EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

EMERGENCY WASH FACILITIES:

WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.
CREATION DATE: 09/07/84 REVISION DATE: 02/21/91

OHS23670
156-60-5
TRANS-1,2-DICHLOROETHYLENE

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OHS08750

MATERIAL SAFETY DATA SHEET

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FOR EMERGENCY SOURCE INFORMATION
 CONTACT: 1-615-366-2000

MSDS # 2027

SUBSTANCE IDENTIFICATION

CAS-NUMBER 141-78-6

SUBSTANCE: ETHYL ACETATE

TRADE NAMES/SYNONYMS:

ACETIC ACID ETHYL ESTER; ACETIC ETHER; ACETIDIN; ACETOXYETHANE;
 ETHYL ETHANOATE; VINEGAR NAPHTHA; ACETIC ESTER; RCRA U112; STCC 4909160;
 UN 1173; C4H8O2; OHS08750

CHEMICAL FAMILY:

ESTER, CARBOXYLIC, ALIPHATIC

MOLECULAR FORMULA: C-H3-C-O2-C2-H5

MOLECULAR WEIGHT: 88.11

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=0 PERSISTENCE=0
 NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=3 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: ETHYL ACETATE
 CAS# 141-78-6

PERCENT: 100.0

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

ETHYL ACETATE:

400 PPM (1440 MG/M3) OSHA TWA
 400 PPM (1440 MG/M3) ACGIH TWA
 400 PPM (1440 MG/M3) NIOSH RECOMMENDED TWA
 400 PPM (1440 MG/M3) DFG MAK TWA;
 800 PPM (2880 MG/M3) DFG MAK 5 MINUTE PEAK, MOMENTARY VALUE, 8 TIMES/SHIFT

MEASUREMENT METHOD: CHARCOAL TUBE; CARBON DISULFIDE; GAS CHROMATOGRAPHY WITH
 FLAME IONIZATION DETECTION; (NIOSH VOL. II(2) # S49).

5000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY

PHYSICAL DATA

DESCRIPTION: TRANSPARENT, COLORLESS, VOLATILE LIQUID HAVING A FRAGRANT,

1

PAGE 2

SLIGHTLY FRUITY ODOR AND A PECULIAR, FRUITY, BURNING TASTE.

BOILING POINT: 171 F (77 C) MELTING POINT: -119 F (-84 C)

SPECIFIC GRAVITY: 0.9003 VOLATILITY: 100% VAPOR PRESSURE: 73 MMHG @ 20 C

EVAPORATION RATE: (BUTYL ACETATE=1) 6.2 PH: NEUTRAL

SOLUBILITY IN WATER: 8.7% ODOR THRESHOLD: 50 PPM VAPOR DENSITY: 3.04

SOLVENT SOLUBILITY: SOLUBLE IN ALCOHOL, BENZENE, ETHER, ACETONE, AND CHLOROFORM.

MSDS # 2027

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:

DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH BACK.

VAPOR-AIR MIXTURES ARE EXPLOSIVE ABOVE FLASH POINT.

FLASH POINT: 24 F (-4 C) (CC) UPPER EXPLOSIVE LIMIT: 11.5%

LOWER EXPLOSIVE LIMIT: 2.0% AUTOIGNITION TEMP.: 800 F (426 C)

FLAMMABILITY CLASS(OSHA): IB

FIREFIGHTING MEDIA:

DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR ALCOHOL-RESISTANT FOAM (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR ALCOHOL-RESISTANT FOAM (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

ALCOHOL FOAM

(NFPA 325M, FIRE HAZARD PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND VOLATILE SOLIDS, 1984).

FIREFIGHTING:

MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO IT WITHOUT RISK. APPLY COOLING WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED TO FLAMES UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM ENDS OF TANKS. FOR MASSIVE FIRE IN CARGO AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES; IF THIS IS IMPOSSIBLE, WITHDRAW FROM AREA AND LET FIRE BURN. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF TANK DUE TO FIRE. ISOLATE FOR 1/2 MILE IN ALL DIRECTIONS IF TANK, RAIL CAR OR TANK TRUCK IS INVOLVED IN FIRE (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5, GUIDE PAGE 26).

EXTINGUISH ONLY IF FLOW CAN BE STOPPED; USE WATER IN FLOODING AMOUNTS AS FOG, SOLID STREAMS MAY NOT BE EFFECTIVE. COOL CONTAINERS WITH FLOODING AMOUNTS OF

1

PAGE 3

WATER, APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING VAPORS, KEEP UPWIND.

WATER MAY BE INEFFECTIVE (NFPA 325M, FIRE HAZARD PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND VOLATILE SOLIDS, 1984)

TRANSPORTATION DATA

MSDS # 2027

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND
SUBPART E:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.119
EXCEPTIONS: 49 CFR 173.118

TOXICITY

ETHYL ACETATE:

IRRITATION DATA: 400 PPM EYE-HUMAN.

TOXICITY DATA: 400 PPM INHALATION-HUMAN TCLO; 1600 PPM/8 HOURS INHALATION-RAT
LC50; 45 GM/M3/2 HOURS INHALATION-MOUSE LC50; 77 MG/M3/1 HOUR
INHALATION-GUINEA PIG LCLO; 61 GM/M3 INHALATION-CAT LCLO; 5620 MG/KG
ORAL-RAT LD50; 4100 MG/KG ORAL-MOUSE LD50; 4935 MG/KG ORAL-RABBIT LD50;
5500 MG/KG ORAL-GUINEA PIG LD50; 5000 MG/KG SUBCUTANEOUS-RAT LDLO;
3000 MG/KG SUBCUTANEOUS-GUINEA PIG LD50; 3000 MG/KG SUBCUTANEOUS-CAT LD50;
709 MG/KG INTRAPERITONEAL-MOUSE LD50; MUTAGENIC DATA (RTECS).

CARCINOGEN STATUS: NONE.

LOCAL EFFECTS: IRRITANT- INHALATION, SKIN, EYE.

ACUTE TOXICITY LEVEL: TOXIC BY INHALATION; SLIGHTLY TOXIC BY INGESTION.

TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSANT. POISONING MAY ALSO AFFECT
THE LIVER AND KIDNEYS.

AT INCREASED RISK FROM EXPOSURE: PERSONS WITH CHRONIC RESPIRATORY DISEASE,
SKIN DISEASE OR ANEMIA.

HEALTH EFFECTS AND FIRST AID

INHALATION:

ETHYL ACETATE:

IRRITANT/NARCOTIC/TOXIC. 10,000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.

ACUTE EXPOSURE- INHALATION OF 400 PPM FOR 3-5 MINUTES HAS CAUSED RESPIRATORY
TRACT IRRITATION IN HUMANS. LOW VAPOR CONCENTRATIONS MAY ALSO CAUSE
HEADACHE, COUGHING, DIZZINESS, DROWSINESS, AND SHORTNESS OF BREATH. HIGH
CONCENTRATIONS MAY CAUSE NARCOTIC EFFECTS WITH ANESTHESIA AND
UNCONSCIOUSNESS AND RENAL AND HEPATIC DAMAGE. PATHOLOGIC FINDINGS HAVE
INCLUDED MARKED HYPEREMIA OF THE RESPIRATORY TRACT, PULMONARY EDEMA,
HEMORRHAGIC GASTRITIS, AND HYPEREMIA OF THE SPLEEN AND KIDNEYS.

CHRONIC EXPOSURE- NO ADVERSE SYMPTOMS WERE OBSERVED IN WORKERS EXPOSED TO
375-1500 PPM FOR SEVERAL MONTHS. ANIMAL STUDIES INDICATE THAT 4450 PPM

FOR 1 HOUR DAILY FOR 40 DAYS CAUSED SECONDARY ANEMIA, LEUKOCYTOSIS, AND LIVER AND KIDNEY DAMAGE. IN RARE INSTANCES, REPEATED EXPOSURE MAY RESULT IN SENSITIZATION WITH MUCOUS MEMBRANE IRRITATION AND ECZEMATOUS ERUPTIONS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
ETHYL ACETATE:
IRRITANT.

MSDS #2027

ACUTE EXPOSURE- DIRECT CONTACT WITH THE LIQUID MAY CAUSE IRRITATION WITH REDNESS AND DEFATTING ACTION ON THE SKIN.
CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE DEFATTING DERMATITIS. IN RARE INSTANCES, REPEATED EXPOSURE MAY RESULT IN SENSITIZATION WITH ECZEMATOUS ERUPTIONS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
ETHYL ACETATE:
IRRITANT.

