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Hanford Facility Dangerous Waste Permit Application, Waste Receiving and Processing Facility

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HANFORD FACILITY DANGEROUS WASTE PERMIT APPLICATION, WASTE RECEIVING AND PROCESSING FACILITY

FOREWORD

The *Hanford Facility Dangerous Waste Permit Application* is considered to be a single application organized into a General Information Portion (document number DOE/RL-91-28) and a Unit-Specific Portion. The scope of the Unit-Specific Portion is limited to Part B permit application documentation submitted for individual, 'operating' treatment, storage, and/or disposal units, such as Waste Receiving and Processing Facility (this document, DOE/RL-91-16).

Both the General Information and Unit-Specific portions of the *Hanford Facility Dangerous Waste Permit Application* address the content of the Part B permit application guidance prepared by the Washington State Department of Ecology (1996) and the U.S. Environmental Protection Agency (40 Code of Federal Regulations 270), with additional information needs defined by the *Hazardous and Solid Waste Amendments* and revisions of Washington Administrative Code 173-303. For ease of reference, the Washington State Department of Ecology alpha-numeric section identifiers from the permit application guidance documentation (1996) follow, in brackets, the chapter headings and subheadings. A checklist indicating where information is contained in Waste Receiving and Processing Facility permit application documentation, in relation to the Washington State Department of Ecology guidance, is located in the Contents Section.

Documentation contained in the General Information Portion is broader in nature and could be used by multiple treatment, storage, and/or disposal units (e.g., the glossary provided in the General Information Portion). Wherever appropriate, Waste Receiving and Processing Facility permit application documentation makes cross-reference to the General Information Portion, rather than duplicating text.

Information provided in this Waste Receiving and Processing Facility permit application documentation is current as of May 1998.

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METRIC CONVERSION CHART

The following conversion chart is provided to the reader as a tool 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.

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Facility name **Waste Receiving and Processing Facility**

Date Application Received _____

State of Washington Part B Permit Application Review Checklist for Treatment and Storage in Tanks and Containers			
		Technically Adequate?	Location in Application
A.	Part A Form		Chapter 1.0
B.	Facility Description and General Provisions		2.0
B-1	General Description		2.1
B-1(a)	Facility Description		2.1
B-1(b)	Construction Schedule		2.1.9
B-2	Topographic Map		2.2
B-2a	General Requirements		2.2
B-2b	Additional Requirements for Land Disposal Facilities	Not Applicable	Not Applicable
B-3	Seismic Consideration		N/A
B-4	Traffic Information		2.3
C.	Waste Analysis		3.0
C-1	Chemical, Biological and Physical Analyses		3.1
C-1a C-1b C-1c	Waste In Piles Landfilled Wastes Wastes Incinerated and Wastes Used in Performance Tests	Not Applicable	Not Applicable
C-2	Waste Analysis Plan		3.2 and Appendix 3A

		Technically Adequate?	Location in Application
C-2a	Detailed Chemical, Physical, and/or Biological Analysis		Appendix 3A
C-2a(1)	Parameters and Rationale		Appendix 3A
C-2a(2)	Analytical Methods		Appendix 3A
C-2a(3)	Generator-Supplied Analyses		Appendix 3A
C-2b	Additional Requirements for Wastes Generated Off-site		Appendix 3A
C-2b(1)	Parameters and Rationale to Confirm Identity of Off-site Waste		Appendix 3A
C-2b(2)	Analytical Methods to Confirm Identity of Off-site Waste		Appendix 3A
C-2b(3)	Representative Sampling of Incoming Off-site Wastes		Appendix 3A
C-2c	Methods for Collecting Samples for Detailed and Confirming Analyses		Appendix 3A
C-2d	Frequency of Analyses		Appendix 3A
C-3	Manifest System		Appendix 3A
C-3a	Procedures for Receiving Shipments		Appendix 3A
C-3b	Response to Significant Discrepancies		Appendix 3A
C-3c	Provisions for Non-acceptance of Shipment		Appendix 3A
C-3c(1)	Non-acceptance of Undamaged Shipment		Appendix 3A
C-3c(2)	Activation of Contingency Plan for Damaged Shipment		Appendix 3A
C-4	Tracking System		Appendix 3A
D.	Process Information		4.0
D-1	Containers		4.1

		Technically Adequate?	Location in Application
D-1a	Description of Containers		4.1.1
D-1b	Container Management Practices		4.1.2
D-1c	Container Labelling		4.1.3
D-1d	Containment Requirements for Storing Containers		4.1.4
D-1d(1)	Secondary Containment System Design		4.1.4.1
D-1d(1)(a)	System Design		4.1.4.2
D-1d(1)(b)	Structural Integrity of Base		4.1.4.3
D-1d(1)(c)	Containment System Capacity		4.1.4.4
D-1d(1)(d)	Control of Run-on		4.1.4.5
D-1d(2)	Removal of Liquids from Containment System		4.1.5
D-1e	Demonstration that Containment Is Not Required Because Containers Do Not Contain Free Liquids, Wastes That Exhibit Ignitability or Reactivity, or Wastes Designated F020 - 023, F026, or F027		N/A
D-1f	Prevention of Reaction of Ignitable, Reactive, and Incompatible Wastes in Containers		4.2
D-1f(1)	Management of Certain Reactive Wastes in Containers		4.2.1
D-1f(2)	Management of Ignitable and Certain Other Reactive Wastes in Containers		4.2.2
D-1f(3)	Design of Areas to Manage Incompatible Wastes		4.2.3
D-2	Tank Systems		N/A

		Technically Adequate?	Location in Application
D-2a	Design, Installation and Assessment of Tanks Systems		N/A
D-2a(1)	Design Requirements		N/A
D-2a(2)	Integrity Assessments		N/A
D-2a(3)	Additional Requirements for Existing Tanks		N/A
D-2a(4)	Additional Requirements for New Tanks		N/A
D-2a(5)	Additional Requirements for New On-ground or Underground Tanks		N/A
D-2b	Secondary Containment and Release Detection for Tank Systems		N/A
D-2b(1)	Requirements for All Tank Systems		N/A
D-2b(2)	Additional Requirements for Specific Types of Systems		N/A
D-2b(2)(a)	Vault Systems		N/A
D-2b(2)(b)	Double-walled Tanks		N/A
D-2b(2)(c)	Ancillary Equipment		N/A
D-2c	Variances from Secondary Containment Requirements		N/A
D-2d	Tank Management Practices		N/A
D-2e	Labels or Signs		N/A
D-2f	Air Emissions		N/A
D-2g	Management of Ignitable or Reactive Wastes in Tank Systems		N/A
D-2h	Management of Incompatible Wastes in Tank Systems		N/A

		Technically Adequate?	Location in Application
D-3 D-4 D-5 D-6 D-7	Waste Piles Surface Impoundments Incinerators Landfills Land Treatment	Not Applicable	Not Applicable
D-8	Air Emissions Control		4.3
D-8a	Process Vents		N/A
D-8a(1)	Applicability of Subpart AA Standards		N/A
D-8a(1)(a)	Process Vents Subject to Subpart AA Standards		N/A
D-8a(1)(b)	Process Vents Not Subject to Subpart AA Standards		N/A
D-8a(1)(c)	Re-evaluating Applicability of Subpart AA Standards		N/A
D-8a(2)	Process Vents - Demonstrating Compliance		N/A
D-8a(2)(a)	The Basis for Meeting Limits/Reductions		N/A
D-8a(2)(b)	Demonstrating Compliance via Selected Method		N/A
D-8a(2)(c)	Design Information and Operating Parameters for Closed Vent Systems and Control Devices		N/A
D-8a(2)(d)	Re-evaluating Compliance with Subpart AA Standards		N/A
D-8b	Equipment Leaks		N/A
D-8b(1)	Applicability of Subpart BB Standards		N/A
D-8b(1)(a)	Equipment Subject to Subpart BB		4.3.1
D-8b(1)(b)	Re-evaluating Applicability of Subpart BB Standards		4.3.1

		Technically Adequate?	Location in Application
D-8b(2)	Equipment Leaks - Demonstrating Compliance		4.3.1
D-8b(2)(a)	Procedures for Identifying Equipment Location and Method of Compliance, Marking Equipment, and Ensuring Records are Up-to-date		4.3.1
D-8b(2)(b)	Demonstrating Compliance with D-8b(1)(a) and (2)(a) Procedures		4.3.1
D-8b(2)(c)	Closed Vent Systems or Control Devices: Showing Compliance with Emission Reduction Standards		4.3.1
D-8c	Tanks and Containers		4.3.1
D-8c(1)	Applicability of Subpart CC Standards		4.3.2
D-8c(2)	Tank Systems and Container Areas - Demonstrating Compliance		4.3.2
D-9	Waste Minimization		10.0
D-10	Groundwater Monitoring for Land-based Units	Not Applicable	Not Applicable
E.	Releases from Solid Waste Management Units		2.4
E-1	Solid Waste Management Units and Known and Suspected Releases of Dangerous Wastes or Constituents		2.4
E-1a	Solid Waste Management Units		2.4
E-1b	Releases		2.4
E-2	Corrective Actions Implemented		2.4
F.	Procedures to Prevent Hazards		6.0
F-1	Security		6.1
F-1a	Security Procedures and Equipment		6.1.1

	Technically Adequate?	Location in Application
F-1b Waiver		6.1.2
F-2 Inspection Plan		6.2
F-2a General Inspection Requirements		6.2.1
F-2b Inspection Log		6.2.1
F-2c Schedule for Remedial Action for Problems Revealed		6.2.2
F-2d Specific Process or Waste Type Inspection Requirements		6.2.3
F-2d(1) Container Inspections		6.2.3
F-2d(2) Tank System Inspections and Corrective Actions		N/A
F-2d(2)(a) Tank System Inspections		N/A
F-2d(2)(b) Tank Systems - Corrective Actions		N/A
F-2d(3) Storage of Ignitable or Reactive Wastes		6.5.2
F-2d(4) Air Emissions Control and Detection - Inspections, Monitoring, and Corrective Actions		N/A
F-2d(4)(a) Process Vents		N/A
F-2d(4)(b) Equipment Leaks		N/A
F-2d(4)(c) Tanks and Containers		N/A
F-2d(5) Waste Pile Inspection F-2d(6) Surface Impoundment Inspection F-2d(7) Incinerator Inspection F-2d(8) Landfill Inspection F-2d(9) Land Treatment Facility Inspection	Not Applicable	Not Applicable
F-3 Preparedness and Prevention Requirements		6.3

		Technically Adequate?	Location in Application
F-3a	Equipment Requirements		6.3.1
F-3b	Aisle Space Requirement		6.3.2
F-4	Preventive Procedures, Structures, and Equipment		6.4
F-5	Prevention of Reaction of Ignitable, Reactive, and/or Incompatible Wastes		6.5
F-5a	Precautions to Prevent Ignition or Reaction of Ignitable or Reactive Waste		6.5.1
F-5b	Precautions for Handling Ignitable or Reactive Waste and Mixing Incompatible Wastes		6.5.2
F-5b(1)	Ignitable or Reactive Wastes In Tanks		N/A
F-5b(2)	Incompatible Wastes In Containers or Tanks		N/A
G.	Contingency Plan		7.0 and Appendix 7A
G-1	General Information		Appendix 7A
G-2	Emergency Coordinators		Appendix 7A
G-3	Circumstances Prompting Implementation		Appendix 7A
G-4	Emergency Response Procedures		Appendix 7A
G-4a	Notification		Appendix 7A
G-4b	Identification of Dangerous Materials		Appendix 7A
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G-4f	Post-Emergency Actions		Appendix 7A
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		Technically Adequate?	Location in Application
G-6	Coordination Agreements		Appendix 7A
G-7	Evacuation Plan		Appendix 7A
G-8	Required Reports, Recordkeeping, and Certifications		Appendix 7A
G-8a	General Requirements		Appendix 7A
G-8a	Requirements for Tank Systems		N/A
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H-1	Job Title/Job Description		Appendix 8A
H-2	Outline of Training Program		Appendix 8A
H-3	Implementation of Training Program		Appendix 8A
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I-1	Closure Plan/Financial Assurance for Closure		N/A
I-1a	Closure Performance Standard		11.2
I-1b	Closure Activities		11.3
I-1b(1)	Maximum Extent of Operation		11.4
I-1b(2)	Removing Dangerous Wastes		11.3
I-1b(3)	Decontaminating Structures, Equipment, and Soil		11.3
I-1b(4)	Sampling and Analysis to Identify Extent of Decontamination/ Removal and to Verify Achievement of Closure Standard		11.3
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		Technically Adequate?	Location in Application
I-1b(5)	Other Activities		11.3
I-1c	Maximum Waste Inventory		11.4
I-1d	Closure of Waste Piles, Surface Impoundments, Incinerators, Land Treatment, and Miscellaneous Units	Not Applicable	Not Applicable
I-1e	Closure of Landfill Units		
I-1f	Schedule for Closure		11.5
I-1g	Extension for Closure Time		N/A
I-1h	Closure Cost Estimate		N/A
I-1i	Financial Assurance Mechanism for Closure		N/A
I-2	Notice in Deed of Already Closed Disposal Units		N/A
I-3	Post-Closure Plan		N/A
I-4	Liability Requirements		N/A
I-4a	Coverage for Sudden Accidental Occurrences		N/A
I-4b	Coverage for Nonsudden Accidental Occurrences		N/A
I-4c	Request for Variance		N/A
J.	Other Federal and State Laws		13.0
K.	Part B Certification		14.0

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1.0 PART A [A] 1-1

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1.0 PART A [A]

The Part A, Form 3, covers Waste Receiving and Processing Facility (WRAP). The original Part A, Form 3, (Revision 0) was submitted May 19, 1988 and included the Radioactive Mixed Waste Storage Facility [now known as Central Waste Complex (CWC)] and WRAP. The revised Part A, Form 3, (Revision 1) was submitted October 22, 1990. Revision 1 was prepared to ensure agreement between annual waste quantities as identified in the Part A, Form 3 (Revision 0), and the Hanford Site Annual Dangerous Waste Report submitted in March 1990 to the Washington State Department of Ecology. Two waste codes (D012 and D016) and 26 new dangerous waste codes, based on the U.S. Environmental Protection Agency *Final Rule Change*, "Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Toxicity Characteristics Revisions" (55 FR 61), were added. Revision 2 submitted October 7, 1994 added waste codes (F039, P057, U248, U249, U328, U353, and U359) and removed waste codes (U230, WC01, P052, and U013). Revision 0, submitted January 25, 1995, provided a separate Part A, Form 3, for WRAP. The CWC Part A, Form 3, Revision 3 is included in the Hanford Facility Dangerous Waste Permit Application, Central Waste Complex, Revision 1 (DOE/RL-91-17). Revision 1, submitted September 30, 1996, identified a new co-operator. In addition the Part A, Form 3, was revised to (1) remove the detailed descriptions of WRAP Module 2A and Module 2B and replace them with a general statement that future additions of WRAP could be designed; (2) review the maximum weight limit of containers received at WRAP; (3) delete dangerous waste number WC02 (carcinogenic) because this dangerous waste number has been removed from WAC 173-303; (4) add dangerous number WSC2 (state-only, corrosive dangerous waste); (5) list the dangerous waste numbers in a streamline format; and (6) identify treatment, storage, and/or disposal (TSD) unit boundary.

Revision 2 of the Part A, Form 3, included in this permit application documentation, has the following changes:

- Clarified the TSD unit boundary. The original TSD boundary was established to include WRAP 2 and 2A modules projects, however these projects have since been canceled. The TSD boundary has been moved to encompass just the WRAP 2336W Building

- Removed three dangerous waste numbers, added 61 dangerous waste numbers that have been added to the federal and state regulations to increase the estimated annual quantities of waste

- Updated site drawings

- Removed discussion in Section III.C. for process codes S01, "storage-container", and all discussion in Section IV.E. because discussion of this process code is not required in accordance with the Part A, Form 3, instructions.

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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 *(mo., day, & yr.)*	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)*

☐ 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

MO. 0 3 | DAY 2 2 | YR. 4 3 * FOR EXISTING FACILITIES, PROVIDE THE DATE *(mo., day, & yr.)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

* The date construction of the Hanford Facility commenced.

☐ 2. NEW FACILITY *(Complete item below)*

MO. | DAY | YR. FOR NEW FACILITIES, PROVIDE THE DATE, *(mo., day, & yr)* OPERATION BEGAN OR IS EXPECTED TO BEGIN

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

☒ 1. FACILITY HAS AN INTERIM STATUS PERMIT

☒ 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	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
torage:		
:ONTAINER (barrel, drum, etc)	S01	GALLONS OR LITERS
,ANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D80	GALLONS OR LITERS
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

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
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.)	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H
ACRE-FEET	A
HECTARE-METER	F
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. PROCESS CODE *(from list above)*	B. PROCESS DESIGN CAPACITY 1. AMOUNT *(specify)*	B. 2. UNIT OF MEASURE *(enter code)*	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE *(from list above)*	B. PROCESS DESIGN CAPACITY 1. AMOUNT *(specify)*	B. 2. UNIT OF MEASURE *(enter code)*	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
1	T 0 4	12,900	V		7				
	S 0 1	73,500	L		8				
3					9				
4					10				

CONTINUE ON REVERSE

Continued from the front.

III. PROCESSES (continued)

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESS (code "T04"). FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPAC

T04

The Waste Receiving and Processing Facility (WRAP) commenced construction in 1994 and began waste management operations in March of 1997.

WRAP has the capability to treat waste through deactivation, solidification or absorption of liquids, neutralization of corrosives, amalgamation, microencapsulation, macroencapsulation, volume reduction of waste (e.g. supercompaction), reaction of reactive waste, and repackaging of waste.

The total process design capacity for treatment is 12,900 liters (3,408 gallons) per day.