ACUTE EXPOSURE- DIRECT CONTACT WITH THE LIQUID MAY CAUSE IRRITATION, WITH REDNESS, PAIN, AND LACRIMATION. EXPOSURE TO 400 PPM MAY CAUSE A SENSATION OF IRRITATION IN HUMANS. APPLICATION OF 2 DROPS TO RABBIT CORNEAS, FOLLOWED 2 MINUTES LATER BY RINSING WITH WATER, CAUSED IMMEDIATE FINE OPTICAL IRREGULARITY OF THE CORNEAL EPITHELIUM, WHICH RETURNED TO NORMAL IN 2 DAYS.
CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE CONJUNCTIVITIS AND CORNEA CLOUDING. RABBITS EXPOSED TO THE VAPOR AT LEVELS WHICH WOULD BE SCARCELY TOLERABLE TO HUMANS CAUSED NO CORNEAL DAMAGE DESPITE BEING EXPOSED FOR 8 HOURS/DAY FOR 5 DAYS/WEEK FOR UP TO 7 WEEKS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
ETHYL ACETATE:
NARCOTIC.

ACUTE EXPOSURE- INGESTION OF SMALL AMOUNTS MAY CAUSE SORE THROAT, ABDOMINAL PAIN, AND DIARRHEA. LARGE AMOUNTS MAY CAUSE CENTRAL NERVOUS SYSTEM DEPRESSION, WITH DIZZINESS, HEADACHE, WEAKNESS, FATIGUE, DROWSINESS, AND UNCONSCIOUSNESS. POISONING MAY CAUSE CONGESTION OF THE LIVER AND KIDNEYS.
CHRONIC EXPOSURE- ANIMALS FED 1000 MG/KG FOR 1 MONTH SHOWED NO EFFECTS.

FIRST AID- IF THE PERSON IS CONSCIOUS AND NOT CONVULSING, INDUCE EMESIS BY GIVING SYRUP OF IPECAC FOLLOWED BY WATER. (IF VOMITING OCCURS KEEP THE HEAD BELOW THE HIPS TO PREVENT ASPIRATION). REPEAT IN 20 MINUTES IF NOT EFFECTIVE INITIALLY. GIVE ACTIVATED CHARCOAL. IN PATIENTS WITH DEPRESSED RESPIRATION

1

PAGE 5

OR IF EMESIS IS NOT PRODUCED, PERFORM GASTRIC LAVAGE CAUTIOUSLY (DREISBACH, HANDBOOK OF POISONING, 12TH ED.). TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GASTRIC LAVAGE SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

MSDS # 2027

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:

ETHYL ACETATE:

ACIDS (STRONG): EXOTHERMIC DECOMPOSITION.
BASES (STRONG): EXOTHERMIC DECOMPOSITION.
CHLOROSULFONIC ACID: EXOTHERMIC DECOMPOSITION.
LITHIUM TETRAHYDROALUMINATE: POSSIBLE EXPLOSION.
NITRATES: FIRE AND EXPLOSION HAZARD.
OLEUM: EXOTHERMIC DECOMPOSITION.
OXIDIZERS (STRONG): FIRE AND EXPLOSION HAZARD.
POTASSIUM TERT-BUTOXIDE: POSSIBLE IGNITION.

DECOMPOSITION:

THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC OXIDES OF CARBON.

POLYMERIZATION:

HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

****STORAGE****

STORE IN ACCORDANCE WITH 29 CFR 1910.106.

BONDING AND GROUNDING: SUBSTANCES WITH LOW ELECTROCONDUCTIVITY, WHICH MAY BE IGNITED BY ELECTROSTATIC SPARKS, SHOULD BE STORED IN CONTAINERS WHICH MEET THE BONDING AND GROUNDING GUIDELINES SPECIFIED IN NFPA 77-1983, RECOMMENDED PRACTICE ON STATIC ELECTRICITY.

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

****DISPOSAL****

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40CFR 262. EPA HAZARDOUS WASTE NUMBER U112.

MSDS # 2027

CONDITIONS TO AVOID

AVOID CONTACT WITH HEAT, SPARKS, FLAMES, OR OTHER SOURCES OF IGNITION. VAPORS MAY BE EXPLOSIVE AND POISONOUS; DO NOT ALLOW UNNECESSARY PERSONNEL IN AREA. DO NOT OVERHEAT CONTAINERS; CONTAINERS MAY VIOLENTLY RUPTURE AND TRAVEL A CONSIDERABLE DISTANCE IN HEAT OF FIRE.

SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:

SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA. KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND DENY ENTRY.

REPORTABLE QUANTITY (RQ): 5000 POUNDS

THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT

VENTILATION:

PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION TO MEET THE PUBLISHED EXPOSURE LIMITS. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

RESPIRATOR:

THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS; NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29 CFR 1910 SUBPART Z.

THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

ETHYL ACETATE:

- 1000 PPM- ANY CHEMICAL CARTRIDGE RESPIRATOR WITH A FULL FACEPIECE AND ORGANIC VAPOR CARTRIDGE(S).
- ANY POWERED, AIR-PURIFYING RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE(S).

1

MSDS # 2027 PAGE 7

10,000 PPM- ANY AIR-PURIFYING, FULL-FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE, FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
 ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
 ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
 ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS-FLOW MODE.

ESCAPE- ANY AIR-PURIFYING, FULL-FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE, FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
 ANY APPROPRIATE ESCAPE-TYPE, SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

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 BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:

EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE.

EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

 AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.
 CREATION DATE: 10/09/84 REVISION DATE: 05/27/91

OHS08750
 141-78-6
 ETHYL ACETATE

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1

PAGE 1

OHS24940

MATERIAL SAFETY DATA SHEET

MSDS #4989

OCCUPATIONAL HEALTH SERVICES, INC.
 11 WEST 42ND STREET, 12TH FLOOR
 NEW YORK, NEW YORK 10036
 1-800-445-MSDS (1-800-445-6737) OR
 1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
 CONTACT: 1-615-366-2000

SUBSTANCE IDENTIFICATION

SUBSTANCE: VINYL CHLORIDE

CAS-NUMBER 75-01-4

TRADE NAMES/SYNONYMS:

CHLOROETHYLENE; CHLOROETHENE; CHLORETHENE; TROVIDUR; ETHYLENE MONOCHLORIDE;
 MONOCHLOROETHYLENE; EXON-470; MONOCHLORO ETHENE; VINYL CHLORIDE MONOMER;
 VINYL CHLORIDE, INHIBITED; STCC 4905792; RCRA U043; UN 1086; C2H3CL;
 OHS24940

CHEMICAL FAMILY:

HALOGEN COMPOUND, ALIPHATIC

MOLECULAR FORMULA: C-H2-C-H-CL

MOLECULAR WEIGHT: 62.50

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=2 PERSISTENCE=3

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=4 REACTIVITY=1

COMPONENTS AND CONTAMINANTS

COMPONENT: VINYL CHLORIDE
 CAS# 75-01-4

PERCENT: >99.9

OTHER CONTAMINANTS: MAY CONTAIN TRACES OF PHENOL OR OTHER INHIBITORS

EXPOSURE LIMITS:

VINYL CHLORIDE:

1.0 PPM OSHA TWA; 5 PPM OSHA 15 MINUTE CEILING;

0.5 PPM OSHA ACTION LEVEL AS AN 8 HOUR TWA

5 PPM ACGIH TWA

ACGIH A1-CONFIRMED HUMAN CARCINOGEN.

LOWEST FEASIBLE LIMIT NIOSH RECOMMENDED EXPOSURE CRITERIA

MEASUREMENT METHOD: CHARCOAL TUBE (2); CARBON DISULFIDE; GAS CHROMATOGRAPHY
 WITH FLAME IONIZATION DETECTION; (NIOSH VOL. III # 1007).

1 POUND CERCLA SECTION 103 REPORTABLE QUANTITY

SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

SUBJECT TO CALIFORNIA PROPOSITION 65 CANCER AND/OR REPRODUCTIVE TOXICITY

WARNING AND RELEASE REQUIREMENTS- (FEBRUARY 27, 1987)

PHYSICAL DATA

DESCRIPTION: COLORLESS GAS WITH A MILD, SWEET ODOR.

MSDS # 4989

BOILING POINT: 9 F (-13 C) MELTING POINT: -245 F (-154 C)

SPECIFIC GRAVITY: 0.9106 VAPOR PRESSURE: 2515.6 MMHG @ 21.1 C

SOLUBILITY IN WATER: 0.25% ODOR THRESHOLD: 260 PPM VAPOR DENSITY: 2.2

SOLVENT SOLUBILITY: SOLUBLE IN ALCOHOL, ETHER, CARBON TETRACHLORIDE,
BENZENE.VISCOSITY: 0.01072 CP @ 20 C (GAS); 0.280 CP @ -20 C (LIQUID)

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:

DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

DANGEROUS EXPLOSION HAZARD WHEN EXPOSED TO HEAT OR FLAME.

VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE
OF IGNITION AND FLASH BACK.

VAPOR-AIR MIXTURES ARE EXPLOSIVE.

DUE TO LOW ELECTROCONDUCTIVITY OF THE SUBSTANCE, FLOW OR AGITATION MAY
GENERATE ELECTROSTATIC CHARGES RESULTING IN SPARKS WITH POSSIBLE IGNITION.

FLASH POINT: -108 F (-78 C) UPPER EXPLOSIVE LIMIT: 33%

LOWER EXPLOSIVE LIMIT: 3.6% AUTOIGNITION TEMP.: 882 F (472 C)

FIREFIGHTING MEDIA:

DRY CHEMICAL OR CARBON DIOXIDE
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).FOR LARGER FIRES, USE WATER SPRAY, FOG OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FIREFIGHTING:

MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO IT WITHOUT RISK. FOR MASSIVE FIRE
IN CARGO AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES; IF THIS IS
IMPOSSIBLE, WITHDRAW FROM AREA AND LET FIRE BURN. WITHDRAW IMMEDIATELY IN CASE
OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF TANK DUE TO
FIRE. COOL CONTAINER WITH WATER USING UNMANNED DEVICE UNTIL WELL AFTER FIRE IS
OUT. LET TANK, TANK CAR OR TANK TRUCK BURN UNLESS LEAK CAN BE STOPPED; WITH
SMALLER TANKS OR CYLINDERS, EXTINGUISH/ISOLATE FROM OTHER FLAMMABLES. ISOLATE
FOR 1/2 MILE IN ALL DIRECTIONS IF TANK, RAIL CAR OR TANK TRUCK IS INVOLVED IN
FIRE (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5, GUIDE PAGE 17).

1

PAGE 3

EXTINGUISH ONLY IF FLOW CAN BE STOPPED; USE WATER IN FLOODING QUANTITIES AS FOG. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER, APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING TOXIC VAPORS, KEEP UPWIND. EVACUATE TO A RADIUS OF 2500 FEET FOR UNCONTROLLABLE FIRES. CONSIDER EVACUATION OF DOWNWIND AREA IF MATERIAL IS LEAKING.

STOP FLOW OF GAS (NFPA 325M, FIRE HAZARD PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND VOLATILE SOLIDS, 1984).

MSDS #4989

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101:
FLAMMABLE GAS

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND
SUBPART E:
FLAMMABLE GAS

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.304;
49 CFR 173.314 AND 49 CFR 173.315
EXCEPTIONS: 49 CFR 173.306

TOXICITY

VINYL CHLORIDE:

TOXICITY DATA: 500 MG/KG ORAL-RAT LD50; 18 PPH/15 MINUTES INHALATION-RAT LC50;
200 PPM/18 MINUTES INHALATION-RAT LC50; MUTAGENIC DATA (RTECS); REPRODUCTIVE
EFFECTS DATA (RTECS); TUMORIGENIC DATA (RTECS).

CARCINOGEN STATUS: OSHA CARCINOGEN; KNOWN HUMAN CARCINOGEN (NTP); HUMAN
SUFFICIENT EVIDENCE, ANIMAL SUFFICIENT EVIDENCE (IARC GROUP-1). STUDIES SHOW
OCCUPATIONAL EXPOSURE RESULTED IN A SIGNIFICANT INCREASE IN ANGIOSARCOMAS OF
THE LIVER, AND ALSO TUMORS OF THE BRAIN, LUNG, AND HEMATOPOIETIC SYSTEMS.
VINYL CHLORIDE WAS CARCINOGENIC IN RATS, MICE, AND HAMSTERS FOLLOWING ORAL
AND INHALATION EXPOSURE, PRODUCING ANGIOSARCOMAS OF THE LIVER AND ALSO
TUMORS AT VARIOUS SITES, AND WAS CARCINOGENIC IN RATS FOLLOWING PRENATAL
EXPOSURE.

LOCAL EFFECTS: IRRITANT- SKIN, EYE.

ACUTE TOXICITY LEVEL: TOXIC BY INGESTION; RELATIVELY NON-TOXIC BY INHALATION.

TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSANT. POISONING MAY AFFECT THE
BLOOD, LIVER, AND LYMPHATIC AND RESPIRATORY SYSTEMS.

ADDITIONAL DATA: STIMULANTS SUCH AS EPINEPHRINE MAY INDUCE VENTRICULAR
FIBRILLATION.

HEALTH EFFECTS AND FIRST AID

INHALATION:

VINYL CHLORIDE:
NARCOTIC/CARCINOGEN.

ACUTE EXPOSURE- MAY BE IRRITATING. EXPOSURE TO 1000-16,000 PPM MAY
CAUSE CENTRAL NERVOUS SYSTEM DEPRESSION WITH DROWSINESS, VERTIGO,
STAGGERING GAIT, TINGLING AND NUMBNESS OF HANDS AND FEET, IMPAIRED

1

MSDS # 4989

PAGE 4

HEARING AND VISION, CARDIAC ARRHYTHMIAS AND POSSIBLY UNCONSCIOUSNESS; 20,000-25,000 PPM FOR 3-5 MINUTES MAY CAUSE DIZZINESS, LIGHTEADEDNESS, DISORIENTATION, NAUSEA AND BURNING SENSATION OF THE SOLES OF THE FEET; AND 120,000 PPM MAY BE FATAL. ADDITIONAL EFFECTS MAY INCLUDE NARCOLEPSY, HEADACHE, UNDUE FATIGUE, MUSCLE AND JOINT PAIN, DYSPNEA, AND ANESTHESIA. DEATH MAY BE DUE TO RESPIRATORY PARALYSIS WITH CARDIAC ARREST. HUMAN AND ANIMAL PATHOLOGIC REPORTS SHOW PULMONARY EDEMA, HYPEREMIA OF KIDNEYS AND LIVER, AND HEPATIC DEGENERATION.

CHRONIC EXPOSURE- REPEATED EXPOSURE MAY RESULT IN DOSE-RELATED SENSORY DISORDERS, AUTONOMIC NERVOUS SYSTEM POLYNEURITIS, SPASTIC ANGIOEURITIS, LEUKOPENIA, THROMBOCYTOPENIA, SPLENOMEGALY, HEPATITIS-LIKE LIVER CHANGES, LIVER MALFUNCTION WITH PORTAL FIBROSIS, IMPOTENCE AND PULMONARY INSUFFICIENCY. WORKERS INVOLVED IN THE POLYMERIZATION PROCESS MAY EXHIBIT A PECULIAR TRIAD OF SYMPTOMS: MODIFICATION OF PERIPHERAL CIRCULATION RESULTING IN PALLOR, CYANOSIS, AND THEN REDNESS (RAYNAUD'S PHENOMENON); SKELETAL CHANGES OF DISTAL PHALANGES (ACRO-OSTEOLYSIS); AND SCLERODERMA LIKE SKIN CHANGES. PSEUDO-CLUBBING OF THE FINGERS MAY ALSO OCCUR. OCCUPATIONAL EXPOSURE HAS PRODUCED ANGIOSARCOMAS OF THE LIVER AND IS ASSOCIATED WITH TUMOR PRODUCTION AT OTHER SITES. ANIMAL STUDIES SHOW THAT VINYL CHLORIDE IS CARCINOGENIC IN RATS FOLLOWING PRENATAL EXPOSURE. ONE STUDY SUGGESTED AN INCREASED FETAL MORTALITY DUE TO EXPOSURE OF THE FATHERS TO VINYL CHLORIDE. SEVERAL STUDIES HAVE REPORTED AN INCREASED RATE OF BIRTH DEFECTS, ESPECIALLY CENTRAL NERVOUS SYSTEM ANOMALIES, IN THE CHILDREN OF PARENTS RESIDING IN COMMUNITIES WHERE VINYL CHLORIDE PRODUCTION AND POLYMERIZATION PLANTS ARE LOCATED.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. ADMINISTRATION OF OXYGEN SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
VINYL CHLORIDE:
IRRITANT.

ACUTE EXPOSURE- CONTACT MAY CAUSE IRRITATION WITH REDNESS AND PAIN. DUE TO RAPID EVAPORATION, THE LIQUID MAY CAUSE FROSTBITE WITH REDNESS, TINGLING, AND PAIN OR NUMBNESS. IN MORE SEVERE CASES, THE SKIN MAY BECOME HARD AND WHITE AND DEVELOP BLISTERS.

CHRONIC EXPOSURE- WORKERS HANDLING VINYL CHLORIDE HAVE EXHIBITED A PECULIAR TRIAD OF SYMPTOMS: RAYNAUD'S PHENOMENON, ACRO-OSTEOLYSIS, AND SCLERODERMA LIKE SKIN CHANGES. REPEATED OR PROLONGED EXPOSURE TO IRRITANTS MAY CAUSE DERMATITIS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS. IN CASE OF FROSTBITE, WARM AFFECTED SKIN IN WARM WATER AT A TEMPERATURE OF 107 F. IF WARM WATER IS NOT AVAILABLE OR IMPRACTICAL TO USE, GENTLY WRAP AFFECTED PART IN BLANKETS. ENCOURAGE VICTIM TO EXERCISE AFFECTED PART WHILE IT IS BEING WARMED. ALLOW CIRCULATION TO RETURN NATURALLY (MATHESON GAS, 6TH ED.). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
VINYL CHLORIDE:
IRRITANT.