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 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)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
X-1	K 0 6 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

 CONTINUE ON PAGE 3

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

I.D. NUMBER *(entered from page 1)*: A 7 8 9 0 0 0 8 9 6 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)*	D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
1	D001	20,000	K	T04 S01	Treatment-Other/Storage-Container
2	D002	15,000			
3	D003	500			
4	D004	50			
5	D005	400			
6	D006	117			
7	D007	400			
8	D008	400			
9	D009	800			
10	D010	10			
	D011	20			
12	D012	300			
13	D016				
14	D018				
15	through				
16	D043				
17	WT01	16,000			
18	WT02	22,000			
19	WP01	12,000			
20	WP02	3,000			
21	WP03	2,000			
22	WSC2	15,000			
23	W001	5,000			
24	F001	4,000			
	F002	4,500			
26	F003	6,500			

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

I.D. NUMBER *(entered from page 1)*

W	A	7	8	9	0	0	0	8	9	6	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)*				D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
1	F004	570	K	T04	S01			Treatment-Other/Storage-Container
2	F005	6,000						(Continued)
3	F020	300						
4	F021							
5	F022							
6	F023							
7	F026							
8	F027	500						
9	F028	300						
10	F039	500						
11	U001	5,000						
12	through							
13	U012							
14	U014							
15	through							
16	U039							
17	U041							
18	through							
19	U053							
20	U055							
21	through							
22	U064							
23	U066							
24	through							
25	U099							
26	U101							

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

I.D. NUMBER *(entered from page 1)*

		7	8	9	0	0	0	8	9	6	7

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)*				D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
1	U102	5,000	K	T04	S01			Treatment-Other/Storage Container
2	U103							(Continued)
3	U105							
4	through							
5	U138							
6	U140							
7	through							
8	U174							
9	U176							
10	through							
	U194							
12	U196							
13	U197							
14	U200							
15	U223							
16	U225							
17	through							
18	U228							
19	U230							
20	through							
21	U240							
22	U242							
23	through							
24	U244							
	U246							
26	U247							

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

I.D. NUMBER *(entered from page 1)*: WA7890008967

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)*	D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
1	U248	5,000	K	T04 S01	Treatment-Other/Storage-Container
2	U249				(Continued)
3	U271				
4	U277				
5	through				
6	U280				
7	U328				
8	U353				
9	U359				
10	U364				
11	through				
12	U367				
13	U372				
14	U373				
15	U375				
16	through				
17	U379				
18	U381				
19	through				
20	U387				
21	U389				
22	through				
23	U396				
24	U400				
25	through				
26	U404				

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

I.D. NUMBER *(entered from page 1)*: A 7 8 9 0 0 0 8 9 6 7

... 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)*	D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
1	U407	5,000	K	T04 S01	Treatment-Other/Storage-Container
2	U409				(Continued)
3	U411				
4	P001				
5	through				
6	P018				
7	P020				
8	through				
9	P024				
10	P026				
	through				
12	P031				
13	P033				
14	P034				
15	P036				
16	through				
17	P051				
18	P054				
19	P056				
20	through				
21	P060				
22	P062				
23	through				
24	P078				
	P081				
26	P082				

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

I.D. NUMBER *(entered from page 1)*: WA7890008967

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)*				D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
1	P084	5,000	K	T04	S01			Treatment-Other/Storage-Container
2	P085							(Continued)
3	P087							
4	through							
5	P089							
6	P092							
7	through							
8	P099							
9	P101							
10	through							
11	P116							
12	P118							
13	through							
14	P123							
15	P127							
16	P128							
17	P185							
18	P188							
19	through							
20	P192							
21	P194							
22	P196							
23	through							
24	P199							
25								
26								

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

I.D. NUMBER *(entered from page 1)*: A 7 8 9 0 0 0 8 9 6 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)*				D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
1	P 2 0 1	5,000	K	T04	S01			Treatment-Other/Storage-Container
2	through							
3	P 2 0 5							Included With Above
4								
5								
6								
7								
8								
9								
10								
12								
13								
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18								
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26								

Continued from the front.

IV. DESCRIPTION OF DANGEROUS WASTES (continued)

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

V. FACILITY DRAWING Refer to attached drawing(s).

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 Refer to attached photograph(s).

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 drawing(s) and photograph(s).

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*

VIII. FACILITY OWNER

[x] 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		5/22/98

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		

 CONTINUE ON PAGE 5

X. OPERATOR CERTIFICATION

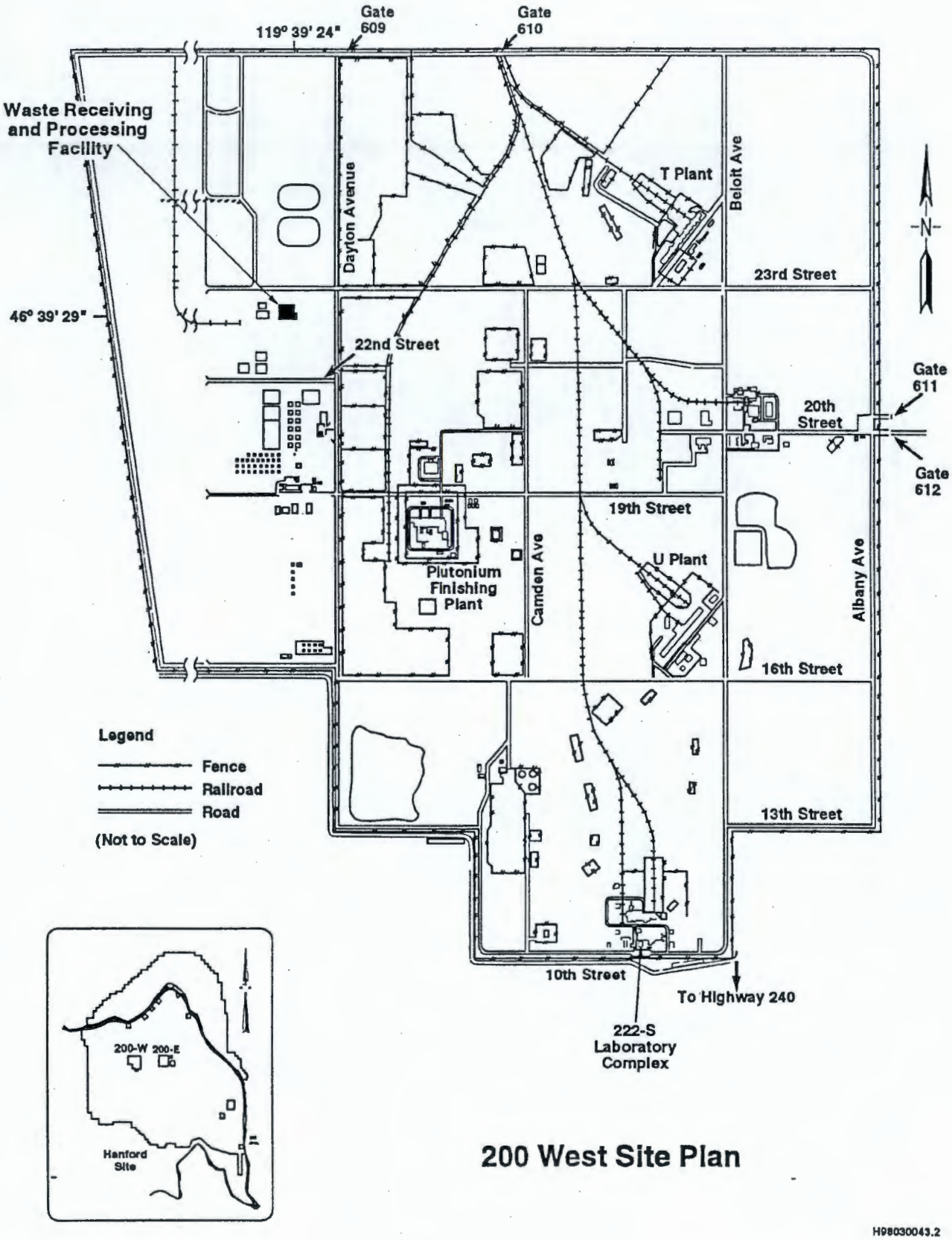
I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, 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

Date 5/21/98

Co-Operator
H. J. Hatch,
President and Chief Executive Officer
Fluor Daniel Hanford, Inc.

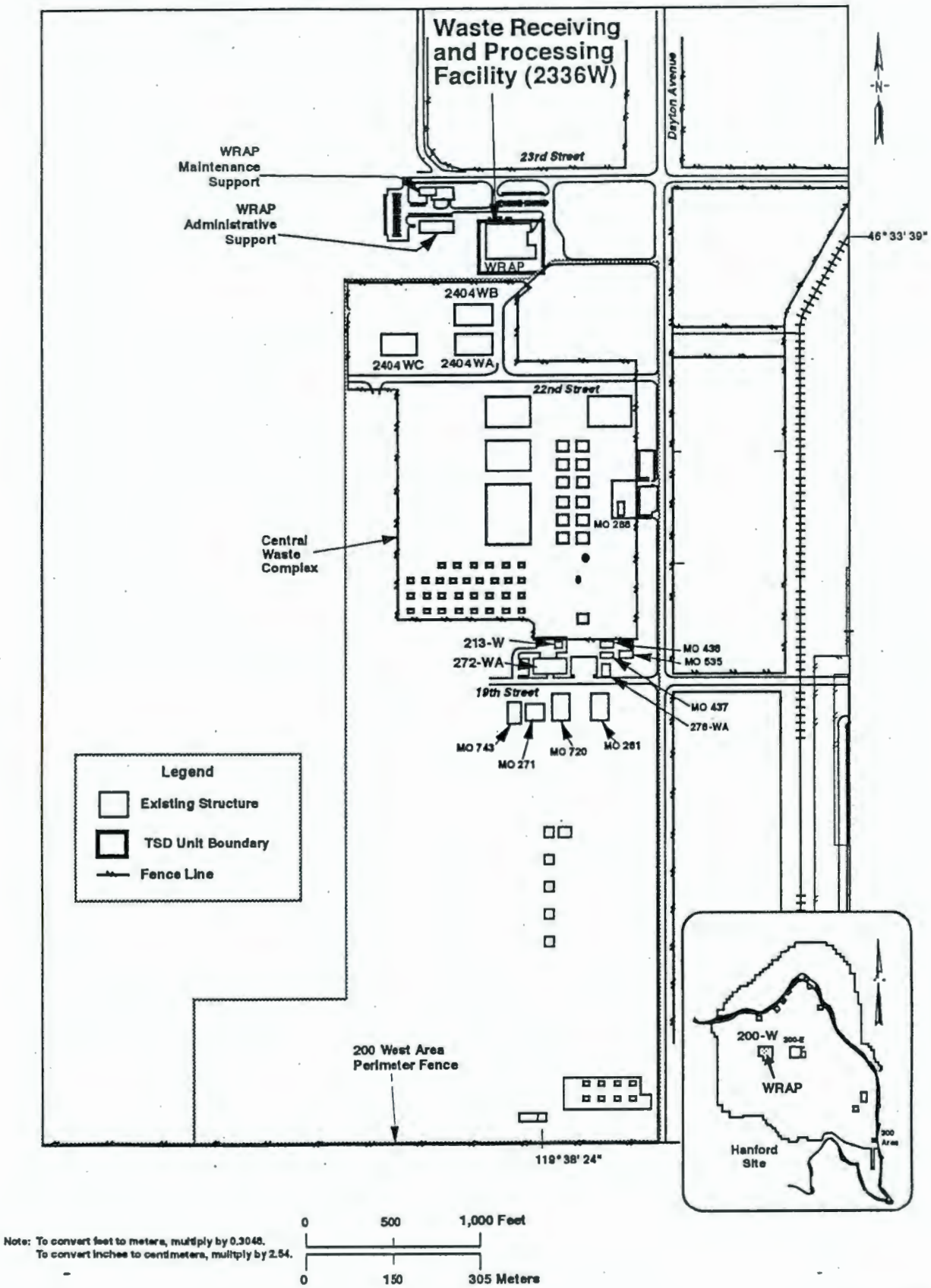
Date May 14, 1998



200 West Site Plan

H98030043.2

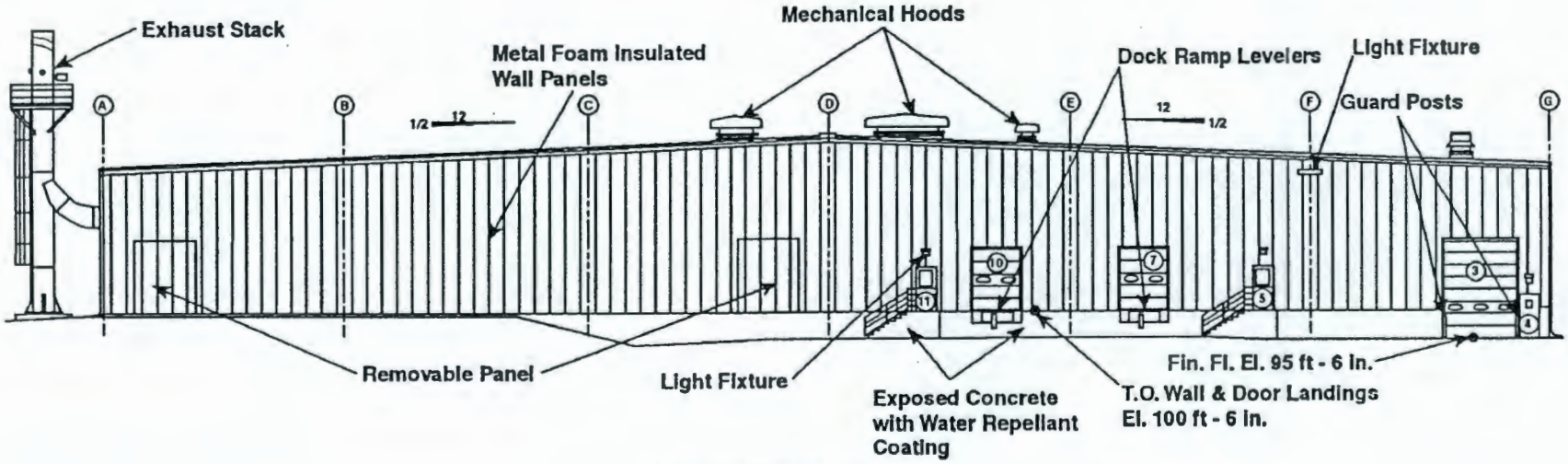
Waste Receiving and Processing Facility (WRAP)



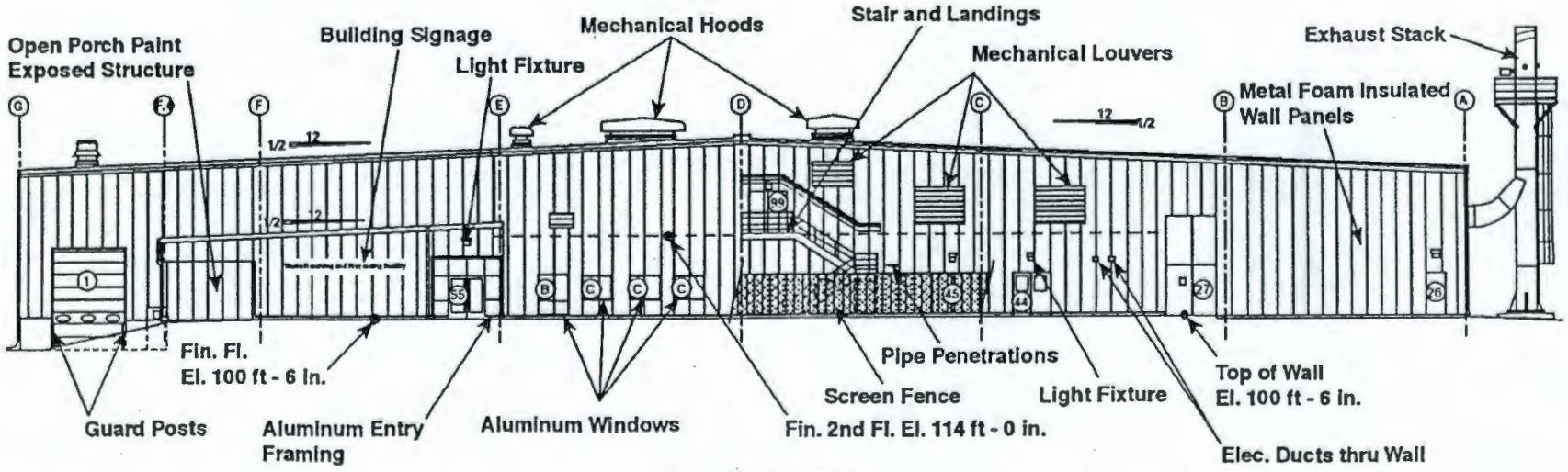
Note: To convert feet to meters, multiply by 0.3048.
To convert inches to centimeters, multiply by 2.54.

H98030043.3R1

Waste Receiving and Processing Facility
2336-W Building



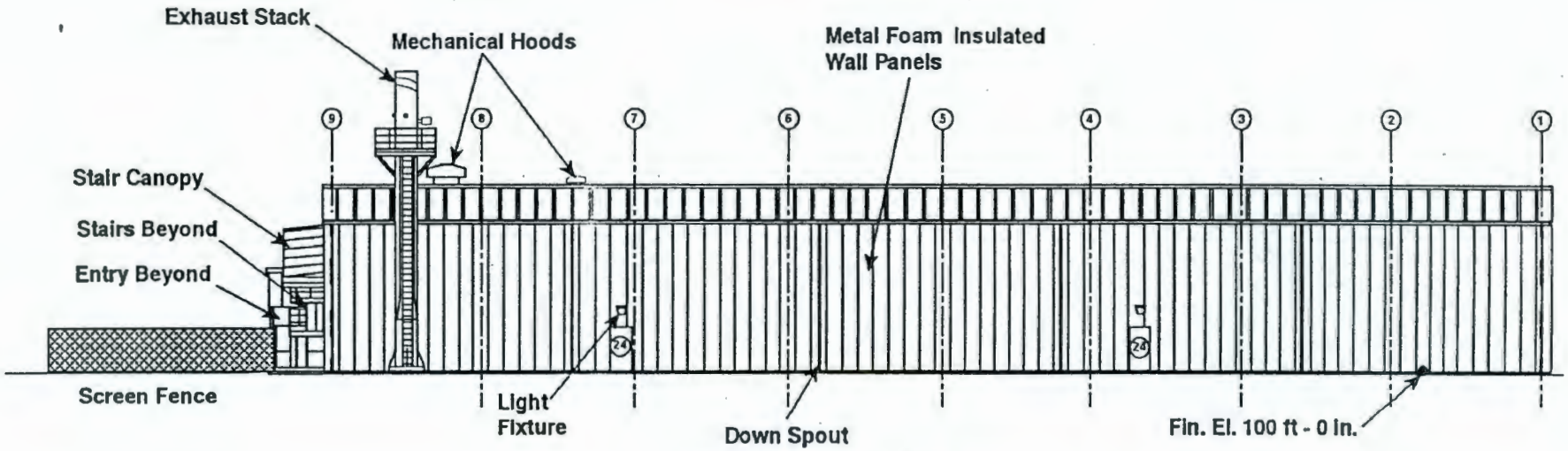
South Elevation



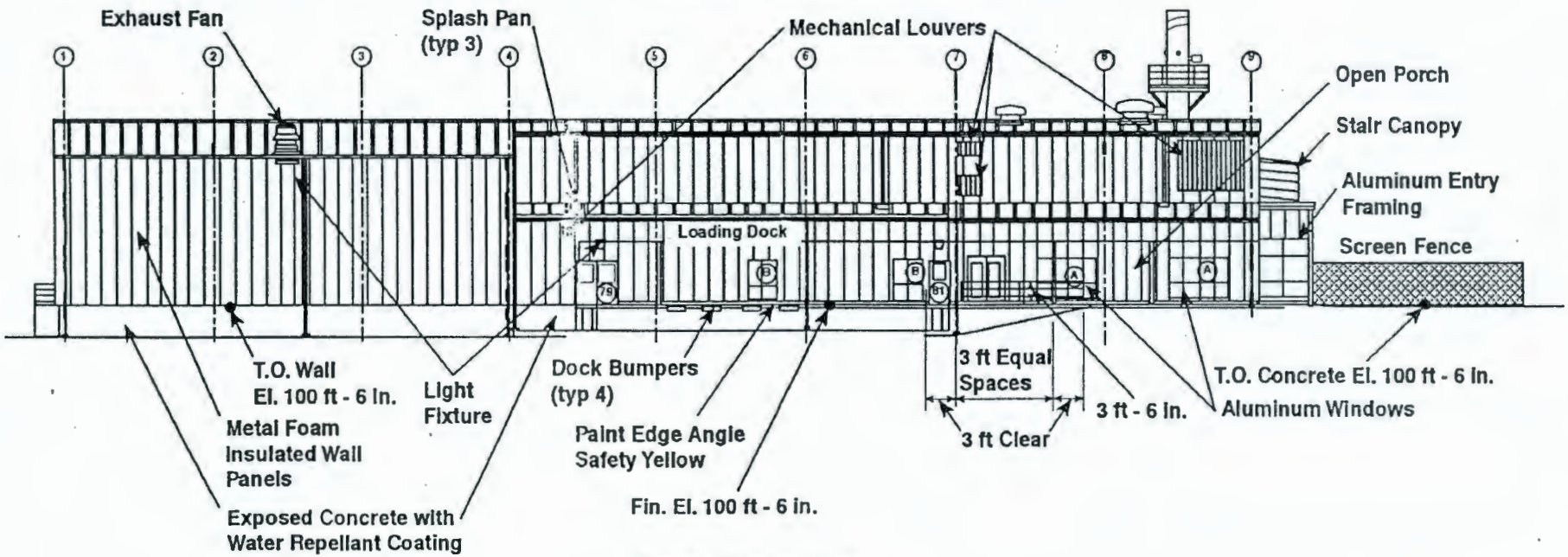
North Elevation

H98030043.4

Waste Receiving and Processing Facility
2336-W Building

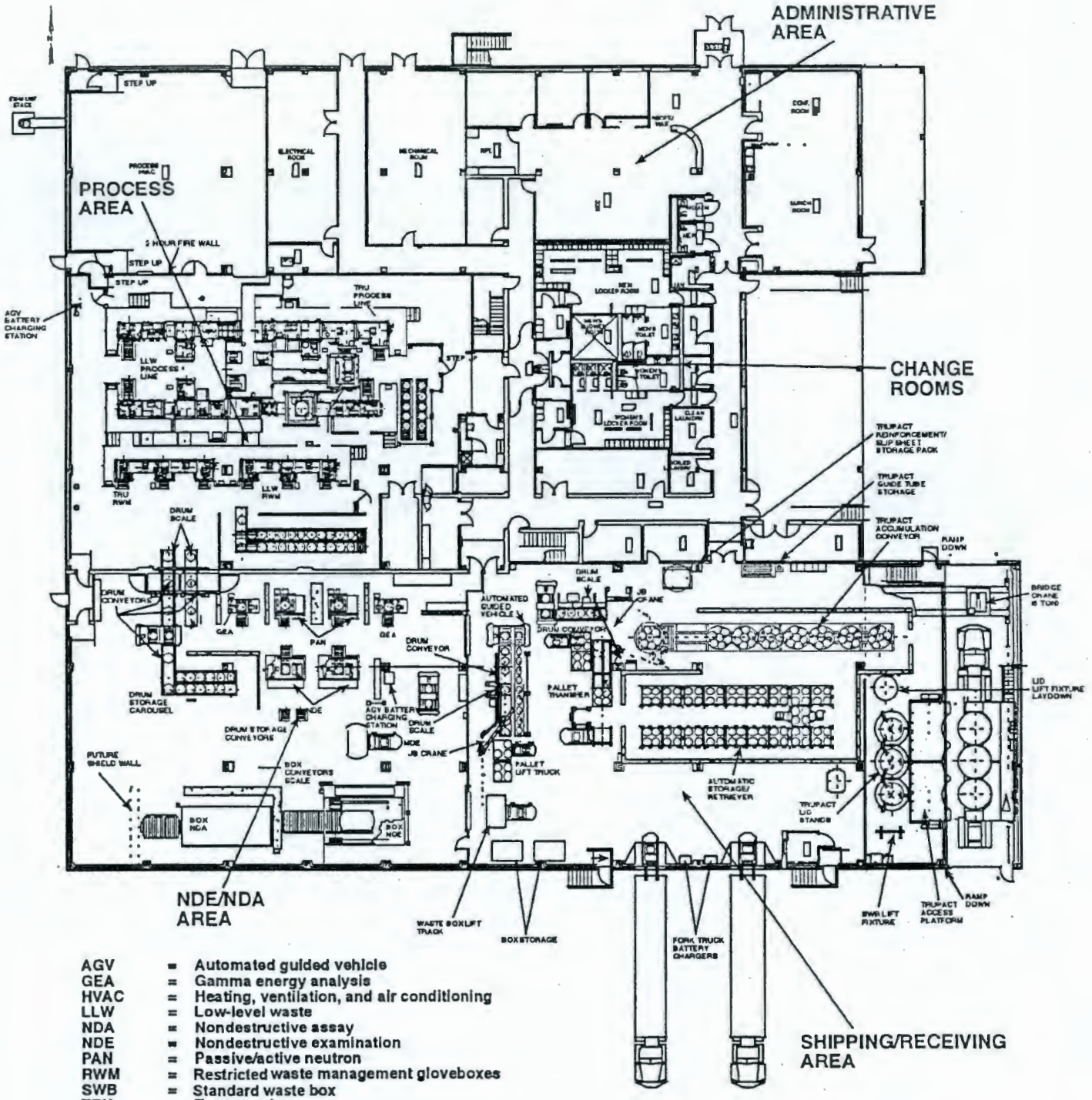


West Elevation



East Elevation

H98030043.5



AGV	=	Automated guided vehicle
GEA	=	Gamma energy analysis
HVAC	=	Heating, ventilation, and air conditioning
LLW	=	Low-level waste
NDA	=	Nondestructive assay
NDE	=	Nondestructive examination
PAN	=	Passive/active neutron
RWM	=	Restricted waste management gloveboxes
SWB	=	Standard waste box
TRU	=	Transuranic
TRUPACT	=	Transuranic waste transporter

H98030043.1

WASTE RECEIVING AND PROCESSING FACILITY

46°33'29"
119°38'24"

96050191-68CN
(PHOTO TAKEN 1996)

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CONTENTS

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APPENDIX

2A TOPOGRAPHIC MAP ..... APP 2A-I

FIGURES

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2.0 FACILITY DESCRIPTION AND GENERAL PROVISIONS [B AND E]

WRAP, located in the 200 West Area (Chapter 1.0), provides waste receipt, confirmation, repackaging, certification, and/or storage of dangerous, mixed, and radioactive waste from onsite generating units or from offsite generators, TSD units, or as a result of operations. Mixed and/or radioactive waste is treated in WRAP.

A more detailed discussion of the waste types and known characteristics of the waste that WRAP processes, and the associated process information, are provided in Chapters 3.0 and 4.0, respectively. Because dangerous waste does not include the source, special nuclear, and by-product material components of mixed waste, radionuclides are not within the scope of WAC 173-303 or of this permit application documentation. The information on radionuclides is provided only for general knowledge where appropriate.

2.1 DESCRIPTION OF WASTE RECEIVING AND PROCESSING FACILITY [B-1]

WRAP accepts contact-handled waste packaged in 208- or 322-liter steel drums and steel or wooden boxes no larger than 2.7 meters long by 1.5 meters high by 1.5 meters wide. Contact-handled waste is waste where the external surface dose rate does not exceed 200 millirems per hour. Remote-handled waste could be received on a case-by-case basis with special precautions. Remote-handled waste is waste where the external surface dose rate exceeds 200 millirems per hour. The maximum weight of containers received at WRAP is 455 kilograms for drums and 3,175 kilograms for boxes. However, heavier boxes could be received on a case-by-case basis.

WRAP has a waste shipping and receiving area, a nondestructuve examination (x-ray) and nondestructive assay area, and a processing area. The processing area contains process enclosures (referred to as gloveboxes) for opening, sorting, sampling, and treating the contents of the waste containers. WRAP also includes a process support area, a sample management area, and an administrative area (Figure 2-1).

Waste containers are received in the shipping and receiving area. After processing, the low-level portion of the waste is transferred to an onsite treatment, storage, and/or disposal unit or to an offsite TSD facility (hereinafter, use of 'TSD unit' does not preclude the possibility that an offsite TSD facility could be used). The transuranic waste will be shipped to a TSD unit approved by appropriate agencies to accept transuranic waste.

WRAP provides nondestructive examination and nondestructive assay of the contact-handled waste. Nondestructive examination is used to identify the physical contents of waste containers to support waste characterization and processing, confirmation, or certification. The assay results are used to determine radioactive content and distribution.

WRAP process area gloveboxes are designed for opening, sorting, and sampling to characterize or confirm the contents of containers of transuranic, low-level, and mixed waste. Treatment of waste includes deactivation, solidification or absorption of liquids, neutralization of corrosives, amalgamation, microencapsulation, macroencapsulation, volume reduction of waste (e.g., supercompaction), reaction of reactive waste, and repackaging of waste.

Process support areas are provided with space for heating, ventilation, and air conditioning equipment, mechanical equipment, and electrical equipment used to support operations.

A sample management area is provided to manage the various samples that are taken from within the process area gloveboxes.

The administrative area contains a computer control room. A computer is used to monitor the process control system, nondestructive examination equipment, nondestructive assay equipment, and other process equipment.

Exterior storage space is provided for the receipt of empty containers and other materials.

The following sections describe the functional areas of WRAP and include the following:

- Shipping and receiving area
- Nondestructive examination and nondestructive assay area
- Process area
- Sample management area
- Process support area
- Administrative area
- Exterior storage area.

Although a separate equipment decontamination area is not provided within WRAP, manual decontamination of equipment and waste containers is performed throughout the various areas when necessary.

2.1.1 Shipping and Receiving Area

The shipping and receiving area (Figure 2-2) provides approximately 350 square meters of interim storage for incoming and outgoing waste.

Storage within the shipping and receiving area is handled by an automated storage and retrieval system. Waste is segregated by container type and compatibility as follows.

- Mixed waste is segregated from waste that is only radioactively contaminated.

- Processed waste is segregated from unprocessed waste or waste awaiting analytical results.

- Transuranic waste is segregated from low-level waste.

- Ignitable and reactive waste is segregated and stored in compliance with WAC 173-303-630 and the Uniform Fire Code (NFPA 1997).

- Incompatible waste is packaged and segregated on containment pallets in accordance with the requirements of WAC 173-303-630.

Placement of containers is administratively controlled within the automated storage and retrieval system. In addition to segregation of incompatible waste, containment pallets are used to segregate other waste types and to contain any leaks.

Space is provided to accommodate the storage of at least 216 containers within the automated storage and retrieval system. A concrete wall provides shielding around the automated storage and retrieval system for radiological protection of personnel. Space also is provided in the shipping and receiving area for storage of up to eight waste boxes. In addition, waste containers can be stored throughout WRAP to accommodate waste management operations. Container storage locations are recorded on a computerized tracking system that selects individual containers for processing, which match current process requirements.

After processing at WRAP, most mixed waste and transuranic waste ready for treatment, storage, or disposal is transported to a permitted TSD unit.

Transuranic and transuranic mixed waste containers have their own loading and storage area in WRAP. In this area, containers are stretch-wrapped in plastic in a seven-drum configuration for loading into TRUPACT[1]-II shipping casks. Two seven-packs of containers or two standard waste boxes (SWB)[2] are loaded into each cask. However, loading configuration is subject to modification to accommodate receiving TSD unit requirements. Three casks can be on each trailer. Once the casks are loaded, the waste is shipped to an approved waste disposal site.

2.1.2 Nondestructive Examination and Nondestructive Assay Area

The nondestructive examination and nondestructive assay area (Figure 2-3) provides approximately 700 square meters for radiography and nondestructive assay equipment. The nondestructive examination equipment uses x-ray to examine the content of each waste container. The nondestructive assay equipment is used to determine the radionuclide content of each waste container.

Nondestructive examination systems are used to identify dense waste items that could influence nondestructive assay, to indicate the physical appearance of the waste, and to identify if liquids or other noncompliant[3] waste forms are present. Such identifications are noted on a computerized system to ensure that these noncompliant items are removed in the open/sort location in a glovebox in the process area.

---

[1] Transuranic package transporter.

[2] SWB is the name of a specific box designed expressly for transport in a TRUPACT-II shipping cask. Each SWB is approximately 139 centimeters wide by 162 centimeters long by 83 centimeters high with round ends with either a welded or gasketed bolted lid. Each SWB is constructed of 12-gauge painted carbon steel with carbon steel reinforcement and is equipped with one or more carbon composite filtered vents. Each SWB has an empty weight of 368 kilograms with a nominal capacity of 1.8 cubic meters and 2,727 kilograms gross.

[3] Noncompliant waste refers to materials that cannot be accepted for transportation or disposal without further processing and does not refer to noncompliance with WAC 173-303.

All radiography equipment is designed to meet the Bureau of Radiological Health Standard for cabinet x-ray systems (21 CFR 1020.40). This equipment is located inside shielded enclosures.

Nondestructive assay indicates the radionuclide content and distribution in the waste. Separate nondestructive examination and nondestructive assay lines are provided for containers and boxes. Space is provided within the nondestructive examination and nondestructive assay area for the storage of 12 waste containers. Concrete shield walls are located around the storage area to provide radiological protection for personnel.

After examination and assay, containers are routed to the shipping and receiving area. Containers that are found to include noncompliant items are processed through WRAP to remove or treat the noncompliant items. Containers with noncompliant items also could be stored at WRAP or at another TSD unit until treatment can be performed.

2.1.3 Process Area

The 650-square-meter process area (Figure 2-4) contains waste management gloveboxes. The area is designed to provide secondary containment when waste containers are opened in the gloveboxes. Automatic dry chemical fire extinguishment systems are provided inside the gloveboxes.

Waste containers are opened in the process gloveboxes. The waste is sorted, field screened, and sampled. Compliant waste and empty containers could be compacted and compliant waste is loaded out into new containers. Noncompliant waste items are transferred to one of two restricted waste management gloveboxes. These gloveboxes are used for screening, sampling, and treating waste. Aerosol cans are punctured, vented, and drained in the restricted waste management gloveboxes. The sampling and screening occur for both verification and waste characterization.

Because much of the waste is contained in small inner packages inside the containers, a nondestructive examination system is located within the gloveboxes to assist in the identification of noncompliant items. Also a small nondestructive assay system is located within the transuranic waste process glovebox.

The low-level and transuranic waste gloveboxes contain movable stainless steel sorting tables. The sorting tables are a primary location for all sorting, screening, and sampling activities within the WRAP process lines. The tables, on rails, travel under the respective drum tipper to accept waste from drums. The low-level waste sorting table can be tipped, when in the 'home' position, to replace waste into the drum after sorting. The transuranic sorting table moves into a position between two receiving drums so that waste can be sorted into the appropriate containers. Each table has a capacity of 0.91 metric ton. Closed circuit television cameras view the sorting tables to aid the operator in clearing the waste into the appropriate containers.