MSDS #4989

ACUTE EXPOSURE- CONTACT MAY CAUSE IMMEDIATE AND SEVERE IRRITATION, AND CORNEAL INJURY WITH COMPLETE RECOVERY IN 48 HOURS. DUE TO RAPID EVAPORATION, THE LIQUID MAY CAUSE FROSTBITE WITH REDNESS, PAIN AND BLURRED VISION.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE TO IRRITANTS MAY CAUSE CONJUNCTIVITIS.

FIRST AID- IMMEDIATELY WASH THE EYES WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). IF FROSTBITE IS PRESENT, WARM WATER MAY BE PREFERRED. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
VINYL CHLORIDE:
CARCINOGEN/TOXIC.

ACUTE EXPOSURE- THE REPORTED LETHAL DOSE IN RATS IS 500 MG/KG. THE SYMPTOMS WERE NOT REPORTED. IF THE LIQUID IS SWALLOWED, FROSTBITE DAMAGE TO THE LIPS, MOUTH AND MUCOUS MEMBRANES MAY OCCUR.

CHRONIC EXPOSURE- ORAL ADMINISTRATION TO RATS, MICE, AND HAMSTERS RESULTED IN TUMOR PRODUCTION AT VARIOUS SITES, INCLUDING ANGIOSARCOMAS OF THE LIVER.

FIRST AID- IF EXTENSIVE VOMITING HAS NOT OCCURRED, THE SUBSTANCE SHOULD BE REMOVED BY EMESIS OR GASTRIC LAVAGE PROVIDED THAT THE PATIENT IS CONSCIOUS AND CONVULSIONS ARE NOT PRESENT. KEEP HEAD BELOW HIPS DURING VOMITING TO PREVENT ASPIRATION. DO NOT ATTEMPT TO MAKE AN UNCONSCIOUS PERSON VOMIT. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY (DREISBACH, HANDBOOK OF POISONING, 12TH ED.). TREATMENT SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:
FORMS UNSTABLE PEROXIDES WHEN EXPOSED TO AIR WHICH MAY INITIATE POLYMERIZATION. MAY ALSO POLYMERIZE ON EXPOSURE TO HEAT OR LIGHT.

INCOMPATIBILITIES:
VINYL CHLORIDE:
ACETYLIDE-FORMING MATERIALS: MAY FORM EXPLOSIVE COMPOUNDS.
ALUMINUM: MAY CAUSE POLYMERIZATION.
COPPER AND ALLOYS: MAY FORM EXPLOSIVE COMPOUNDS.
IRON: MAY CORRODE IN THE PRESENCE OF WATER.
MONEL: MAY FORM EXPLOSIVE COMPOUND.
NITROGEN OXIDES: EXPLODES.
OXIDIZERS (STRONG): FIRE AND EXPLOSION HAZARD.
PEROXIDES: MAY INITIATE POLYMERIZATION.

STEEL: MAY CORRODE IN THE PRESENCE OF WATER.

DECOMPOSITION:

THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE HIGHLY TOXIC FUMES OF PHOSGENE, TOXIC AND CORROSIVE FUMES OF CHLORIDES, AND OXIDES OF CARBON.

POLYMERIZATION:

POLYMERIZATION OCCURS ON EXPOSURE TO SUNLIGHT, HEAT, OR AIR. THE PRESENCE OF IMPURITIES MAY RESULT IN EXOTHERMIC SELF-POLYMERIZATION, GENERATING SUFFICIENT HEAT AND PRESSURE TO RUPTURE THE CONTAINER.

MSDS #4989

STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

****STORAGE****

STORE IN ACCORDANCE WITH 29 CFR 1910.101.

PROTECT AGAINST PHYSICAL DAMAGE. OUTSIDE OR DETACHED STORAGE IS PREFERABLE. INSIDE STORAGE SHOULD BE IN A COOL, WELL-VENTILATED, NON-COMBUSTIBLE LOCATION, AWAY FROM ALL POSSIBLE SOURCES OF IGNITION. SEPARATE FROM OXIDIZING MATERIALS. (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

BONDING AND GROUNDING: SUBSTANCES WITH LOW ELECTROCONDUCTIVITY, WHICH MAY BE IGNITED BY ELECTROSTATIC SPARKS, SHOULD BE STORED IN CONTAINERS WHICH MEET THE BONDING AND GROUNDING GUIDELINES SPECIFIED IN NFPA 77-1983, RECOMMENDED PRACTICE ON STATIC ELECTRICITY.

****DISPOSAL****

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40CFR 262. EPA HAZARDOUS WASTE NUMBER U043.

VINYL CHLORIDE - REGULATORY LEVEL: 0.2 MG/L

MATERIALS WHICH CONTAIN THE ABOVE SUBSTANCE AT OR ABOVE THE REGULATORY LEVEL MEET THE EPA CHARACTERISTIC OF TOXICITY, AND MUST BE DISPOSED OF IN ACCORDANCE WITH 40 CFR PART 262. EPA HAZARDOUS WASTE NUMBER D043.

CONDITIONS TO AVOID

MATERIAL IS EXTREMELY FLAMMABLE; AVOID CONTACT WITH HEAT, SPARKS, FLAMES OR OTHER SOURCES OF IGNITION. CONTENTS ARE UNDER PRESSURE; CONTAINERS MAY RUPTURE VIOLENTLY AND TRAVEL A CONSIDERABLE DISTANCE.

SPILL AND LEAK PROCEDURES

WATER SPILL:

THE CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (PROPOSITION 65) PROHIBITS CONTAMINATING ANY KNOWN SOURCE OF DRINKING WATER WITH SUBSTANCES KNOWN TO CAUSE CANCER AND/OR REPRODUCTIVE TOXICITY.

OCCUPATIONAL SPILL:

SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. ISOLATE AREA UNTIL GAS HAS DISPERSED. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND DENY ENTRY. VENTILATE CLOSED SPACES BEFORE ENTERING.

REPORTABLE QUANTITY (RQ): 1 POUND

THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT

MSDS # 4989

VENTILATION:

PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION TO MEET THE PUBLISHED EXPOSURE LIMITS. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

VINYL CHLORIDE:

VENTILATION SHOULD MEET THE REQUIREMENTS IN 29 CFR 1910.1017(F).

RESPIRATOR:

THE FOLLOWING RESPIRATORS ARE THE MINIMUM LEGAL REQUIREMENTS AS SET FORTH BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION FOUND IN 29 CFR 1910, SUBPART Z.

REQUIRED RESPIRATORS FOR VINYL CHLORIDE

ATMOSPHERIC CONCENTRATIONS OF VINYL CHLORIDE

REQUIRED APPARATUS

UNKNOWN OR ABOVE 3600 PPM

OPEN-CIRCUIT, SELF CONTAINED BREATHING APPARATUS, PRESSURE DEMAND TYPE, WITH FULL FACEPIECE

NOT OVER 3600 PPM

COMBINATION TYPE 'C' SUPPLIED AIR RESPIRATOR, PRESSURE DEMAND TYPE, WITH A FULL OR HALF FACEPIECE AND AUXILIARY SELF-CONTAINED AIR SUPPLY;

OR

COMBINATION TYPE SUPPLIED AIR RESPIRATOR, CONTINUOUS FLOW TYPE, WITH A FULL OR HALF FACEPIECE,

1

MSDS # 4989

PAGE 8

AND AUXILIARY SELF-CONTAINED AIR SUPPLY.

NOT OVER 1000 PPM TYPE 'C' SUPPLIED AIR RESPIRATOR, CONTINUOUS FLOW TYPE, WITH A FULL OR HALF FACEPIECE, HELMET OR HOOD.

NOT OVER 100 PPM COMBINATION TYPE 'C' SUPPLIED AIR RESPIRATOR, DEMAND TYPE, WITH A FULL FACEPIECE, AND AUXILIARY SELF-CONTAINED AIR SUPPLY;
OR
OPEN-CIRCUIT SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE, IN DEMAND MODE;
OR
TYPE 'C' SUPPLIED AIR RESPIRATOR, DEMAND TYPE, WITH FULL FACEPIECE.