Limited treatment of noncompliant waste is performed in the restricted waste management glovebox. Noncompliant materials include the following:

- Aerosol cans
- Reactive metals
- Chelating compounds
- Chemically incompatible materials

- Corrosives
- Explosives
- Gas cylinders not permanently vented
- High-efficiency particulate air (HEPA) filters
- Lead
- Free liquids
- Mercury
- Particulate materials
- Pyrophoric materials.

Waste requiring treatment other than what WRAP can provide is repackaged, labeled, and transferred to a TSD unit for treatment or for storage pending identification or development of an appropriate treatment.

Waste sampling occurs in the restricted waste management gloveboxes, and to a lesser degree in the process gloveboxes, to determine the presence and characteristics of any dangerous waste constituents. Field screening techniques are used as much as practical to assist in the characterization of the waste. The specific waste analysis plan is provided in Chapter 3.0.

Samples of waste are transferred to the sample management area for packaging and transferred to an onsite laboratory or shipped offsite to a laboratory for analysis. Samples are collected and analyzed in accordance with Chapter 3.0, Appendix 3A.

Storage is provided for waste containers while awaiting laboratory analysis and empty containers. The storage area is surrounded by concrete shield walls and roof to protect operating personnel. The total space provided is for 24 containers. If there is insufficient space in this storage area, excess containers either are stored in the automated storage and retrieval system located in the shipping and receiving area or transferred to a TSD unit.

2.1.4 Sample Management Area

The sample management area receives samples from the process area and restricted waste management gloveboxes. The sample management area is used to package samples for transport to appropriate onsite or offsite analytical laboratories. All samples have a bar code label and are accompanied by chain-of-custody documentation as appropriate.

The sample management area contains storage space for samples, which includes refrigerated storage and laboratory supplies.

2.1.5 Process Support Area

The process support area provides approximately 900 square meters on the main level and the mezzanine for electrical equipment; mechanical equipment; heating, ventilation, and air conditioning systems; and a maintenance area.

The electrical equipment room is located adjacent to the process area. Incoming electrical power is brought to the room via overhead bus duct from transformers located outside WRAP.

The mechanical room contains the pumps associated with the heating, ventilation, and air conditioning equipment. Two chillers/tower units are located outside the building. This space also contains plant air compressors, a fire water entry, and a hot water heater.

The heating, ventilation, and air conditioning systems, exhaust fans, and HEPA filtration equipment are located adjacent to the process area. All air is exhausted through a stack located outside the building.

A maintenance room is provided for limited disassembly, part replacement, and maintenance activities associated with the process equipment. Other activities could occur in this room, as required.

2.1.6 Administrative Area

The administrative area provides approximately 800 square meters on the main level and the mezzanine for offices, lunch rooms, records retention, conference rooms, restrooms, change rooms for operations personnel including an anticontamination clothing change area, and a computer control room.

The computer control room is located on the upper level of the building and is centrally located to allow for direct observation of the shipping and receiving area, nondestructive examination and nondestructive assay area, and the process area. The control room contains five control stations to support operation of the nondestructive examination and nondestructive assay equipment, and to monitor the internal transport of waste containers and building and process systems. All computer equipment that supports process control or data management is located in the control room.

2.1.7 Exterior Loading Dock and Storage Area

The exterior loading dock and storage area provides approximately 200 square meters of space for storage of new containers and other supplies. A dry-pipe fire suppression system is provided within this area. This area is located on the east side of the building.

2.1.8 Other Environmental Permits

Environmental permits that are required to support operation of the WRAP are identified in the *Annual Hanford Site Environmental Permitting Status Report* (e.g., DOE/RL-96-63).

2.1.9 Construction Schedule [B-1b]

Any proposed new construction for WRAP will be managed as described in the *Hanford Facility Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste* (HF RCRA Permit) (Ecology 1994).

2.2 TOPOGRAPHIC MAP [B-2]

Topographic map (Drawing H-13-000003) is located in Appendix 2A.

2.3 ROADWAY TRAFFIC TO WASTE RECEIVING AND PROCESSING FACILITY [B-4]

General traffic information for the Hanford Facility is presented in the General Information Portion (DOE/RL-91-28).

Various access routes to WRAP are provided on the topographic map located in Appendix 2A.

Waste is shipped to and from WRAP in vehicles that range in size from fork lifts to 18.3-meter tractor-trailer rigs, depending on the size of the load. Sufficient turnaround space is provided for a TRUPACT-II tractor-trailer rig outside of the shipping and receiving areas. The weight of fully loaded TRUPACT-II casks is 8,372 kilograms and three casks are transported on one specially designed flatbed tractor-trailer. This is the heaviest of the vehicles to operate over the paved roadways to WRAP. The heaviest axle loading of a fully loaded TRUPACT-II shipment is 9,072 kilograms for the rear axles, corresponding to a load of approximately 6,895 newtons per square meter.

In addition, parking space is provided for up to two tractor-trailers and two enclosed 1,301-kilogram waste transport vans. Separation of service vehicles and personnel vehicle access and parking is provided. Paved roads are constructed to provide adequate all weather access to WRAP.

Typical shipments to WRAP are 40 containers each day and two boxes each week (two to three trucks each day).

2.4 RELEASE FROM SOLID WASTE MANAGEMENT UNITS [E]

Information concerning releases from solid waste management units is discussed in the General Information Portion (DOE/RL-91-28).

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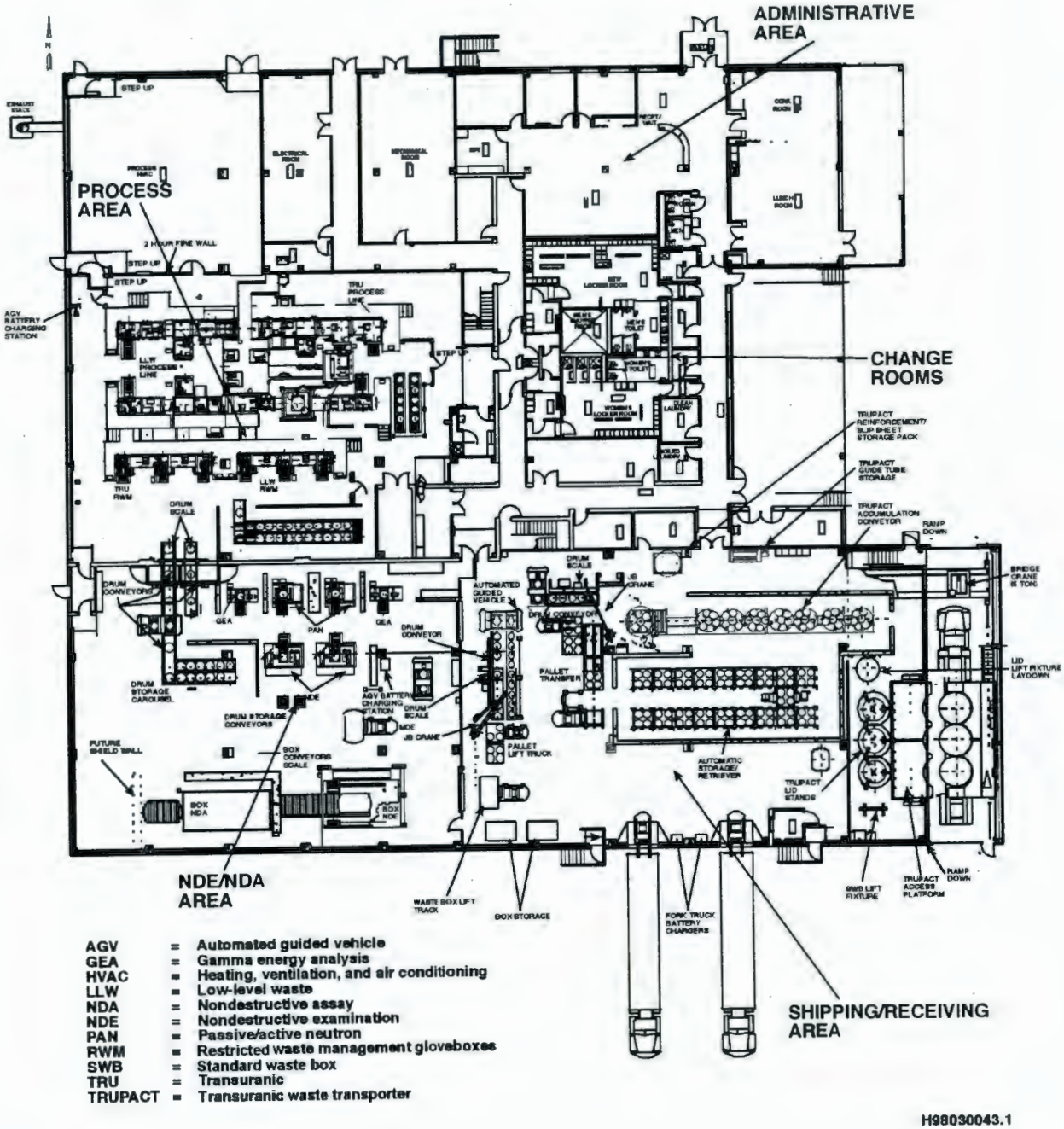
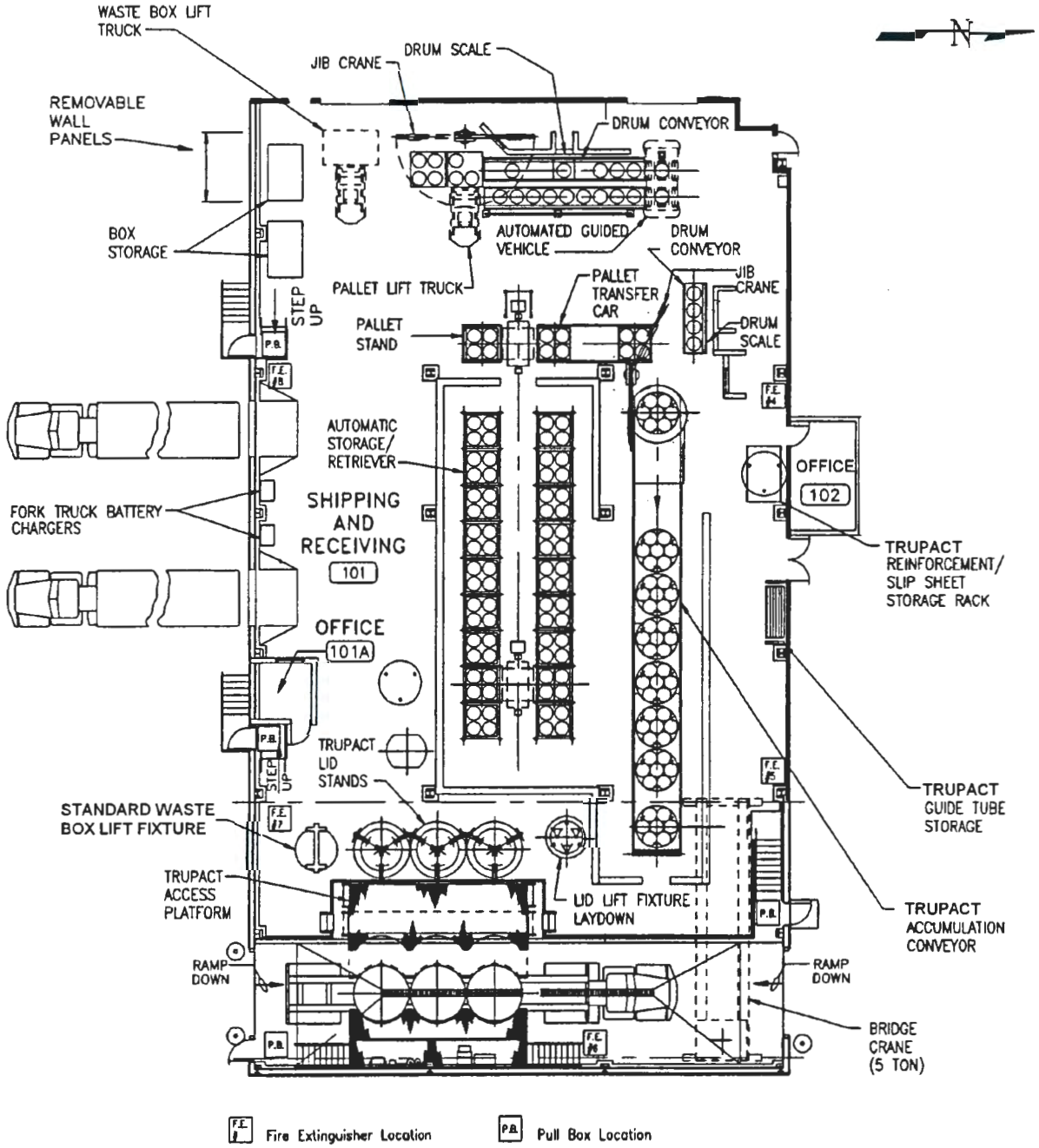
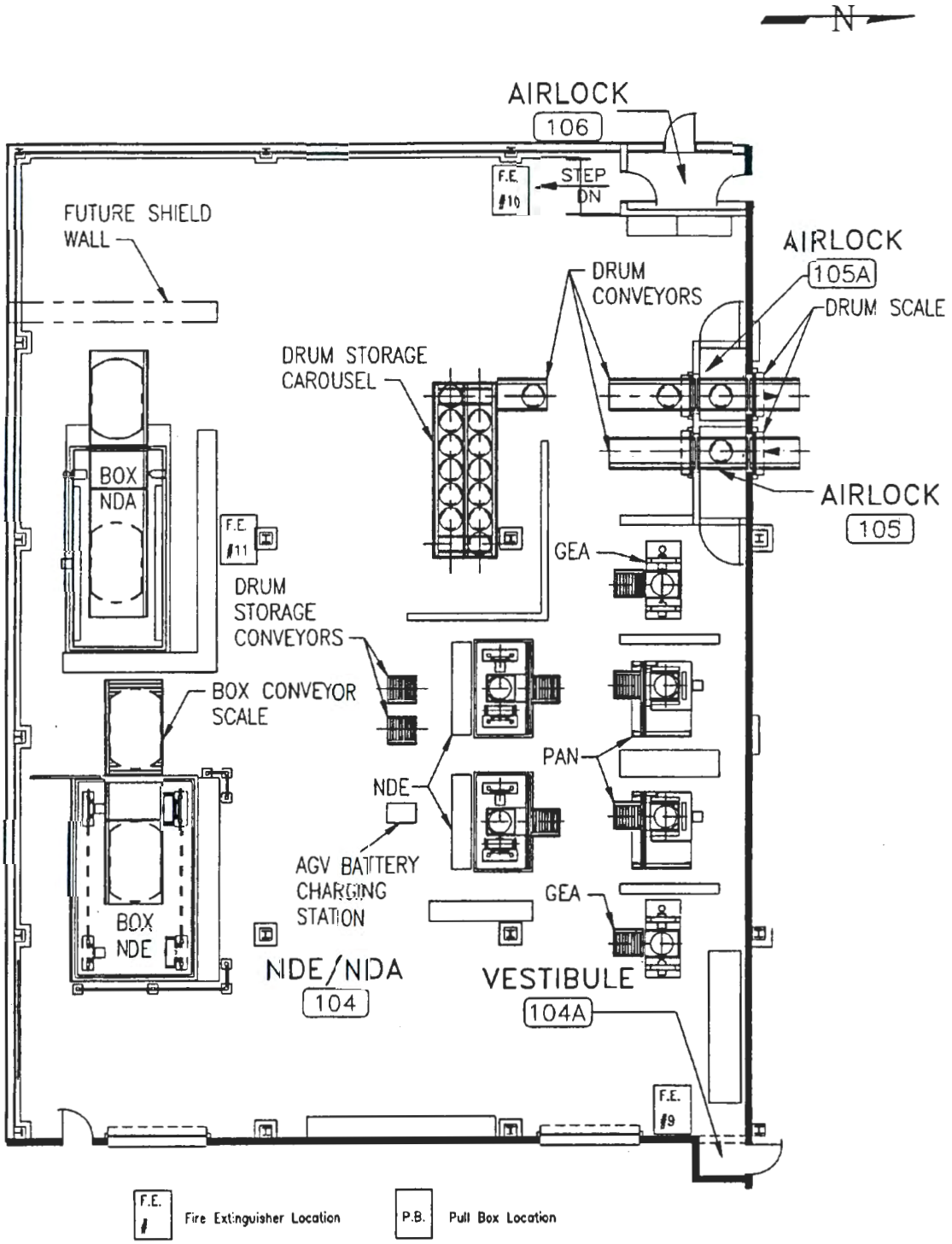


Figure 2-1. Layout for Waste Receiving and Processing Facility.



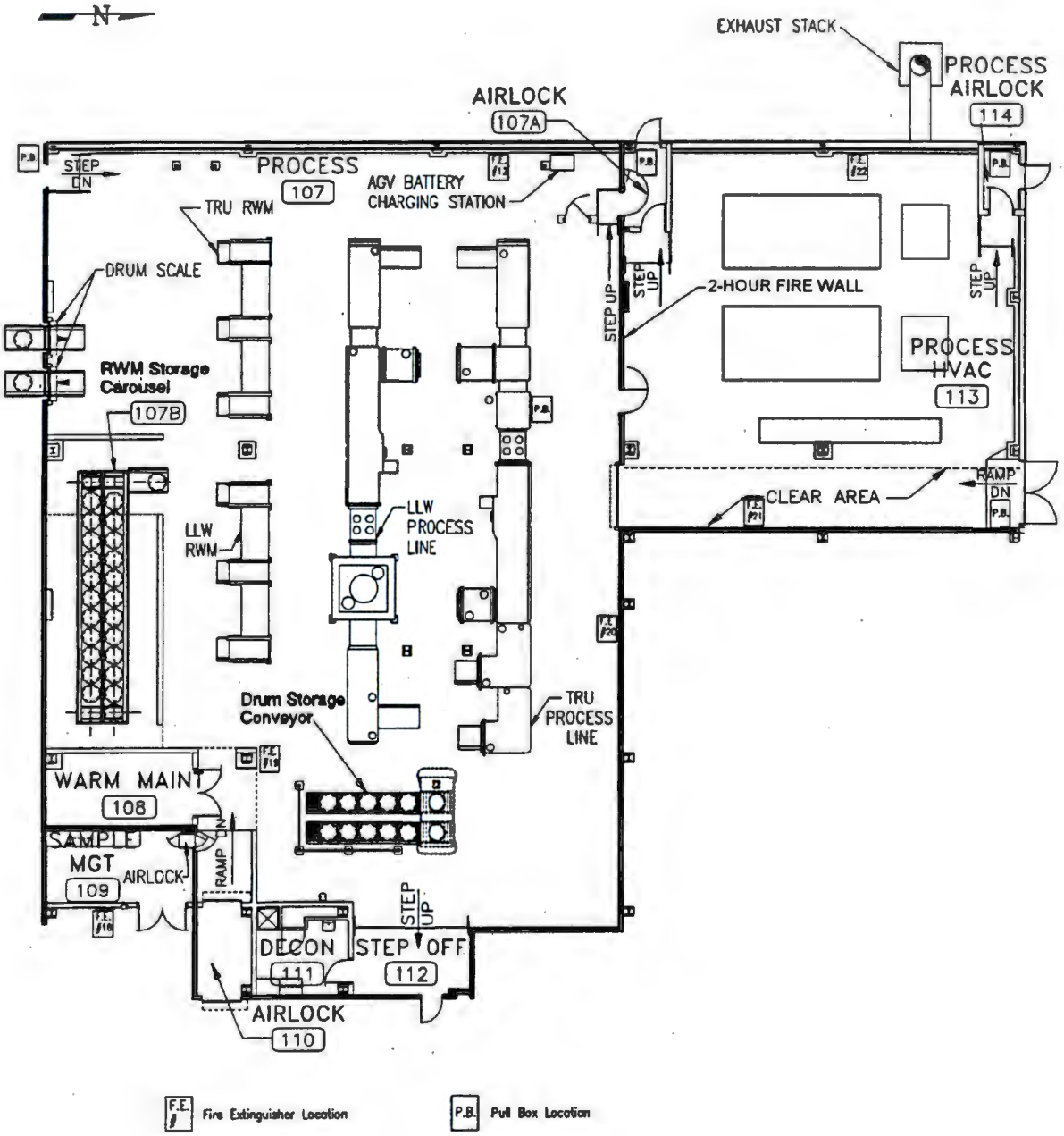
TRUPACT = transuranic waste transporter

Figure 2-2. Shipping and Receiving Area.



AGV = automated guided vehicle
GEA = gamma energy analysis
NDA = nondestructive assay
NDE = nondestructive examination
PAN = passive/active neutron

Figure 2-3. Nondestructive Examination and Nondestructive Assay Area.



AGV = automated guided vehicle
HVAC = heating, ventilation, and air conditioning
LLW = low-level waste
RWM = restricted waste management
TRU = transuranic

Figure 2-4. Process Area.

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3.0 WASTE ANALYSIS [C]

This chapter provides information on the chemical, biological, and physical characteristics of the waste stored at WRAP and on analysis to support identification of the waste. Any discussion of the storage of radioactive waste in this chapter is included for information only. A waste analysis plan for WRAP is included as Appendix 3A.

3.1 CHEMICAL, BIOLOGICAL, AND PHYSICAL ANALYSES [C-1]

Waste identification information provided by the onsite generating units or offsite generator's waste coordinator is used to designate the waste according to requirements of WAC 173-303-070. Waste normally is characterized into Ecology waste code designations 'U', 'P', 'F', 'D', 'W' waste numbers (WAC 173-303) (Table 3-1) using manufactures product information, material safety data sheets, laboratory analysis, and reference material such as *Registry of Toxic Effects of Chemical Substances* (NIOSH 1997). Waste also is characterized in accordance with the requirements of 40 CFR 261 and 761.

Biological waste received from onsite generating units or offsite generators could consist of animal remains that were used for radiological experiments. This type of waste is analyzed using nondestructive examination, visual examination during sorting, and laboratory analysis.

Waste received in WRAP is contained primarily in U.S. Department of Transportation 208-liter (55-gallon) drums, 208-liter (55-gallon) containers overpacked in 322-liter (85-gallon) drums, and standard waste boxes. Waste also could be received in other U.S. Department of Transportation-approved containers.

3.2 WASTE ANALYSIS PLAN [C-2]

WRAP waste analysis plan (Appendix 3A) summarizes the waste acceptance processes. Also described in the waste analysis plan are sampling methods; analytical parameters and rationale; quality control and quality assurance methods; requirements for incoming waste; requirements for spill material; storage requirements for ignitable, reactive, and incompatible waste; and the waste tracking and recordkeeping procedures.

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Table 3-1. Designation for Waste Types Reprocessed at Waste Receiving and Processing Facility.

Number	Reference
U and P numbers	WAC 173-303-9903
F numbers	WAC 173-303-9904
W001	WAC 173-303-9904
D001	WAC 173-303-090(5)
D002	WAC 173-303-090(6)
D003	WAC 173-303-090(7)
D004 through D043	WAC 173-303-090(8)
WT01 and WT02	WAC 173-303-100 and 104
WP01, WP02, and WP03	WAC 173-303-100 and 104
WSC2	WAC 173-303-103/104

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4.0 PROCESS INFORMATION [D]

This chapter provides the process information for WRAP.

4.1 CONTAINERS [D-1]

Waste is received at WRAP from onsite waste generating units, offsite waste generators, or TSD units, or a result of WRAP operations. Waste is contained inside either metal containers, overpacked containers, standard waste boxes or other metal or wooden boxes. Other types of containers could be accepted on a case-by-case basis.

4.1.1 Description of Containers [D-1a]

Waste is received packaged in 208- or 322-liter galvanized or coated steel containers (88.9 centimeters high by 61 centimeters in diameter and 99.1 centimeters high by 70.1 centimeters in diameter, respectively), standard waste boxes (carbon steel 93.2 centimeters high by 132 centimeters wide by 174 centimeters in length with an internal volume of approximately 1.84 cubic meters), steel or wooden boxes no larger than 2.7 meters long by 1.5 meters high by 1.5 meters wide (internal volume of approximately 5.4 cubic meters), or other approved containers. Containers meet the requirements for Type A shipping containers as indicated in 49 CFR 173.410 and 412. Boxes meet the Type A requirements indicated previously or the requirements of 49 CFR 173.24 and 24a for strong tight containers. The inner containment, as appropriate, could consist of either a heavy plastic liner or a rigid metal or plastic liner.

Containers coming into WRAP either are in good condition or are overpacked to maintain integrity during the storage period before processing. New containers are used for repackaging the waste. Waste is repackaged into either new 208-liter, 322-liter steel containers or other approved containers. Generally only solid waste is placed into the new waste containers. Some liquid waste could be placed in these containers to await future treatment. Non-sorbed liquid organic and aqueous waste is packaged in glass, plastic, or metal inner containers with sufficient absorbent material to absorb twice the volume of liquid present. The material used to sorb liquid waste is compatible with TSD requirements. The inner containers are enclosed in a rigid plastic liner within the steel drum or the steel drums have a special performance coating compatible with the waste. Any waste that could have the potential of reacting with the steel of the new containers is contained in plastic liner bags, or other containers to prevent contact with the steel.

4.1.2 Container Management Practices [D-1b]

Before shipment to WRAP, 208- and 322-liter containers must be closed by means of a gasketed steel lid. Other containers will be sealed by appropriate means (e.g., sealed with gaskets and either locking metal clips or bolts). Containers are transported within WRAP by fork lift, automated guided vehicle, or other approved lifting devices. Containers and the respective delivery vehicles are inspected visually and radiologically and the associated paperwork is reviewed. Any discrepancies noted either are resolved with the shipper, flagged for resolution by WRAP operations, returned to the onsite generating unit, or returned to the offsite generator.

Mixed waste containers received are opened only within gloveboxes. These gloveboxes provide the primary level of containment within WRAP when the containers are opened. The sealed stainless steel gloveboxes are designed to contain the waste during examination, sampling, and/or treatment.

Containers are stored in the shipping and receiving area and in the following locations within the process area: the drum storage carousel, the empty drum conveyor, the drum airlock, the lift tables, the process gloveboxes, and on the automated guided vehicle. Waste boxes are stored in the shipping and receiving area or the NDE/NDA area on pallets or have attached skids to keep the boxes off the floor and away from any leaking or spilled liquids. Waste containers are stored on the automated stacker retriever system, conveyors, or carousels to keep the drums above the floor level and away from any leaking or spilled liquids. The container storage capacity is shown in Table 4-1. Figure 4-1 shows the storage arrangements for the containers in the various storage areas.

Storage in the shipping and receiving area provides aisle spacing of at least 0.76 meter between rows. Rows are not more than two containers wide to facilitate inspections [WAC 173-303-630(5)(c)]. Sufficient access to containers is provided in case a container needs to be moved either for reprocessing or because of a problem identified during routine inspections.

Segregation of waste containers in the shipping and receiving area automated stacker retriever system is accomplished by segregating incompatible waste, ignitable and reactive waste, radioactive waste from nonradioactive waste, transuranic waste from low-level waste, mixed waste from radioactive waste, and processed waste from non-processed waste. The containers are placed in the automated stacker retriever system on containment pallets designed to collect liquids. The containment pallets have a raised grating or rack to keep the containers above the bottom of the pallet so as not to contact liquids. Storage conforms to National Fire Protection Association (NFPA) requirements (NFPA 1997) and WAC 173-303-630.

Containers shipped from WRAP are examined visually to ensure acceptable condition, proper identification, marking, labeling, and closure. Appropriate marking and labels are selected, completed, and applied to comply with U.S. Department of Transportation (49 CFR) labeling requirements and WAC 173-303. Each container not weighed previously will be weighed, and radiological surveys will be performed and documented.

4.1.3 Container Labeling [D-1c]

All waste containers received are marked and labeled in accordance with the requirements specified under 49 CFR 172. In addition to the 49 CFR 172 marking and labeling requirements, all waste containers must be marked, as appropriate, to adequately identify the major risk(s) associated with the contents of the containers, per WAC 173-303-630(3).

The labels and markings are affixed, as required, to the sides and tops of the containers. In addition, all containers received have either a bar code affixed to the container or the bar code is affixed in the shipping and receiving area.

Empty containers are crushed and loaded into overpacks. Overpacks are labeled as previously discussed.

4.1.4 Containment Requirements for Storing Containers [D-1d]

Secondary containment is provided for all waste containers. The secondary containment is described in the following sections.

4.1.4.1 Secondary Containment System Design [D-1d(1)]. Containers arriving at WRAP have at least two layers of containment, the outer container and the inner bags or rigid liners. The inner containment also could consist of a special medium or high performance coating on the inside of the metal container. This coating is compatible with the waste.

4.1.4.2 System Design [D-1d(1)(a)]. The building foundation is constructed of reinforced concrete with all process and waste storage areas located within the building. Copies of design and profile drawings of the secondary containment system are included in Appendix 4A. All floors have an impervious coating applied in accordance with construction specifications and material manufacturer's instructions to facilitate cleanup of any spills.

Sorting tables located within the process enclosures are designed to collect and retain liquids that might spill during the opening and sorting of the waste packages. The waste super compactor is designed to collect any liquids that are squeezed out of the waste during the compaction process. All liquid collected, either on the tables or in the base of the super compactor, is transferred to the low-level waste restricted waste management gloveboxes where the liquid is sampled for characterization purposes, treated as appropriate, or transferred to an onsite TSD unit or offsite TSD facility.

The hydraulic systems used to operate the compactors are located in the process area. The floor in this area is bermed (15.24 centimeters) and sealed to retain any fluid that leaks or spills if the system is breached for any reason. Any leaks or spills are cleaned up appropriately.

The base floor is located 15.24 centimeters above the ground level; therefore, run-on should not occur. In addition, all process areas or areas where containers are stored have 15.24 centimeter curbing around the respective areas without floor drains. Areas that have curbing include the shipping and receiving; nondestructive examination and nondestructive assay; process; and the process heating, ventilation, and air conditioning room. Waste boxes are stored on pallets or have attached skids to keep the boxes off the floor and away from any leaking or spilled liquids. Waste containers are stored on the automated stacker retriever, conveyors, carousels, or pallets to keep the containers above the floor level and away from any leaking or spilled liquids. In addition, containment pallets are used in the automated stacker retriever system located in the shipping and receiving area and could be used in other storage areas to further localize any leaks from the containers and to minimize cleanup. Because of these provisions, any spills are contained locally and readily cleaned up.

4.1.4.3 Structural Integrity of Base [D-1d(1)(b)]. The foundation and floor areas of WRAP are constructed of reinforced concrete. An engineering evaluation of the base is provided in Appendix 4B. All process areas, including the nondestructive examination and nondestructive assay area, shipping and receiving areas, and the process area are coated with a special coating to retard any infiltration of spilled liquids into the flooring. Any waste or liquid spills are contained within the bermed flooring and are cleaned up.

After pouring and setting, the foundation concrete was inspected to detect any gaps or cracks. Any gaps or cracks identified were filled and sealed. Sealants used are compatible with acids, bases, and organic

materials provided that residency times are not extensive. The contingency plan, contained in Chapter 7.0, describes the actions to be taken in the event of a spill or leak.

The design of curbing, water stops, and the slope of the floors at points near the exits and outer walls of the building contain liquid within the building. Because the storage areas are all located within the WRAP structure, precipitation would not affect these areas.

4.1.4.4 Containment System Capacity [D-1d(1)(c)]. The size of the floor for WRAP was determined based on storage requirements, the size of the gloveboxes needed for waste processing, working space, and shipping and receiving space requirements. Each area contained by the 15.24-centimeter curbing is of sufficient volume to retain 10 percent of the volume of the total containers within the respective areas. The floor capacity, total volume of containers, and calculations for each storage area are shown in Table 4-2. There is no volume displaced by the containers because the containers are stored above the floor. The volume displaced by other structures is not sufficient to effect the 10 percent containment requirement. The containment pallets that are used in the automated stacker retriever system are designed to hold a maximum volume of 56.8 liters of liquid.

4.1.4.5 Control of Run-on [D-1d(1)(d)]. The only potential for run-on and run-off would be fire sprinkler activation or a break in the water main. No floods are predicted to impact WRAP (DOE/RL-91-28). All process areas have a 15.24-centimeter berm. The WRAP structure is located 15.24 centimeters above the ground level.

Collected or contained liquid is removed by pumps for large quantities and by absorbents for smaller quantities. All waste stored in WRAP is in containers, which limits the detrimental impact of any run-on and/or run-off situation.

Sprinkler discharge was considered when determining the height of the containment berms within the process and storage areas.

Actions to be taken in response to a spill or discharge are detailed in the building emergency plan (Chapter 7.0).

4.1.5 Removal of Liquids from Containment Systems [D-1d(2)]

If a spill or release within WRAP results in collection of liquid waste material, the following is performed.

- Leaking containers are overpacked and identified in the WRAP operating log.
- If present, the liquid is removed from the containment system. Normally, a hand-held pump or vacuum system equipment is used for removal of large quantities of liquid. Absorbents are used for removal of small amounts of liquid. The area is cleaned using a damp cloth(s). The cloths will be handled appropriately depending on the nature of the liquid or other material being cleaned.
- If the liquid is unknown, the liquid is analyzed for dangerous constituents.

- The containerized liquid is handled as follows:

  - The waste material is placed in the appropriate U.S. Department of Transportation-specified container.

  - If the liquid has been altered during stabilization and cleanup actions (e.g., absorbed, mixed, diluted), the container is managed in accordance with the provisions of the waste analysis plan (Chapter 3.0).

  - If the waste was not altered during stabilization and cleanup activities, the containerized waste is labeled appropriately and processed through WRAP or another approved TSD unit. WRAP inventory is revised to reflect any changes.

  - WRAP inventory is revised to reflect the changes in waste description, volume, and storage location.

- Any liquid effluents resulting from a discharge of the building fire suppression system would be pumped to appropriate containers. The liquid would be sampled and if determined to contain regulated concentrations of dangerous waste, the waste would be sent to an appropriate onsite or offsite TSD unit. Sanitary waste is discharged to a dedicated tile and leach field near WRAP (refer to Appendix 2A).

- When all the liquid is removed from the surface and the area is determined to be clean of any spilled material based upon the cleaning methodology, the area of the spill is considered free from all radiological or dangerous waste contamination.

Specific actions to be taken in response to a spill or discharge are detailed in the building emergency plan provided in Chapter 7.0.

The following is performed if a fire sprinkler activation or pipe break occurs that could result in collection of water in the containment system.

- Water in the containment system is inspected visually for signs of contamination.

- If contamination is suspected, an analysis of the pH and radioactive contamination will be performed.

- Containers in the area(s) affected by sprinkler activation or pipe break are inspected for signs of leakage.

- The water is removed from the containment system. A hand-held pump or vacuum system normally is used for removal of large quantities of liquid. Absorbents are used for removal of small amounts of liquid. The area also is cleaned using a damp cloth(s).

- Water that has accumulated in the containment system that cannot be confirmed to be free of contamination is handled in the same manner as removal of liquid waste material from the containment system as discussed previously.

- Water that has accumulated in the containment system that can be confirmed to be free of contamination will be released to the ground.