NOT OVER 25 PPM A POWERED AIR PURIFYING RESPIRATOR WITH HOOD, HELMET, FULL OR HALF FACEPIECE, AND A CANISTER WHICH PROVIDES A SERVICE LIFE OF AT LEAST 4 HOURS FOR CONCENTRATIONS OF VINYL CHLORIDE UP TO 25 PPM;
OR
GAS MASK, FRONT- OR BACK-MOUNTED CANISTER WHICH PROVIDES A SERVICE LIFE OF AT LEAST 4 HOURS FOR CONCENTRATIONS OF VINYL CHLORIDE UP TO 25 PPM.

NOT OVER 10 PPM COMBINATION TYPE 'C' SUPPLIED AIR RESPIRATOR, WITH A HALF FACEPIECE AND AUXILIARY SELF-CONTAINED AIR SUPPLY;
OR
TYPE 'C' SUPPLIED-AIR RESPIRATOR, DEMAND TYPE, WITH A HALF FACEPIECE;
OR
ANY CHEMICAL CARTRIDGE RESPIRATOR WITH AN ORGANIC VAPOR CARTRIDGE WHICH PROVIDES A SERVICE LIFE OF AT LEAST 1 HOUR FOR CONCENTRATIONS OF VINYL CHLORIDE UP TO 10 PPM.

ENTRY INTO UNKNOWN CONCENTRATIONS OR CONCENTRATIONS GREATER THAN 36,000 PPM (LOWER EXPLOSION LIMIT) MAY BE MADE ONLY FOR THE PURPOSES OF LIFE RESCUE;
AND
ENTRY INTO CONCENTRATIONS OF LESS THAN 36,000 PPM, BUT GREATER THAN 3600 PPM

MAY BE MADE ONLY FOR THE PURPOSES OF LIFE RESCUE, FIREFIGHTING OR SECURING EQUIPMENT SO AS TO PREVENT A GREATER HAZARD OF RELEASE OF VINYL CHLORIDE.

THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS, OR NIOSH CRITERIA DOCUMENTS.

THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

VINYL CHLORIDE (AT ANY DETECTABLE CONCENTRATION):

MSDS # 4989

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED CANISTER PROVIDING PROTECTION AGAINST VINYL CHLORIDE.

ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

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 BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT ANY POSSIBILITY OF SKIN CONTACT WITH THIS SUBSTANCE.

VINYL CHLORIDE:

PROTECTIVE CLOTHING SHOULD MEET THE REQUIREMENTS FOR PROTECTIVE GARMENTS IN 29 CFR 1910.1017(H).

GLOVES:

FOR GAS: WEAR IMPERVIOUS GLOVES. SPECIFIC TYPE OF GLOVE MAY BE TESTED AND/OR RECOMMENDED BY MANUFACTURER.

FOR COMPRESSED LIQUID: WEAR FULL PROTECTIVE, COLD INSULATING GLOVES.

VINYL CHLORIDE:

PROTECTIVE GLOVES SHOULD MEET THE REQUIREMENTS FOR PROTECTIVE GARMENTS IN 29 CFR 1910.1017(H).

EYE PROTECTION:

I

PAGE 10

EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A
FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

EMERGENCY WASH FACILITIES:
WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE
EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN
AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

VINYL CHLORIDE:
PROTECTIVE EYE EQUIPMENT SHOULD MEET THE REQUIREMENTS FOR PROTECTIVE GARMENTS
IN 29 CFR 1910.1017(H).

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.
CREATION DATE: 10/16/84 REVISION DATE: 04/11/91

OHS24940
75-01-4
VINYL CHLORIDE

MSDS # 4989

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APPENDIX E

PERSONNEL TRAINING

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1 Title: Generator Hazards Safety Training
2 Description: Provides the dangerous material/waste worker with
the fundamentals for safe use and disposal of
dangerous materials.
3 Target Audience: Dangerous material and waste workers
4 Technique: Classroom
5 Evaluation: Written test
6 Length: 4 hours
7 Frequency: 24 months

8

9

10 Title: Hazardous Waste Worker Safety Training
11 Description: Provides the dangerous waste worker with the
fundamentals of safety when working with dangerous
waste.
12 Note: This course fulfills training requirements
of 29 CFR 1910.120 requiring dangerous waste
training of workers at all treatment, storage,
and/or disposal facilities regulated under RCRA.
13 Target Audience: Dangerous material and waste workers
14 Technique: Classroom and on-the-job training
15 Evaluation: Written test
16 Length: 24 hours
17 Frequency: Not applicable

18

1 Title: Hazardous Waste Worker Safety Training Refresher
2 Description: Provides the dangerous waste worker with a
refresher in the fundamentals of safety when
working with dangerous waste.
3 Note: This course fulfills training requirements
of 29 CFR 1910.120 requiring dangerous waste
training of workers at all treatment, storage,
and/or disposal facilities regulated under RCRA.
4 Target Audience: Dangerous material and waste workers
5 Technique: Classroom
6 Evaluation: Written test
7 Length: 8 hours
8 Frequency: 12 months

9

10

11 Title: Hazardous Material/Waste job-Specific Training
12 Description: Provides job-specific dangerous material/waste
information. Two checklists may be obtained from
safety training to help the supervisor/manager
through this session with each employee.
13 Note: Not a classroom presentation--supervisor
conducts this exercise with each employee using the
checklists.
14 Target Audience: Employees who complete generator hazards safety
training
15 Technique: On-the-job training
16 Evaluation: On-the-job training checklist
17 Length: Average - 2 hours
18 Frequency: 12 months

1 Title: Scott SKA-PAK MSA PAPR
2 Description: This class is designed to instruct employees in the
proper use of the Scott "SKAPAK" for entry, exit or
work in conditions immediately dangerous to life
and health and to instruct employees to recognize
and handle emergencies. This class also includes
instructions in the use of MSA, Inc. Powered Air
Purifying Respirator (PAPR).
3 Target Audience: General, Safety, QA, OPS/OPRS, Management,
Maintenance Engineering
4 Technique: Classroom
5 Evaluation: Practical exam
6 Length: Approximately 2 hours
7 Frequency: 12 months

8

9

10 Title: Self-Contained Breathing Apparatus (SCBA) Annual
Qualification
11 Description: Provides instructions in the proper use of a
pressure-demand respirator in which breathing air
is supplied from a cylinder carried on the user's
back. The SCBA are typically used for emergency
response situations in an atmosphere that is
immediately dangerous to life or health.
12 Target Audience: General, Safety, OPS/OPRS, Maintenance
13 Technique: Taught in a classroom using a slide projector and
overhead
14 Evaluation: Written and practical test
15 Length: Approximately 4 hours
16 Frequency: 12 months

17

1 Title: Radiation Safety Training
2 Description: A practical dress/undress demonstration is also
required. Instructs radiation workers in the
fundamentals of radiation protection and the proper
procedures for monitoring exposures (ALARA).
Training includes knowledge of the acute and
chronic effects of exposure to radiation risks
associated with occupational radiation exposure,
mode of exposure, protective measures,
instrumentation, monitoring programs, contamination
control, personnel decontamination, warning signs
and alarms, and responsibilities of employees and
managers.
3 Target Audience: Radiation workers as defined in WHC-CM-4-10
4 Technique: Taught in a classroom using a white board,
appropriate audio/visual equipment
5 Evaluation: Written exam and practical dress/undress
6 Length: Approximately 7 hours
7 Frequency: 24 months (Retraining under Course Number 020003)

8

9

10 Title: On-The-Job Training
11 Description: On-the-job training session under the supervision
of an experienced person before full
responsibilities may be assumed. In addition, all
personnel on the hazardous waste site are required
to have reviewed this Waste Sampling and Analysis
Plan.
12 Target Audience: Nuclear Operators and Operations Management
13 Technique: Classroom and on-the-job training
14 Evaluation: Practical exercise and on-the-job training
checklist
15 Length: 40 hours
16 Frequency: 12 months
17

1 Title: Cardiopulmonary Resuscitation (CPR)
2 Description: Provide cardiopulmonary resuscitation training to the
American Heart Association standards.
3 Target Audience: All employees
4 Technique: Classroom and active participation
5 Evaluation: Practical exam and written test
6 Length: 4 hours
7 Frequency: 24 months (recertification)

8

9

10 Title: Noise Control (Noise-Hearing Conservation)
11 Description: Provide employees with information conducive to hearing
conservation. Supervisors and employees responsibility,
exposure limits, hearing conservation requirements,
protection devices, diagnosis of noise, induced hearing
loss.
12 Target Audience: All employees exposed to an 8 hour time weighted average
sound level of 85 dBA or greater.
13 Technique: Classroom
14 Evaluation: None
15 Length: Approximately 1 hour
16 Frequency: 12 months

17

1 Title: Hazardous Waste Site Supervisor/Manager Safety
Management Training

2 Description: This program provides an additional eight hours of
training for supervisors and managers covering hazardous
waste programs.

3 Target Audience: Personnel who manage or have safety overview
responsibilities of dangerous material and waste
operations.