4.2 PREVENTION OF REACTION OF IGNITABLE, REACTIVE, AND INCOMPATIBLE WASTES IN CONTAINERS [D-1f]

Physical barriers such as containment pallets and administrative controls are employed to segregate waste throughout WRAP as appropriate. All damaged waste packages arrive in overpack containers. Known data on each waste package is forwarded to WRAP along with the waste package. The information is added to the data management system along with a bar code label for identifying and tracking the waste container through WRAP. Additional information gained through nondestructive examination and waste sampling is added to the data management system.

Waste requiring more extensive treatment than WRAP provides is packaged and transferred to a TSD unit until treatment is available.

4.2.1 Management of Certain Reactive Wastes in Containers [D-1f(1)]

Waste that contains reactive material can be accepted at WRAP for deactivation as an alternative to long-term storage or treatment at an onsite generating unit. In addition, some waste might not be well characterized. If reactive materials are in such waste, the materials would not be identified until after the waste is characterized at WRAP. If during waste characterization, reactive waste is identified, the waste is segregated, deactivated (if possible), and repackaged. If the waste cannot be safely deactivated, the waste will be repackaged. Subsequent treatment or storage of reactive waste will be accomplished at another TSD unit.

4.2.2 Management of Ignitable and Certain Other Reactive Wastes in Containers [D-1f(2)]

WRAP is designed and constructed to meet NFPA codes and is equipped with fire, heat, and smoke detectors along with a fire suppression system.

Management of ignitable and reactive waste in containers is conducted in the same manner as discussed in Section 4.3.1. It is possible for WRAP to receive ignitable waste for confirmation or processing. This waste either is sorbed at WRAP with sorbents or is packaged and stored as a liquid at a TSD unit pending development of appropriate treatment capability. Ignitable waste is stored in WRAP or at a TSD unit in an area designated for ignitable materials.

All waste containers used for repackaging transuranic waste within WRAP are vented with filters to preclude buildup of gasses within the waste container.

Explosive, shock sensitive, or pyrophoric waste is not anticipated to be received at WRAP. Nevertheless, should this type of waste be identified through the sorting or characterization process, it would be segregated immediately from all other materials and relocated in such a fashion to prevent detonation. The packaging of this type of waste would be conducted under the direction of the Hanford Fire Department or another approved agency.

4.2.3 Design of Areas to Manage Incompatible Wastes [D-1f(3)]

Incompatible waste is segregated inside all gloveboxes and placed in properly labeled containers to await further processing or treatment. Compatible waste, which does not require further treatment, is repackaged inside new containers. Containerized liquids are removed from waste packages and transferred to the appropriate restricted waste management glovebox.

Suspect incompatible materials are screened or sampled and analyzed as much as practical in the restricted waste management gloveboxes or another approved location to determine the characteristics and incompatibilities of the materials. Incompatible materials are segregated from each other and repackaged to ensure that no incompatible materials are together. If analysis is required to determine compatibility, analysis will be conducted in accordance with ASTM Method D5058-90, *Standard Test Methods for Compatibility Screening Analysis of Waste*.

Corrosive materials (and suspect corrosives) are tested using pH test paper or pH meter to determine if the materials are acidic or basic. Appropriate neutralization and stabilization is performed in the restricted waste management gloveboxes or another approved location.

4.3 AIR EMISSIONS CONTROL [D-8]

This section addresses the WRAP requirements of Air Emission Standards under 40 CFR 264, Subpart BB (WAC 173-303-691) and Subpart CC.

4.3.1 Applicability of Subpart BB Standards [D-8b]

The air emission standards of 40 CFR 264, Subpart BB, apply to equipment that contains or contacts hazardous wastes with organic concentrations of at least 10 parts per million by weight.

The only equipment at WRAP that is subject to the provisions of Subpart BB is the carbon canister associated with the aerosol can venting equipment. This equipment qualifies as a control device subject to the provisions of 40 CFR 264.1060. An exemption is provided in 40 CFR 264.1050(f) for equipment that contains or contacts hazardous waste with organic concentrations of at least 10 percent by weight for a period of less than 300 hours per calendar year. Because this equipment is managed in a manner that meets the requirements of this exemption, this equipment is exempt from the requirements of 40 CFR 264.1052 through 264.1060. As required by 40 CFR 264.1064(g)(6), the aerosol can venting equipment is identified in a log that is maintained as part of the facility operating record. This equipment is marked as required by 40 CFR 264.1050(d).

4.3.2 Applicability of Subpart CC Standards [D-8c]

The air emission standards of 40 CFR 264, Subpart CC, apply to tank, surface impoundment, and container storage units that manage wastes with average volatile organic concentrations equal to or exceeding 500 parts per million by weight, based on the dangerous waste composition at the point of origination

(61 FR 59972). However, containers that are used solely for management of mixed waste are exempt. Dangerous and mixed waste are managed at WRAP.

TSD owner/operators are not required to determine the concentration of volatile organic compounds in a dangerous waste if the waste is placed in waste management units that employ air emission controls that are in compliance with the Subpart CC standards. Therefore, the approach to Subpart CC compliance at WRAP is to demonstrate that WRAP meets the Subpart CC control standards (40 CFR 264.1084 - 264.1086) for containers of dangerous waste.

Container Level 1 and Level 2 standards are met at WRAP by managing all dangerous waste in U.S. Department of Transportation containers [40 CFR 264.1086(f)]. Level 1 containers are those that store more than 0.1 cubic meter and less than or equal to 0.46 cubic meter. Level 2 containers are used to store more than 0.46 cubic meter of waste that are in 'light material service'. Light material service is defined where a waste in the container has one or more organic constituents with a vapor pressure greater than 0.3 kilopascal at 20°C, and the total concentration of such constituents is greater than or equal to 20 percent by weight.

The monitoring requirements for Level 1 and Level 2 containers include a visual inspection when waste is initially placed in a container at WRAP, and at least once every 12 months when stored onsite for 1 year or more.

Container Level 3 standards apply when a container is used for the "treatment of a hazardous waste by a waste stabilization process" [40 CFR 264.1086(2)]. Because treatment of dangerous waste in containers is not provided at WRAP, these standards do not apply.

4.4 WASTE TREATMENT AT WRAP

WRAP has the capability to treat waste through deactivation, solidification or absorption of liquids, neutralization of corrosives, amalgamation, microencapsulation, macroencapsulation, volume reduction of waste (e.g., supercompaction), reaction of reactive waste, and repackaging of waste. Treatment of mixed and/or radioactive waste will occur in the restricted waste management gloveboxes, shipping and receiving area, and other areas within WRAP if needed.

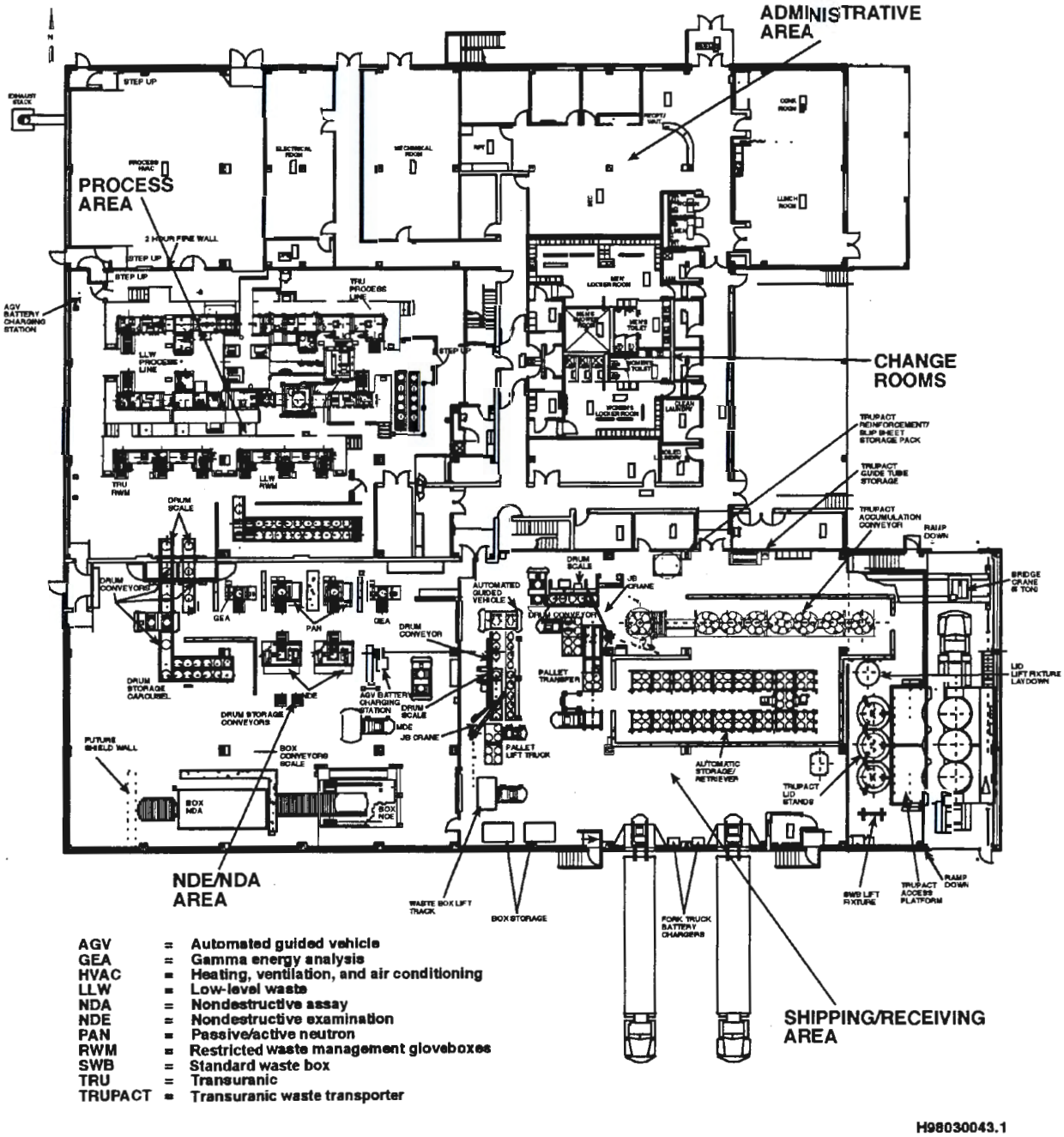

Figure 4-1. Container Storage Arrangement.

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Table 4-1. Number of Waste Containers Expected in Each Area.

Location	Average	Maximum
Shipping and receiving area	241 drums 6 boxes	308 drums 10 boxes
Nondestructive examination area and nondestructive assay area	6 drums	12 drums
Process area	34 drums	42 drums

Table 4-2. Floor and Container Capacity Calculations.

Location	Floor area (square meters)	Liquid capacity (cubic meters) (floor area times .1524 meter berm height)	Maximum container capacity (cubic meters)
Shipping/receiving area	665.19	101.4	308x0.322 = 99.2
Nondestructive examination and nondestructive assay area	653.85	99.6	12x0.322 = 3.9
Process area	634.06	96.6	42x0.322 = 13.5

CONTENTS

5.0 GROUNDWATER MONITORING FOR LAND-BASED UNITS [E] 5-1

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5.0 GROUNDWATER MONITORING FOR LAND-BASED UNITS [E]

WRAP is not operated as a dangerous or mixed waste surface impoundment, waste pile, land treatment unit, or landfill as defined in WAC 173-303-645(1)(a). Therefore, groundwater monitoring is not required.

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6.0 PROCEDURES TO PREVENT HAZARDS [F]

This chapter discusses security, inspection schedules, preparedness and prevention requirements, preventive procedures, structures, equipment, and prevention of reaction of ignitable, reactive and incompatible waste in WRAP.

The WRAP is designed and operated to minimize exposure of the general public and operating personnel. Shielding, contamination control, control of toxic or dangerous material, and safety and security procedures are used to keep exposure as low as reasonably achievable (ALARA).

6.1 SECURITY [F-1]

The following sections describe security measures, equipment, and warning signs used to control entry to WRAP. A discussion of Hanford Facility security is provided in the General Information Portion (DOE/RL-91-28).

6.1.1 Security Procedures and Equipment [F-1a]

The following sections describe the 24-hour surveillance system, barrier, and warning signs used to provide security and to control access to WRAP.

6.1.1.1 24-Hour Surveillance System []. The entire Hanford Facility is a controlled-access area [refer to General Information Portion (DOE/RL-91-28)].

6.1.1.2 Barrier and Means to Control Entry. WRAP is surrounded by the security fencing of the 200 West Area. The security fencing is 2.4-meter-high chain link and is topped with three strands of barbed wire. All entrances to WRAP are locked when the unit is unoccupied.

6.1.1.3 Warning Signs. Entrances to WRAP are posted with radiation signs. In addition, each entrance is posted with a sign, in English, reading, "DANGER-UNAUTHORIZED PERSONNEL KEEP OUT". The signs, in English, are visible from all angles of approach, and are legible from a distance of at least 7.6 meters.

6.1.2 Waiver [F-1b]

Waivers of the security procedures and equipment requirements for WRAP are not requested. Therefore, the requirements of WAC 173-303-310(1)(a) and (b) are not applicable to WRAP.

6.2 INSPECTION PLAN [F-2]

This section describes the method and schedule for inspections of WRAP. These inspections help to ensure that situations do not exist that might cause or lead to the release of dangerous or mixed waste to the

environment or that might pose a threat to human health. Abnormal conditions identified by inspections must be corrected on a schedule that helps prevent hazards to personnel, the public, and the environment.

6.2.1 General Inspection Requirements [F-2a, F-2b, and F-2d(3)]

The content and frequency of inspections are described in this section. The inspections are documented on inspection checklists and log sheets. The schedule and inspection records are kept in the inspection logbooks, maintained on a computerized information system, and retained at WRAP. Inspection records are retained for a minimum of 5 years, and contain the following information:

- Date and time of inspection
- Printed name and the hand written signature of the inspector
- Notation of the observations made
- An account of spills or discharges in accordance with WAC 173-303-145
- Date and nature of any repairs or remedial actions taken.

The inspection checklists consist of a listing of items that are to be assessed during each inspection. A yes/no response is made for each listed item. A 'yes' response means that the item is in compliance with the conditions stated on the checklist. Any problems identified during the inspection, as indicated by a 'no' response on the checklist, are reported immediately to the WRAP operations supervisor.

6.2.1.1 Types of Problems. WRAP inspections include, but are not limited to, the following:

- Condition of loading and unloading areas
- Condition of storage and accumulation areas
- Condition of safety, emergency, and communication equipment
- Condition of security equipment.

6.2.1.2 Frequency of Inspections. The inspection schedule for WRAP is daily when waste management activities occur for all areas subject to spills, daily and weekly for containers, and monthly for safety, emergency, and fire protection equipment (refer to Section 6.2.3). The frequencies of these inspections could be increased based on the condition of the unit and equipment.

As required by WAC 173-303-395(1)(d), an annual inspection of WRAP areas where ignitable or reactive waste is stored is performed by a professional knowledgeable of the Uniform Fire code (NFPA 1997). The following information is entered into WRAP operating record as a result of this inspection:

- The date and time of the inspection
- The name of the person who performed the inspection
- A notation of the observations made
- Any remedial actions that were taken as a result of this inspection

Though unlikely, WRAP secondary waste might have the characteristics of being reactive or ignitable. The Hanford Fire Department performs annual fire inspections of WRAP using a checklist developed specifically for facilities that handle dangerous and/or mixed waste.

6.2.2 Schedule for Remedial Action for Problems Revealed [F-2c]

If inspections identify significant corrosion, leaks, and/or spills in the secondary containment, the resultant liquid will be removed on a schedule that prevents hazards to human health and the environment. Further corrective actions are discussed in the building emergency plan (Chapter 7.0). If significant corrosion is observed, correction actions will be pursued. Depending on the severity of the corrosion, corrective action could range from correcting upon discovery or longer if procurement of needed materials and personnel are required.

Other conditions that are not a threat to human health and the environment will be dispositioned in a timeframe established by the operations supervisor.

6.2.3 Specific Process Inspection Requirements [F-2d and F-2d(1)]

The following describes the container inspections performed at WRAP.

- Daily visual inspection of container storage area when waste management activities occur for leaks, spills, accumulated liquids, and open or improperly sealed containers
- Weekly visual inspection of container labels to ensure labels are not obscured, removed, or otherwise unreadable
- Weekly visual inspection for deterioration of containers, containment systems, or cracks in protective coating or foundations caused by corrosion, mishandling, or other factors.

Weekly inspection of the following are performed:

- First aid kits
- Spill response kits
- Waste containers
- Curbing, floors, and sumps
- Chain and fence barricades.

Monthly inspection of the following are performed:

- Portable safety showers
- Portable eye wash stations
- Automatic fire suppression systems
- Fire extinguishers.

6.3 PREPAREDNESS AND PREVENTION REQUIREMENTS [F-3]

The following sections document the preparedness and prevention measures used at WRAP.

6.3.1 Equipment Requirements [F-3a]

The following sections describe the internal and external communications and emergency equipment located at WRAP.

6.3.1.1 Internal Communication. WRAP is equipped with an internal communication system to provide immediate emergency instruction to personnel. The internal communication system includes telephones, radios, a public address system, closed-circuit television monitoring, and alarm systems. The telephone and radio systems provide for intra-operations communication as well as external communication. Provisions are made to appropriately respond to various emergencies, including the following alarm-activated emergency situations: building evacuations, fire and/or explosion, loss of essential services, loss of ventilation, chemical releases, radioactive discharges, and high-airborne contamination.

Immediate emergency instruction to personnel is provided by a public address system by speaker horns and ceiling-mounted speakers located throughout WRAP. The public address system is coupled to the building telephone system to provide telephone accessed voice paging. The alarms are independent of the public address. The WRAP telephone system is linked to the Hanford Site voice data telecommunications system.