4 Technique: Classroom

5 Evaluation: None

6 Length: 8 hours

7 Frequency: Not applicable

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APPENDIX F

**QUALITY ASSURANCE PROJECT PLAN FOR SAMPLING AND ANALYSIS FOR
THE 303-K STORAGE FACILITY¹**

¹ This is a complete rewrite, revision bars are not used.

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CONTENTS

1
2
3
4 1.0 PROJECT DESCRIPTION APP F-1
5
6 1.1 PROJECT OBJECTIVES APP F-1
7
8 1.2 APPLICABILITY AND RELATIONSHIP TO THE ONSITE CONTRACTOR'S
9 QUALITY ASSURANCE PROGRAM APP F-1
10
11 2.0 DATA QUALITY OBJECTIVES FOR ANALYTICAL
12 LABORATORY MEASUREMENTS APP F-2
13
14 3.0 PROCEDURES APP F-4
15
16 3.1 PROCEDURE APPROVALS AND CONTROLS APP F-4
17 3.1.1 Hanford Site Procedures APP F-4
18 3.1.2 Participating Contractor and/or
19 Subcontractor Procedures APP F-4
20
21 3.2 SAMPLING PROCEDURES APP F-5
22
23 3.3 PROCEDURE ADDITIONS AND CHANGES APP F-5
24
25 4.0 SAMPLE CUSTODY APP F-5
26
27 /
28 5.0 CALIBRATION PROCEDURES APP F-6
29
30 6.0 ANALYTICAL PROCEDURES APP F-6
31
32 7.0 DATA REDUCTION, VALIDATION, AND REPORTING APP F-6
33
34 7.1 DATA REDUCTION AND DATA PACKAGE PREPARATION APP F-7
35
36 7.2 VALIDATION APP F-8
37 7.2.1 Frequencies for Checking Calculation
38 and Transcription Errors APP F-8
39
40 7.3 FINAL REVIEW AND RECORDS MANAGEMENT
41 CONSIDERATIONS APP F-9
42
43 8.0 INTERNAL QUALITY CONTROL APP F-9
44
45 9.0 PERFORMANCE AND SYSTEM AUDITS APP F-10
46
47 10.0 PREVENTIVE MAINTENANCE APP F-11
48
49 11.0 DATA ASSESSMENT APP F-11
50
51 12.0 CORRECTIVE ACTION APP F-11
?

CONTENTS (cont)

1
2
3
4
5
6
7
8
9

13.0 QUALITY ASSURANCE REPORTS APP F-12

14.0 REFERENCES APP F-13

 14.1 DOCUMENTS APP F-13

 14.4 WASHINGTON ADMINISTRATIVE CODE
 AND REVISED CODE OF WASHINGTON APP F-13

1.0 PROJECT DESCRIPTION

This quality assurance project plan (QAPjP) has been prepared for regulatory review as part of the *303-K Storage Facility Closure Plan* (DOE 1993) and in support of the sampling and analysis activities described in Section 7.0 of that closure plan. The QAPjP provides the generic quality assurance and quality control information for the closure activities defined by the closure plan.

The 303-K Storage Facility is a storage and treatment unit for dangerous waste regulated under the Washington Administrative Code (WAC) 173-303 *Dangerous Waste Regulations*. The unit is no longer required and will be closed per WAC 173-303.

1.1 PROJECT OBJECTIVES

The sampling and analysis activities at this unit will support the closure activities defined in the unit closure plan. The ultimate goal is the clean closure of the unit.

1.2 APPLICABILITY AND RELATIONSHIP TO THE ONSITE CONTRACTOR'S QUALITY ASSURANCE PROGRAM

This QAPjP applies specifically to field activities and laboratory analyses performed in support of closure of the unit. This QAPjP has been prepared in compliance with the *Environmental Engineering, Geotechnology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a) and the *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (EPA 1980). This QAPjP describes the means selected to implement quality assurance program requirements, defined in the *Quality Assurance Manual* (WHC 1988b), as the requirements apply to environmental investigations. The QAPjP will accommodate the specific requirements for project plan format and content agreed on in the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1994).

This QAPjP contains a matrix of procedural resources from *Environmental Engineering, Geotechnology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a) and *Environmental Investigations and Site Characterization Manual* (WHC 1988a). Distribution and revision control of this plan will be carried out in compliance with QR 6.0, "Document Control" (WHC 1988b). All plans and procedures referenced in this QAPjP are available for regulatory review.

1 should contain analyte concentrations above the MDL and may involve
2 the use of matrix spikes. The most commonly used estimates of
3 precision are the RSD or the coefficient of variation (CV),
4

$$5 \quad \text{RSD} = 100\text{CV} = 100 s/\bar{x},$$

6
7 where:

8
9 \bar{x} = the arithmetic mean of the x_i measurements
10 s = standard deviation.
11

12 The relative percent difference (RPD) (EPA 1990) when only two samples
13 are available is:
14

$$15 \quad \text{RPD} = 100 [(x_1 - x_2)/\{(x_1 + x_2)/2\}].$$

- 16
- 17 • Accuracy: The closeness of agreement between an observed value and an
18 accepted reference value. When applied to a set of observed values,
19 accuracy will be a combination of a random component and a common
20 systematic error (or bias) component (EPA 1990).
21
 - 22 • Completeness: Requirements for precision and accuracy will be met for
23 at least 95 percent of the total number of determinations on routine
24 samples.
25

26
27 More stringent requirements for precision and accuracy could be specified
28 in procedures for individual laboratory methods. In that event, the more
29 stringent requirements will apply as data quality objectives for this project.

30 Approved analytical procedures will adhere to reporting techniques and
31 units that are consistent with EPA reference methods. This will facilitate
32 the comparability of data sets in terms of precision and accuracy. Actual
33 achieved and/or used detection limits and values for precision, accuracy, and
34 completeness will be provided in all summary analyses reports.
35

36 Goals for data representativeness for sampling are addressed
37 qualitatively by the specification of sample locations and depth intervals
38 (when applicable) in the unit closure plan and unit sampling and analysis
39 plan. Sample data should be comparable with other measurement data for
40 similar samples and sample conditions. Comparability will be achieved
41 qualitatively by using standard techniques to collect and analyze
42 representative samples and by reporting analytical results in appropriate
43 units.
44

45 Failure to conform to these criteria will be documented in data summary
46 reports (Section 7.1). Corrective actions will be initiated by the Technical
47 Lead as appropriate (Section 12.0) in the event that the criteria initially
48 are not achieved.
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3.0 PROCEDURES

Section 3.0 discusses standardized sampling procedures that will be used and the approvals and control of these procedures.

3.1 PROCEDURE APPROVALS AND CONTROLS

The following sections describe the procedures referenced to support sampling and analysis activities.

3.1.1 Hanford Site Procedures

The Hanford Site procedures that have been referenced to support the unit sampling and analysis activities are listed in the quality assurance program index in the *Environmental Engineering, Geotechnology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a). Referenced procedures include Environmental Investigation Instructions (EII) (WHC 1988a) and Quality Requirements (QR) (WHC 1988b). Requirements relating to approval, revision, and distribution control of EIIs are addressed in EII 1.2, "Preparing and Revising of Procedures;" requirements applicable to Quality Instructions (QI) and QRs are addressed in QR 5.0, "Instructions, Procedures, and Drawings," and QR 6.0, "Document Control." Other controlling documents that apply to preparation, review, and revision of Hanford Site analytical laboratory procedures and sample management procedures are identified under Criteria 5.00 and 6.00 in the *Environmental Engineering, Geotechnology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a). All of the aforementioned procedures will be available on request for regulatory review.