Data communication within WRAP and external communication are accomplished using two data communication systems. The local area network (which is compatible with the Hanford Site general usage network) carries general purpose data. The distributed control system is used to detect and annunciate alarms for process and control systems. Table 6-1 details where each type of alarm is sent.

The essential WRAP communication systems are fed from the emergency distribution system (uninterruptible power supply) and are operational for a minimum of 55 minutes following loss of power.

The fire alarm and fire detection system includes a fire alarm control panel, heat detectors, smoke detectors, incipient fire detectors, tamper sensors, and manual pull stations. The entire system is backed up with emergency battery power. The main fire alarm panel monitors input from various sources and indicates trouble or alarm status. The main fire alarm panel repeats these indications to master radio boxes for transmission to the Hanford Fire Department.

Heat detectors are located throughout the building including gloveboxes. The only exceptions are in the ventilation ducts where photo-electric smoke detectors are employed, and in the control/computer area where very early smoke detection apparatus (VESDA) incipient fire detectors are employed.

6.3.1.2 External Communications. WRAP is equipped with devices for summoning emergency assistance from the Hanford Fire Department, the hazardous materials response team, chemical response team, and/or local emergency response teams as necessary. External communication is by a telephone communication system. Telephones are available at numerous locations throughout WRAP. In addition, the following external communication systems are available for notifying persons assigned to emergency response organizations:

- Fire alarm control panel (FACP) and fire sprinkler flow monitoring device--connected to a system monitored around the clock by the Hanford Fire Department

- Telephone number 911--the contact point for the Hanford Site; on notification, the Hanford Patrol Operations Center notifies and/or dispatches required emergency responders

- Telephone number 373-3800--single point of contact for the emergency duty officer; this number can be dialed from any Hanford Site telephone

- Crash alarm telephone system--consists of selected telephones that are disassociated from the regular system and are connected automatically to control stations

- Emergency phone--single point of contact for WRAP emergency control station to the 200 East Area Emergency Control Center (2750-E Building)

- Priority message system (management bulletin)--network of telefax machines used to disseminate information to personnel.

- The DOE-RL radio systems and frequencies--available for emergency communications.

6.3.1.3 Emergency Equipment. Emergency equipment is available for use throughout WRAP (i.e., portable fire extinguishers, fire control equipment, spill control equipment, and decontamination equipment). A detailed list of equipment is included in the building emergency plan (Chapter 7.0, Appendix 7A).

WRAP is equipped with fire control equipment and includes structural features that ensure an improved risk level. All interior fire separation walls, floors, and ceilings have a minimum 2-hour fire rating. All fire doors, ventilation dampers, and control room window shutters have a minimum 1 ½-hour fire rating.

The design of WRAP minimizes the combustible loading by using components of fire resistant and noncombustible material wherever possible, particularly containment barriers and structural members. Containment barriers and structural members include walls, partitions, columns, beams, floors, and roofs. Suspended ceilings, pipe and duct insulation, adhesives, and other such materials are made of low or noncombustible substances. Concealed spaces, such as those above suspended ceilings, contain a minimum number of combustible materials. Cable enclosures, nonflame propagating electrical insulation, and fire stops in penetrations through walls, floors, and ceilings are used to minimize flame-spread potential.

Automatic wet-pipe sprinklers are provided throughout WRAP with the exception of the loading dock area, which is provided with automatic dry-pipe sprinklers. All sprinkler systems are designed in accordance with NFPA for ordinary hazard pipe schedule systems. A dry standpipe system is installed in the loading dock area.

An automatic dry chemical fire suppression system is provided for inside the process area enclosures. The dry chemical system is designed to quickly suppress a fire in the enclosures. The dry chemical fire suppression system is activated by heat detectors located in the enclosures. The dry chemical system uses a multipurpose dry chemical suppressant and is designed in accordance with NFPA for total flooding fire-suppression systems.

Emergency eye washes and safety showers are distributed strategically throughout WRAP for emergency situations involving dangerous materials. An area is provided in WRAP for personnel decontamination in emergency situations. Breathing air is provided using portable bottled air. Sufficient face

masks and bottled breathing air are available to cover all material handling areas and to provide emergency air supplies in case of high airborne contamination or loss of ventilation.

6.3.1.4 Water for Fire Control. The primary water supply for fire protection is supplied from the 200 West Area water system. Water is pumped to WRAP through an underground pipeline that ties into existing water mains. All underground installations are in accordance with NFPA.

Additional water for fire control at WRAP is supplied by the Hanford Fire Department trucks for fires requiring high water volume and pressure. Each fire station normally has a truck equipped with a hydraulically operated aerial ladder, and one pumper (backup fire engine, without a boom, that is used if the aerial ladder is inoperable). Fire engines have a pumping capacity of at least approximately 5,600 liters of water per minute.

Other fire protection equipment use chemicals rather than water as extinguishing media.

6.3.2 Aisle Space Requirements [F-3b]

Aisle spacing at WRAP is sufficient to allow the movement of personnel and fire protection equipment in and around the containers. This storage arrangement also meets the requirement of the NFPA and the Life Safety Code for the protection of personnel and the equipment. A minimum 0.76-meter aisle space is maintained between rows of containers as required by WAC 173-303-630(5)(c).

6.4 PREVENTIVE PROCEDURES, STRUCTURES, AND EQUIPMENT [F-4]

The following sections describe preventive procedures, structures, and equipment.

6.4.1 Unloading Operations

Methods are used to minimize the potential for puncturing or opening containers during waste unloading and are followed during packaging of the waste as well as during unloading. The methods employed are as follows.

- Containers are inspected for damage before being unloaded.
- Containers are handled by appropriate equipment such as a forklift or crane during unloading. Onsite generating units or offsite generators are required to provide rigging and instructions for unloading packages requiring special handling.

6.4.2 Run-Off

Procedures, structures, and equipment are used at WRAP to prevent run-off from dangerous waste and from hazardous chemicals.

WRAP design provides for structures and equipment to prevent run-off and flooding in accordance with the safety requirements of 40 CFR 264 and the WAC 173-303. WRAP is designed to contain spills, leaks, fire sprinkler system releases such that dangerous waste and/or hazardous chemicals are not released to other areas or the environment (e.g., berms, spill pallets, and catch pans).

6.4.3 Water Supplies

Water is supplied to WRAP from the Columbia River via the Hanford Site potable water system. All hose connections to the potable water line have a one-way check valve installed to prevent backflow. These check valves prevent contamination from entering the water supply lines from within WRAP.

The water supply system (potable and fire sprinkler supply) for WRAP is routed from two sources to provided a looped supply system per U.S. Department of Energy Order 6430.1A: one from the south near the 272-WA Building and the second from the east near T Plant Complex.

6.4.4 Equipment and Power Failure

The procedures, structures, and equipment used to mitigate the effects of equipment failure and power outage are described in the following sections.

6.4.4.1 Mitigation of the Effects of Equipment Failure. A combination of reliability, redundancy, maintenance, and repair features are used in the design of WRAP equipment and systems. Preventive maintenance and surveillance are performed to minimize random failure of equipment. The batch nature of WRAP systems minimizes process downtime and allows for preventive maintenance.

Redundant equipment and systems are provided for crucial systems required to run continuously during process operations. For essential production and safety equipment, spare parts are maintained. In addition, the design and layout of process systems enhance physical access for operation and maintenance.

Most of the operations within WRAP gloveboxes consist of hands on manual activities. Shutdown consists of simply stopping the activity in progress. There are several automatic container movement and handling functions controlled by computer. These functions are shutdown by pressing emergency stop buttons located throughout the WRAP process area.

6.4.4.2 Mitigation of the Effects of Power Failure. In the event of a power failure, uninterruptible power supply is provided. The uninterruptible power supply supplies power to critical computers and instrumentation for a minimum of 55 minutes following loss of power.

6.4.5 Personnel Protection Equipment

At WRAP, procedures, structures, and equipment are used to prevent undue exposure of personnel to dangerous waste and hazardous chemicals. Protective clothing and equipment are prescribed for personnel handling chemicals or dangerous waste. Whenever possible, exposures to hazards are controlled by accepted engineering and/or administrative controls. Protective gear is used where effective engineering or administrative controls are not feasible. In addition to providing employees with adequate protective clothing

to prevent exposure to dangerous waste, the design of equipment at WRAP minimizes exposure to dangerous waste and hazardous chemicals. Equipment design follows guidelines such as the following.

- All loads are securely fastened for transport, inspection, and storage.
- Design of equipment and piping minimizes any arrangement that requires employees to place extremities of the body in potential pinch point areas.
- The design of equipment avoids personnel contact with, or exposure to, corrosive chemicals.

6.5 PREVENTION OF REACTION OF IGNITABLE, REACTIVE, AND/OR INCOMPATIBLE WASTES [F-5]

The following section describes prevention of reaction of ignitable, reactive, and incompatible waste.

6.5.1 Precautions to Prevent Ignition or Reaction of Ignitable or Reactive Waste [F-5a]

Pyrophoric and reactive material, once discovered through nondestructive examination, is sent to the restricted waste management glovebox for processing. These materials only can be present if sealed in inner containers inside of drums (if not otherwise sealed from a normal oxygen atmosphere, the materials would have reacted before receipt at WRAP). These sealed inner containers are identified by radiography in the nondestructive examination area. No activities involving open flames, cutting, or welding takes place in this glovebox unless controlled administratively (confined space entry permit). Special processing area electrical equipment is 'hazardous location' rated to prevent sparks from igniting flammable vapor that could be present. Lighting is external to the glovebox. Smoking is not allowed anywhere within WRAP and 'NO SMOKING' signs are appropriately placed. WRAP is heated by heat pump with no ignition sources. Pyrophoric and reactive materials are stabilized before further processing. Chapter 3.0 provides further details on handling of pyrophoric and reactive materials.

6.5.2 Precautions for Handling Ignitable or Reactive Waste and Mixing of Incompatible Waste [F-2d(3) and F-5b]

The following general precautions are taken at WRAP for handling ignitable or reactive waste and mixing of incompatible waste.

- No smoking is allowed in WRAP.
- No open flames, sparking devices, cutting or welding, hot surfaces, or heat sparks are allowed while ignitable or reactive waste is present, unless a hot work permit has been approved.
- Compatibility testing is conducted before mixing any two wastes.
- Incompatible waste is segregated.

- At least yearly, the areas where ignitable or reactive waste are stored are inspected by a professional inspector familiar with the Uniform Fire Code (refer to Section 6.2.1.2).

Incompatible waste is segregated by drums and by containment pallets.

Known data on each waste package are forwarded to WRAP operators along with the waste package itself. The information is added to the waste tracking computer system along with a bar-code label for identifying and tracking the waste container through WRAP. As additional information is gained through nondestructive assay and nondestructive examination and waste sampling, the information is added to the waste tracking computer system.

Reactive waste is not anticipated to arrive at WRAP. If data on a waste package indicate that reactive waste is present within a container, the container can be accepted at WRAP but processing is controlled administratively. If reactive waste is received or identified, the waste is segregated, deactivated (if possible), and repackaged. If the waste cannot be safety deactivated, the waste is repackaged and returned to storage to await further treatment.

Deactivation of reactive waste is performed in the restricted waste management before sampling and testing to ensure that no reactions will occur during aggregation and to ensure complete deactivation. Alkali metals received at the restricted waste management are treated to render the metals nonreactive. Methods are employed to safely handle any reactive waste identified.

Information on ignitable waste, if known, is provided to WRAP operators to facilitate scheduling for processing, sampling, and solidification of this waste. Flammable and/or ignitable liquid waste is immobilized using flammable or combustible absorbent, as appropriate, to facilitate future treatment by incineration.

WRAP is designed and constructed to meet NFPA codes and is equipped with heat and smoke detectors along with a fire sprinkler system and an automatic ventilation shutdown system.

Transuranic waste is required to have vents on the waste containers from the time the containers are filled. Waste is required to be segregated and certified by the onsite generating unit or offsite generator before shipment such that no reaction could occur during storage or transportation.

All waste containers used for repackaging transuranic waste within WRAP are vented with filters to preclude buildup of gasses within the waste container.

Explosive, shock sensitive, and pyrophoric materials are not anticipated to be received in the waste destined for WRAP. Nevertheless, should this type of waste be received, the waste will be segregated immediately from all other materials and relocated in such a fashion to prevent detonation (Chapter 8.0). The packaging of these materials is conducted under the direction of the Richland Police Department Bomb Squad. The package is stored appropriately until an approved plan for destruction has been developed. The contingency plan (Chapter 7.0) will be activated if any explosive, shock sensitive, or pyrophoric materials are discovered in WRAP.

Incompatible waste is segregated at the time of sorting inside of the main process glovebox or the restricted waste management glovebox. Compatible waste, which does not require further treatment at WRAP, is repackaged. Containerized liquids removed from waste packages are sampled for characterization

and tested for compatibility before any aggregation takes place in the restricted waste management gloveboxes.

Table 6-1. Alarm Destinations.

Alarm type	Local station	Central control room	Health protection station	Fire alarm panel
Process/control	X	X		
Safety-related	X	X	X	
Fire		X		X

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7.0 CONTINGENCY PLAN [G] 7-1

APPENDIX

7A BUILDING EMERGENCY PLAN FOR WASTE RECEIVING AND PROCESSING FACILITY ..... APP 7A-i

TABLE

7-1. Hanford Facility Documents Containing Contingency Plan Requirements of WAC 173-303-350(3) T7-1

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7.0 CONTINGENCY PLAN [G]

The WAC 173-303 requirements for a contingency plan are satisfied in the following documents: Portions of the *Hanford Emergency Response Plan* [Attachment 4 of the HF RCRA Permit (DW Portion)] and portions of the *Building Emergency Plan for Waste Receiving and Processing Facility* (Appendix 7A).

The unit-specific building emergency plan also serves to satisfy a broad range of other requirements [e.g., Occupational Safety and Health Administration standards (29 CFR 1910), *Toxic Substance Control Act of 1976* (40 CFR 761) and U.S. Department of Energy Orders]. Therefore, revisions made to portions of this contingency plan document that are not governed by the requirements of WAC 173-303 will not be considered as a modification subject to WAC 173-303-830 or Hanford Facility RCRA Permit (DW Portion) Condition I.C.3. Table 7-1 identifies which portions of the Building Emergency Plan are written to meet WAC 173-303 contingency plan requirements.

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Table 7-1. Hanford Facility Documents Containing Contingency Plan Requirements of WAC 173-303-350(3). (sheet 1 of 2)

Requirement	Attachment 4 of the HF RCRA Permit (DW Portion)	Building Emergency Plan
-350(3)(a) - A description of the actions which facility personnel must take to comply with this section and WAC 173-303-360.	X[1] Section 1.3.2	X[1] Section 7.1 through 7.3
-350(3)(b) - A description of the actions which shall be taken in the event that a dangerous waste shipment, which is damaged or otherwise presents a hazard to the public health and the environment, arrives at the facility, and is not acceptable to the owner or operator, but cannot be transported pursuant to the requirements of WAC 173-303-370(5), Manifest system, reasons for not accepting dangerous waste shipments.	X[1] Section 1.3.2	X[1,2] Section 7.2
-350(3)(c) - A description of the arrangements agreed to by local police departments, fire departments, hospitals, contractors, and state and local emergency response teams to coordinate emergency services as required in WAC 173-303-340(4).	X Sections 3.2.3, 3.3.1, 3.3.2, 3.4, 3.4.1.1, 3.4.1.2, 3.4.1.3, and Table 3-1	
-350(3)(d) - A current list of names, addresses, and phone numbers (office and home) of all persons qualified to act as the emergency coordinator required under WAC 173-303-360(1). Where more than one person is listed, one must be named as primary emergency coordinator, and others must be listed in the order in which they will assume responsibility as alternates. For new facilities only, this list may be provided to the department at the time of facility certification (as required by WAC 173-303-810 (14)(a)(I)), rather than as part of the permit application.		X[3] Section 13.0
-350(3)(e) - A list of all emergency equipment at the facility (such as fire extinguishing systems, spill control equipment, communications and alarm systems, and decontamination equipment), where this equipment is required. This list must be kept up to date. In addition, the plan must include the location and a physical description of each item on the list, and a brief outline of its capabilities.	X Hanford Fire Department: Appendix C	X Section 9.0

Table 7-1. Hanford Facility Documents Containing Contingency Plan Requirements of WAC 173-303-350(3). (sheet 2 of 2)

Requirement	Attachment 4 of the HF RCRA Permit (DW Portion)	Building Emergency Plan
-350(3)(f) - An evacuation plan for facility personnel where there is a possibility that evacuation could be necessary. This plan must describe the signal(s) to be used to begin evacuation, evacuation routes, and alternate evacuation routes.	X[4] Figure 5-2	X[5] Section 1.5

[1]The *Hanford Emergency Response Plan* contains descriptions of actions relating to the Hanford Site Emergency Preparedness System. No additional description of actions are required if emergency planning activities are addressed. If other credible scenarios exist or if emergency procedures at the unit are different, the language contained in the Building Emergency Plan will be used during an event by a Building Emergency Director.

[2]This requirement only applies to TSD units which receive shipment of dangerous or mixed waste defined as off-site shipments in accordance with WAC 173-303.

[3]Emergency Coordinator names and home telephone numbers are maintained separate from any contingency plan document, on file in accordance with Hanford Facility RCRA Permit, DW Portion, General Condition II.A.4. and is updated, at a minimum, monthly.

[4]The Hanford Facility (sitewide) signals are provided in this document. No unit/building signal information is required unless unique devices are used at the unit/building.

[5]An evacuation route for the TSD unit must be provided. Evacuation routes for occupied buildings surrounding the TSD unit are provided through information boards posted within buildings.