3.1.2 Participating Contractor and/or Subcontractor Procedures

Participating contractor and/or subcontractor services may be procured for sampling or technical assistance. All such procurement will be subject to the applicable requirements of QR 4.0, "Procurement Document Control;" QI 4.1, "Procurement Document Control;" QI 4.2, "External Services Control;" QR 7.0, "Control of Purchased Items and Services;" QI 7.1, "Preprocurement Planning and Proposal Evaluation;" and/or QI 7.2, "Supplier Evaluation" (WHC 1988b). Whenever such services require procedural controls, conformance to onsite procedures, or submittal of contractor procedures for onsite review and approval before implementation, the requirement(s) will be identified in the procurement document or work order. Contracting or subcontracting analytical laboratories will be required to submit their analytical procedures as well as the current version of their internal quality assurance program plans for review and approval. The subject plans and procedures will be reviewed and approved by the Management and Operations (M&O) Contractor's quality assurance, sample management, and analytical laboratories organization personnel, and/or other qualified personnel as determined by the Technical Lead. If required, all reviewers will be qualified per the requirements of

1 EII 1.7, "Qualification and Training" (WHC 1988a). All approved participating
2 contractor or subcontractor procedures, plans, and/or manuals will be retained
3 as project quality records in compliance with the *Document Control and Record*
4 *Management Manual*, Section 9.0 (WHC 1989); QR 17.0, "Quality Assurance
5 Records;" and QI 17.1, "Quality Assurance Records Control" (WHC 1988b). All
6 such documents will be available upon request for regulatory review.
7

8 9 3.2 SAMPLING PROCEDURES

10 As a minimum, sampling procedures will follow the guidelines and
11 requirements of SW-846 (EPA 1990). Soil samples will be collected in
12 compliance with EII 5.2, "Soil and Sediment Sampling" (WHC 1988a).
13

14 Where no standardized procedures for sampling or analysis exist (e.g.,
15 the sampling and analysis of asphalt or concrete), the best practice will be
16 followed in collection and analysis of these samples. Specific sampling and
17 analytical methodologies will be determined in concert with the appropriate
18 regulatory agencies and documented in the unit closure plan, unit sampling and
19 analysis plan, or other appropriate document.
20

21 Sample numbers will be assigned as indicated in EII 5.10, "Obtaining
22 Sample Identification Numbers and Accessing HEIS Data" (WHC 1988a). Sampling
23 activities will conform with the sample identification, container type,
24 preparation, and preservation requirements of EII 5.11, "Sample Packaging and
25 Shipping" (WHC 1988a).
26

28 29 3.3 PROCEDURE ADDITIONS AND CHANGES

30 Additional EIIs or modifications to existing EIIs that might be required
31 as a consequence of sampling plan requirements will be developed in compliance
32 with EII 1.2, "Preparing and Revising Procedures" (WHC 1988a). Should
33 deviations from established EIIs be required to accommodate unforeseen
34 situations, the Field Team Leader can authorize such deviations consistent
35 with provisions and requirements in EII 1.4, "Instruction Change
36 Authorizations" (WHC 1988a). As required by EII 1.4, deviations will be
37 documented, reviewed, and dispositioned by means of instruction change
38 authorization forms. Other types of document change requests will be
39 completed as required by the procedures governing their preparation and
40 revision.
41

42 43 4.0 SAMPLE CUSTODY

44 All samples obtained during the course of this investigation will be
45 controlled from the point of origin to the analytical laboratory as stipulated
46 in EII 5.1, "Chain of Custody" (WHC 1988a). Chain-of-custody documentation
47 also will be maintained for the return of residual sample materials from the
48 laboratory. Requirements and procedures will be defined in procurement
49 documentation to subcontractor or participant contractor laboratories for the
50
51

1 return of residual sample materials after completion of analysis. Laboratory
2 chain-of-custody procedures will ensure that sample integrity and
3 identification are maintained throughout the analytical process and will be
4 reviewed and approved in advance as required by onsite procurement control
5 procedures (see Section 3.1.2).
6

7 Analytical results will be traceable to the original samples through a
8 unique code or identifier (see Section 3.0). All analytical results will be
9 controlled as permanent project quality records as required by QR 17.0
10 "Quality Assurance Records" (WHC 1988b), and EII 1.6 "Records Processing"
11 (WHC 1988a).
12

13 Sample and/or data flow will be coordinated by the sample management
14 organization. The sample management organization will be responsible for
15 tracking, controlling, and verification of in-process samples and data per the
16 *Sample Management And Administrative Manual*, WHC-CM-5-3, Section 1.0, "Sample
17 Tracking;" Section 1.3, "Data Package Control;" and Section 1.1, "Data Package
18 Verification" (WHC 1990b).
19

20 All samples will be screened in the field for beta/gamma and gross alpha
21 radioactivity in compliance with approved Hanford Site health physics
22 procedures (WHC 1990c). Health physics technicians must release samples
23 before the samples can be transported to offsite laboratories for analysis of
24 dangerous constituents.
25

26 27 5.0 CALIBRATION PROCEDURES

28
29
30 Calibration of the contracting laboratory analytical equipment will be
31 performed per applicable standard methods. The standard methods will be
32 subject to review and approval.
33

34 35 6.0 ANALYTICAL PROCEDURES

36
37
38 Specific analytical methods or procedures will be reviewed and approved
39 before use in compliance with the procedures and procurement control
40 requirements noted in Section 4.1.
41

42 43 7.0 DATA REDUCTION, VALIDATION, AND REPORTING

44
45
46 Data reduction, validation of completed laboratory data packages, and
47 reporting requirements are discussed in the following sections. This includes
48 the review and records management for the data packages.
49
50

7.1 DATA REDUCTION AND DATA PACKAGE PREPARATION

When each group of analyses is completed, the analytical laboratory will prepare a report summarizing the analytical results. The analytical laboratory also will prepare a detailed data package. The data package will include all information necessary to perform data validation to the extent indicated by the minimum applicable requirements (Section 7.2). Data summary report format and data package content will be defined in procurement documentation subject to review and approval (see Section 3.1). As a minimum, laboratory data packages will include the following:

- Sample receipt and tracking documentation. This will including identification of the organization and individuals performing the analysis, the names and signatures of the responsible analysts, sample holding time requirements, references to applicable chain-of-custody procedures, and the dates of sample receipt, extraction, and analysis.
- Instrument calibration documentation. This will including equipment type and model, with continuing calibration data for the time period in which the analyses were performed.
- Quality control data. This will include quality control data appropriate for the methods used. This can including matrix-spike/matrix-spike duplicate data, recovery percentages, precision data, laboratory blank data, and identification of any nonconformances that might have affected the laboratory's measurement system during the time in which the analyses were performed.
- Analytical results or data deliverables. This will include reduced data, reduction formulas or algorithms, and identification of data outliers and/or deficiencies.

Other supporting information (e.g., initial calibration data, reconstructed ion chromatographs, spectrograms, traffic reports, and raw data) are included in the individual data packages. All sample data will be retained by the analytical laboratory and made available for systems or program audit purposes at the request of the M&O contractor, U.S. Department of Energy, or regulatory agency representatives (Section 9.0). Such data will be retained by the analytical laboratory through the duration of the contractual statement of work, at which time the data will be transmitted for archiving.

A completed data package will be reviewed and approved by the analytical laboratory quality assurance manager before the package is submitted to the sample management organization for validation.

The requirements of Section 7.1 will be included in procurement documents and/or work orders, as appropriate, in compliance with the procurement control procedures (Section 3.1).

1 **7.2 VALIDATION**
2

3 Data validation of the completed laboratory data packages and the
4 reporting of the results of the validation process will be performed in
5 conformance with requirements and procedures identified in *Sample Management*
6 *and Administrative Manual* (WHC 1990b) and the *Data Validation Procedures for*
7 *Chemical Analyses Manual* (WHC 1993). Data validators will perform a number of
8 tasks on each sample delivery group in response to general and specific
9 requirements identified in the data validation procedures (WHC 1993). A
10 sample delivery group is defined as a group of samples (usually 20 or fewer)
11 reported within a single laboratory data package. These tasks are summarized
12 as follows:
13

- 14 • Take delivery of the data package, stamp the receipt date on the
15 package, and make duplicate copies of the sample concentration
16 reports or report forms.
- 17
- 18 • Organize and review the data package for completeness as described in
19 the data validation procedures (WHC 1993) and document the
20 completeness review on the applicable data validation checklist.
- 21
- 22 • Validate the data package and qualify sample results according to the
23 procedures and criteria described in the data validation procedures
24 (WHC 1993). Data that are rejected at any point during validation
25 will be eliminated from further review or consideration.
- 26
- 27 • Check for calculation and transcription errors, applying the frequency
28 guidelines (Section 7.2.1).
- 29
- 30 • Resolve any discrepancies identified during the review of the data
31 package, including any missing data, with the laboratory
- 32
- 33 • Prepare a narrative summary of the acceptability of the data, and
34 prepare a summary of the validated results in tabular and electronic
35 formats after the data have been validated.
- 36
- 37 • Submit the data validation report. The report will include the
38 narrative summary, an electronic media copy of the data, checklists,
39 summary forms, and the qualified laboratory concentration reports to
40 the Technical Lead within 21 days after receipt of the data package
41 from the laboratory.
- 42

43 **7.2.1 Frequencies for Checking Calculation**
44 **and Transcription Errors**
45

46 For this sampling and analysis project, the following frequencies will be
47 used to check for calculation and transcription errors:
48

- 49 • Investigative samples and verification samples. All reported
50 laboratory results for at least 20 percent of the samples contained in
51 the sample delivery group and 100 percent of the reported quality
52 control samples (duplicates, matrix spikes, field blanks, and any

1 performance audit samples) will be recalculated and verified against
2 the instrument printouts and bench sheet records (raw data). If
3 possible, at least 50 percent of the samples selected for
4 recalculation should contain positive results for the compounds
5 analyzed.
6

- 7 • Confirmatory samples. All reported laboratory results for 100 percent
8 of the samples contained in the sample delivery group and 100 percent
9 of the reported quality control samples (duplicates, matrix spikes,
10 field blanks, and any performance audit samples) will be calculated
11 and verified against the raw data.
12

13 Reporting requirements for validation of data produced by routine and
14 special analytical methods other than EPA reference methods (EPA 1990) will be
15 established within applicable procedures for the individual methods, subject
16 to review and approval (see Section 3.1). The reporting requirements will be
17 in general compliance with the guidelines provided previously in Section 7.2.
18

19 20 7.3 FINAL REVIEW AND RECORDS MANAGEMENT 21 CONSIDERATIONS 22

23 All validation reports and supporting analytical data packages will be
24 subjected to a final technical review by a qualified reviewer at the direction
25 of the Technical Lead before submittal to regulatory agencies or inclusion in
26 reports or technical memoranda. All validation reports, data packages, and
27 review comments will be retained as permanent project quality records in
28 compliance with *Document Control and Records Management Manual*, Section 9.0
29 (WHC 1989), and QR 17.0, "Quality Assurance Records" (WHC 1988b).
30
31

32 8.0 INTERNAL QUALITY CONTROL 33 34

35 All analytical samples will be subject to in-process quality control
36 measures both in the field and in the laboratory. The following types of
37 control samples are specified in the unit sampling and analysis plan to
38 maintain internal quality control:
39

- 40 • Duplicate Samples--Field duplicate samples are samples retrieved from
41 a single sampling location using the same equipment and sampling
42 technique but analyzed independently. Duplicate samples generally are
43 used to assess sampling precision.
44
- 45 • Trip Blanks--A trip blank consists of a sample container of an
46 appropriate media (e.g., pure silica sand or deionized water) that is
47 prepared in the laboratory, transported to the sampling site, and
48 returned unopened for analysis with the actual samples. Analysis of
49 the trip blank will eliminate false positive results for the actual
50 samples arising from contamination during shipment.
51

- 1 • Equipment Blanks--An equipment blank consists of an appropriate media
2 (e.g., pure silica sand or deionized water) that is drawn through
3 decontaminated sampling equipment and placed in a container identical
4 to those used for the actual field samples. Equipment blanks are used
5 to verify the adequacy of the decontamination procedures for sampling
6 equipment.

7
8 Additional quality control checks will be performed by the analytical
9 laboratories as follows:

- 10
11 • Duplicates or Matrix-Spiked Duplicates--Estimate analytical precision.
12
13 • Matrix-Spiked Samples--A known quantity of a representative analyte of
14 interest is added to an aliquot (or a replicate) of an actual sample
15 and analyzed to measure the recovery percentage. Spike compound
16 selection, quantities, and concentrations will be described in the
17 laboratory's analytical procedures.
18
19 • Laboratory Quality Control Samples--A quality control sample is
20 prepared from an independent standard at a concentration within the
21 calibration range. Reference samples provide an independent check on
22 analytical instrument calibration.

23
24 The numbers and/or frequencies of quality control samples to be submitted
25 and analyzed with each group of samples are specified in the analytical
26 contract. The numbers of quality control samples proposed in the sampling
27 plan have been determined based on guidance presented in SW-846 (EPA 1990) and
28 the discussion during the meetings between the M&O Contractor, DOE, and
29 regulatory agencies during the Data Quality Objectives process.

30
31 Detailed descriptions of internal quality control requirements for
32 participating contractor or subcontractor laboratories will be provided in
33 procurement documents or work orders in compliance with standard procedures
34 (see Section 3.1).

35 36 37 9.0 PERFORMANCE AND SYSTEM AUDITS

38
39
40 Performance, system, and program audits will begin early in the execution
41 of this sampling plan and continue through completion of activities.
42 Collectively, the audits will address quality-affecting activities that
43 include, but are not limited to, measurement accuracy; intramural and
44 extramural analytical laboratory services; field activities; and data
45 collection, processing, validation, and management.

46
47 Regarding offsite contractor laboratory analyses of confirmatory samples,
48 performance audits of analytical accuracy will be implemented through the use
49 of quality assurance and quality control samples.

50
51 System audit requirements will be implemented in accordance with QI 10.4,
52 "Surveillance" (WHC 1988b). Surveillances will be performed regularly

1 throughout the course of sampling activities. Additional performance and
2 system surveillances might be scheduled as a consequence of corrective action
3 requirements or might be performed on request. All quality-affecting
4 activities will be subject to surveillance.
5

6 Sampling plan activities could be evaluated as part of environmental
7 restoration program-wide quality assurance audits under procedural
8 requirements. Program audits will be conducted in accordance with QR 18.0,
9 "Audits," and QI 18.1, "Audit Programming and Scheduling," (WHC 1988b).

10 11.0 PREVENTIVE MAINTENANCE

12 All measurement and testing equipment used in the field and the
13 laboratory that directly affect the quality of analytical data will be subject
14 to preventive maintenance measures that ensure minimization of measurement
15 system downtime. Preventive maintenance instructions for field equipment will
16 be as stipulated in approved operating procedures for the equipment.
17 Laboratories will be responsible for performing or managing the maintenance of
18 assigned analytical equipment. Maintenance requirements, spare parts lists,
19 and preventive maintenance instructions will be included in individual
20 laboratory procedures or in laboratory quality assurance plans, subject to
21 review and approval. When samples are to be analyzed by a contractor or
22 subcontractor laboratory, preventive maintenance requirements for laboratory
23 analytical equipment will be as defined in the contractor laboratory's quality
24 assurance plan(s).
25
26

27 11.0 DATA ASSESSMENT

28 Analytical data will be compiled and summarized by the laboratory and
29 forwarded to the sample management organization for validation (see Section
30 7.2) before the data can be used in any assessment activities. Assessments
31 could include various statistical and probabilistic techniques to compare
32 and/or analyze data. The statistical methodologies and assumptions that are
33 to be used to evaluate data will be identified in written instructions that
34 are to be signed, dated, and retained as project quality records in compliance
35 with EII 1.6, "Records Processing" (WHC 1988a), and QR 17.0, "Quality
36 Assurance Records" (WHC 1988b). These instructions will be documented in the
37 final report for each sampling and analysis project.
38
39
40
41
42
43
44

45 12.0 CORRECTIVE ACTION

46 Corrective actions required as a result of surveillance reports,
47 nonconformance reports, or audit activities will be documented and
48 dispositioned as required by QR 16.0, "Corrective Action"; QI 16.1, "Trend
49 Analysis"; and QI 16.2, "Corrective Action Requests" (WHC 1988b). Primary
50 responsibilities for corrective action resolution will be assigned to the
51

1 Technical Lead and the quality assurance coordinator. Other needs for
2 corrections to measurement systems, procedures, or plans that are identified
3 as a result of routine review processes will be resolved as stipulated in
4 applicable procedures or referred to the Technical Lead for resolution.
5 Copies of all surveillance, nonconformance, audit, and corrective action
6 documentation will be retained as project quality assurance records.
7
8

9 13.0 QUALITY ASSURANCE REPORTS

10
11
12 Project activities will be assessed regularly by audit and surveillance
13 processes (see Sections 9.0 and 12.0). At the conclusion of a given sampling
14 and analysis project, all related field and laboratory data, raw data,
15 reports, surveillance reports, nonconformance reports, audit reports, and
16 corrective action documentation will be transferred for archival to the
17 Hanford Site Records Holding Area (if documentation has not been transmitted
18 previously). In the event that original quality-affecting documents are to be
19 retained and/or controlled by others, legible copies will be transmitted to
20 the Records Holding Area for inclusion in the project record file.

14.0 REFERENCES

14.1 DOCUMENTS

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EPA, 1980, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, EPA-QAMS-005/80, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1990, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, SW-846, Supplement 1990, U.S. Environmental Protection Agency, Washington, D.C.

RL, 1993, *303-K Storage Facility Closure Plan*, DOE/RL-90-04, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

WHC, 1988a, *Environmental Investigation and Site Characterization Manual*, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington.

WHC, 1988b, *Quality Assurance Manual*, WHC-CM-4-2, Westinghouse Hanford Company, Richland, Washington.

WHC, 1989, *Document Control and Records Management Manual*, WHC-CM-3-5, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990a, *Environmental Engineering, Geotechnology, and Permitting Function Quality Assurance Program Plan*, WHC-EP-0330, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990b, *Sample Management and Administrative Manual*, WHC-CM-5-3, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990c, *Health Physics Procedures Manual*, WHC-IP-0692, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993, *Data Validation Procedures for Chemical Analyses*, WHC-SD-EN-SPP-002, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

14.2 CODE OF FEDERAL REGULATIONS AND FEDERAL REGISTER

None.

14.4 WASHINGTON ADMINISTRATIVE CODE
AND REVISED CODE OF WASHINGTON

WAC 173-303, *Dangerous Waste Regulations*, Washington State Department of Ecology, Olympia, Washington.

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