CONTENTS

8.0 PERSONNEL TRAINING [H] 8-1

APPENDIX

8A TRAINING ..... APP 8A-I

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8.0 PERSONNEL TRAINING [H]

The training plan provided in Appendix 8A discusses training requirements pertaining to WRAP.

The training program is designed to be compliant with all applicable federal, state, and DOE-RL training requirements. The training program complies with requirements contained within WAC 173-303-330 for the development of a written dangerous waste training program. The training program is designed to prepare personnel to manage and maintain TSD units in a safe, effective, efficient, and environmentally sound manner. In addition to preparing personnel to manage and maintain TSD units under normal conditions, the training program ensures that personnel are prepared to respond in a prompt and effective manner should offnormal or emergency conditions occur.

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CONTENTS

9.0 EXPOSURE INFORMATION REPORT 9-1

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9.0 EXPOSURE INFORMATION REPORT

WRAP does not store, treat, or dispose of dangerous or mixed waste in a surface impoundment or landfill as defined in 40 CFR 270.10 and RCRA, Section 3019. Therefore, exposure information is not required.

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CONTENTS

10.0 WASTE MINIMIZATION 10-1

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10.0 WASTE MINIMIZATION

To fulfill the requirements of 40 CFR 264.73(b)(9), a certification that WRAP has a waste minimization/pollution prevention program in place is entered annually into the WRAP operating record.

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11.0 CLOSURE AND FINANCIAL ASSURANCE [I]

This chapter describes the planned activities and performance standards for closing WRAP. Closure of WRAP will comply with WAC 173-303-610 regulations for the closure of TSD units. As a controlled treatment and storage unit, WRAP is not anticipated to become extensively contaminated (the use of the word contaminated refers to contamination by dangerous waste regulated by Ecology).

Because it is planned that WRAP be clean closed, postclosure activities are not applicable to this closure plan. To clean close WRAP, it will be demonstrated that dangerous waste has not been left onsite at levels above the closure performance standard for removal and decontamination. Periodically current regulations and laws will be reviewed and the closure plan modified as necessary. If it is determined that clean closure is not possible or is environmentally impractical, the closure plan will be modified to address required postclosure activities.

11.1 CLOSURE PLAN [I-1]

As currently envisioned, the activities to achieve clean closure will be conducted in two phases.

- Phase 1 will consist of the decontamination and/or removal of contaminated process components and the decontamination and/or transportation of any removed components to an appropriate disposal unit.

- Phase 2 will consist of the collection of liquid or particle decontaminants and the decontamination and/or transportation of any removed components to an appropriate disposal unit.

11.2 CLOSURE PERFORMANCE STANDARD [I-1a]

Clean closure of WRAP will require the removal and disposal of all dangerous waste present in the unit, removal of contaminated process equipment and contaminated structural components, decontamination of all building surfaces, and removal of any contaminated soil within the TSD unit boundary (Appendix 2A details TSD unit boundary). Clean closure levels for soil will be calculated using the Washington State Model Toxics Control Act (MTCA) residential exposure assumptions. For any new hazardous substances managed at WRAP not identified in the final permit application, the permit will be modified to include numeric soil clean closure levels for these substances before proceeding with WRAP closure. WRAP is designed to facilitate closure by allowing easy removal, if necessary, of equipment contaminated with dangerous waste.

Any materials, equipment, or structures removed from WRAP will be designated in accordance with WAC 173-303-070 and disposed of accordingly. WRAP will be considered clean when the sampling of the structures and the surrounding soil shows that the concentrations for all constituents analyzed are present at concentrations at or below the residential exposure limits.

Should decontamination be necessary, as determined by sampling of WRAP components, clean closure will require removal and disposal of all dangerous waste, contaminated equipment, and rinsates to standards specified in WAC 173-303-610(2)(b).

A verification sampling program will be conducted at the end of closure operations to confirm that no contamination above residential exposure limits exists in the vicinity of WRAP. Clean closure of WRAP eliminates the need for postclosure maintenance.

11.3 CLOSURE ACTIVITIES [I-1b]

Closure activities will entail decontamination and/or removal and disposal of the structure and all equipment. WRAP will be closed in a manner that protects public health and the environment, and that minimizes or eliminates the escape of waste constituents to the ground, to surface waters, or to the atmosphere. Process design capacities are described in Chapter 1.0.

This closure plan provides for the following:

- Inventory removal
- Uncontaminated equipment disposition
- Process equipment decontamination and/or removal
- Structure decontamination and/or removal
- Closure equipment decontamination
- Soil Sampling.

11.3.1 Inventory Removal

All waste inventory at WRAP will be processed before closure. Any residue remaining in piping and equipment will be removed during decontamination.

11.3.2 Uncontaminated Equipment

WRAP contains some uncontaminated equipment and components. Uncontaminated equipment and components will be left for future use or disassembled, dismantled, and removed for use elsewhere or disposed of.

11.3.3 Process Equipment Decontamination and/or Removal

The options that will be used to dispose of the contaminated equipment from WRAP, listed by order of preference, are the following:

- Decontamination, recycling, and/or reuse
- Offsite disposal as dangerous waste
- Onsite storage as mixed waste
- Onsite disposal as mixed waste.

The selection of the option to be used for disposition will be made individually for each piece of equipment removed from WRAP. The decision will be made based on the designation of the piece of equipment (e.g., dangerous waste, mixed waste, radioactive waste), the radiation level associated with each

piece of equipment, and the estimated quantity of waste that would be generated during decontamination. The determination of the final disposal option for each piece of equipment will be made as follows.

- The radiation level associated with the equipment will be measured. If the radiation level is above 200 millirems per hour, the equipment will be sampled to determine the proper waste designation of the equipment and to provide the necessary information to support disposal onsite as either mixed waste or radioactive waste. Further decontamination of equipment with radiation levels exceeding 200 millirems per hour is not considered feasible because of the large worker radiation doses that would be incurred during decontamination.

- If the radiation level is less than 200 millirems per hour, samples of the equipment will be taken to determine appropriate decontamination methods. These samples also will be used to confirm the applicability of the decontamination method selected and to provide an estimate of the quantity and type of waste that would be generated by decontamination. If the amount of waste that would be generated by decontamination is less than that which would be generated by direct disposal, the equipment will be decontaminated. If the decontamination waste generated would exceed the quantity generated by direct disposal, the equipment will be disposed of without initial decontamination.

The equipment decontamination process will be performed using appropriate technologies such as washing with water or other liquid solvents, steam cleaning, aqua-blasters, sandblasting, and high-pressure water jet scarifiers. The actual equipment used will consist of an appropriate combination of equipment that is the most effective as determined by sampling results and testing of the decontamination methods. During the decontamination process, a verification sampling and testing effort will be conducted for the purpose of monitoring the effectiveness of the decontamination work.

11.3.4 Structure Decontamination

Decontamination will begin with a radiation survey, where necessary, and visual inspection. In areas where surveys show measurable radioactivity, the samples and residue collected also will be surveyed for radiation. Any waste deposits found during the visual inspection will be removed and disposed of.

The building surfaces will be decontaminated by using one of the following methods:

- Scouring
- Sandblasting
- Steam cleaning
- Other appropriate technologies.

Decontamination procedures will address minimization of decontamination waste and collection of the waste into containers. Sampling will be conducted to verify the effectiveness of the decontamination process.

Verification sampling of the structure surfaces will entail comparative analyses of the decontamination medium before and after decontamination. In addition, authoritative wipe sampling will be performed on any metal surfaces that appear stained, rusted, or discolored. If the verification sampling indicates contamination is still present, the decontamination procedure will be repeated until no contamination is found or until the decontamination is no longer effective. If it is not possible to fully decontaminate an area, the extent of

contamination will be determined through additional sampling. The contaminated sections will be removed, placed in a containment module, and disposed of based on the results of the sample designation.

Random and authoritative core sampling of the floors will be performed to verify the decontamination process. The floor areas will be divided into 1.5-meter by 1.5-meter grids. Five percent of the grids generated will be sampled on a random basis. Random numbers will be generated by an appropriate method such as a random number table. Authoritative samples will be taken from areas noted as discolored or stained during the visual inspection, and from areas of suspected contamination (e.g., sumps, drains, etc.). The cores will be taken according to technologies available at the time of closure, and the coring device will be of sufficient size to allow sampling of the soil underneath. A laboratory will perform analyses on the core per SW-846 or other approved protocols. Analyses of the samples will determine whether or not regulated constituents have penetrated the sealant. In the event that contaminants are determined to have penetrated the sealant, the soil under the cores will be sampled to a depth of 0.6 meter, and analyzed for the constituents identified in the core sample.

11.3.5 Closure Equipment Decontamination

The equipment used during the closure activities will be cleaned three times with a steam cleaner. The equipment cleaning will be performed over a solid sheet of durable plastic. The plastic will be at least 8 mils thick. The thickness will depend on the equipment and the amount of abrasion expected from cleaning activities. The sides of the plastic will be elevated to prevent the escape of rinsate. The rinsate from steam cleaning will be collected, pumped into new bung-type 17-H 208-liter containers, and sampled. The pump will be flushed three times with water that will be managed as rinsate. The plastic liner will be removed and disposed of in a manner determined by contaminants found in the rinsate.

11.3.6 Soil Sampling

To determine the extent of any soil contamination from WRAP operations, the soil sampling analyses will be compared to the approved Hanford Site-wide background (DOE/RL-92-24) or an environmental baseline soil sampling program will be conducted for WRAP. If an environmental baseline is necessary, the baseline sampling will be performed before the start of construction or before operations begin. The most likely sources of soil contamination would be an accidental spill or a leak from a waste containment structure, and minor surface soil contamination within the vicinity of the exhaust vents. These leaks or spills will be detected with monitoring instruments. Operational practices will require cleanup as soon as possible, given the nature of the spill or leak. A soil sampling program designed to detect the presence of contaminants will be conducted at the end of cleanup operations. A comprehensive review of records will take place to determine if any past releases of contamination to air and/or soil occurred adjacent to the WRAP building. The soil sampling program could use tools such as hollow stem augers and split-spoon samplers. If contamination is detected, the sampling effort will be extended to determine the extent of contamination, and the contaminated soils will be removed and disposed of appropriately. As a minimum, soil samples will be collected in areas with documented or potential soil contamination.

11.3.7 Sampling Quality Control

The required quality control procedures will be followed to the extent necessary to adequately control sampling activities. The various quality control procedures are described in the following sections.

11.3.7.1 Data Quality. To ensure quality data, all of the sampling procedures will be conducted in conformance with applicable procedures. All laboratory analyses will be performed in accordance with standard EPA methods described in the most recent edition of SW-846. The analytical laboratory will submit all analytical and quality assurance and quality control procedures to the contractor for approval before samples are analyzed. The EPA guidelines for reporting accuracy, precision, and practical quantification limit specified in the analytical methods will be met.

Quality control of sampling and analysis will be ensured through the use of field duplicates, equipment blanks, field blanks, matrix spike, and matrix/spike duplicates. Quality control of records and documentation will be accomplished by following applicable procedures.

Sampling records to be kept on file include logbooks, daily memoranda, records of meetings and activities concerning the sampling program, and chain-of-custody records. In addition, quality control will be implemented through the recording of field memoranda and logbooks. Before sampling begins, a quality assurance project plan for sampling and analysis at WRAP is completed.

11.3.7.2 Field Quality Control. Field quality control will be accomplished through the use of various sampling duplicates and blanks, as described in the following paragraphs.

Field duplicate samples will be taken for concrete cores and underlying soils. Duplicate samples are independent samples that are collected as close as possible to the same point in space and time. They are two separate samples taken from the same source, stored in separate containers, and analyzed independently. These duplicates are useful in documenting the precision of the sampling process .

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

Wipe sample blanks will consist of filter paper that has been laboratory prepared with the appropriate solution and will be placed in a sample container in the field. Blanks will be collected with the wipe samples to determine if contaminants were introduced by the paper, preparation solution, or sampling environment.

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

Field blanks will consist of pure deionized, distilled water that is transferred to a sample container at the site and preserved with the reagent specified for the analyses of interest. Field blanks will be used to check for possible contamination originating with the reagent or the sampling environment and will be collected daily.

11.3.7.3 Laboratory Quality Control. The contractor laboratory will ensure the integrity and validity of test results through implementation of an internal quality control program. The program will meet the quality control criteria of SW-846. A system of reviewing and analyzing the results of these samples will be maintained to detect problems caused by contamination, inadequate calibrations, miscalculations, improper procedures, or other factors. Standard methods will be used and alternative methods that are developed or adapted will be tested and completely documented. To use alternative methods requires approval by Ecology per WAC 173-303-110(4) and (5). All methods and method changes will be approved by a contractor contracts representative.

The quality control procedures for hazardous chemical analyses will include (as appropriate to each analysis and as specified in Section 1.2 of SW-846) evaluation of blanks, random matrix spikes (for 10 percent of the samples), internal standards, surrogates, and standard calibration curves. Matrix/spike duplicate analysis-in matrix/spike duplicate analysis, predetermined quantities of stock solutions of certain analytes are added to a sample matrix before sample extraction/digestion and analysis. Samples are split into duplicates, spiked and analyzed. The relative percent recovery between the samples as calculated and used to assess analytical precision. Percent recoveries are calculated for each of the analytes detected. Spikes will be added in amounts comparable to the amount of analyte present in the sample. The quality control procedures specific to individual methods will be detailed in the documented analytical procedures from the laboratory and will be included with each batch of samples analyzed.

11.3.8 Closure of Containers

At closure all containers will be processed and removed from WRAP. All mixed waste residue will be removed from the containment system components. Contaminated equipment, floors, walls, loading areas, and soil will be decontaminated or removed. All decontamination equipment and contained rinsate will be tested and disposed of as dangerous waste if contaminated. Sampling and testing will be conducted to ensure that no contamination remains on, in, or around the storage area and containment system.

11.4 MAXIMUM WASTE INVENTORY [I-1c]

Based on current design specifications, the maximum waste inventory at WRAP at any one time should be approximately 131 cubic meters of solid waste. This represents an upper limit volume based on a summation of the total volume of drums and boxes handled in the process. No liquid waste, except labpacks, will be inventoried at WRAP.

11.5 SCHEDULE FOR CLOSURE [I-1f]

Closure of WRAP is expected to begin approximately 25 years after the start of operations. The actual year of closure is unknown but will be based, among other considerations, on availability of waste requiring processing, operational requirements, on aging effects on WRAP. In addition, notification by DOE-RL that the unit or structure(s) will no longer receive waste is a prerequisite of closure.

When a closure date is established for the overall TSD unit, a revised closure plan and schedule will be evaluated, including any additional closure activities required for clean closure. If closure plan modifications

are necessary to achieve clean closure, a revised schedule will be proposed as part of the permit modification package.

For partial closure of the TSD unit, Ecology will be notified in writing that partial closure activities are beginning. The written notification will indicate those portions of the TSD unit being closed.

11.6 CERTIFICATION OF CLOSURE

Professional Engineer (PE) certification of closure will cover only the portions of the WRAP covered by the closure activities proposed (partial closure or closure of the entire unit). The PE certification will occur upon disposition of decontamination generated waste and completion of closure activities. The PE will provide a signed statement that meets the applicable requirements of WAC 173-303-610(6), certifying that the closure activities were performed in accordance with the technical specifications of the approved closure plan. A copy of the PE certification will be transmitted to Ecology and placed in the Administrative Record.

The PE will certify that the unit has been closed in accordance with the approved partial closure plan. The PE certification is to confirm that the activities took place as described. The PE is not responsible for corroborating information on any part of the partial closure plan not addressing activities completed in support of closure.

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12.0 REPORTING AND RECORDKEEPING

Reporting and recordkeeping requirements that could be applicable to the Hanford Facility are described in Chapter 12.0 of the General Information Portion (DOE/RL-91-28). Not all of these requirements and associated reports and records identified in Chapter 12.0 of the General Information Portion are applicable to WRAP. Those reporting and recordkeeping requirements determined to be applicable to WRAP are summarized as follows:

- Contingency plan and incident records (as identified in the General Information Portion):

  - Immediate reporting
  - Written reporting.

- Unit-specific Part B permit application documentation and associated plans

- Personnel training records

- Inspection records (unit)

- Land disposal restriction records

- Waste minimization and pollution prevention.

In addition, the following reports prepared for the Hanford Facility will contain input, when appropriate, from WRAP:

- Quarterly HF RCRA Permit modification report
- Anticipated noncompliance
- Required annual reports.

Annual reports updating projections of anticipated costs for closure and postclosure will be submitted as required by the HF RCRA Permit.

The WRAP Operating Record 'records contact' is kept on file in the General Information file of the Hanford Facility Operating Record (refer to DOE/RL-91-28, Chapter 12.0).

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CONTENTS

13.0 OTHER FEDERAL AND STATE LAWS [J] 13-1

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13.0 OTHER FEDERAL AND STATE LAWS [J]

Federal, state, and local laws applicable to WRAP are discussed in Chapter 13.0 of the General Information Portion (DOE/RL-91-28). Generally, the laws applicable to WRAP include, but might not be limited to, the following:

Atomic Energy Act of 1954
Federal Facility Compliance Act of 1992
Clean Air Act of 1977
Safe Drinking Water Act of 1974
Emergency Planning and Community Right-to-Know Act of 1986
Toxic Substances Control Act of 1976
National Historic Preservation Act of 1966
Endangered Species Act of 1973
Fish and Wildlife Coordination Act of 1934
Federal Insecticide, Fungicide, and Rodenticide Act of 1975
Hazardous Materials Transportation Act of 1975
National Environmental Policy Act of 1969
Washington Clean Air Act of 1967
Washington Water Pollution Control Act of 1945
Washington Pesticide Control Act of 1971
New Source Construction Permits
Model Toxics Control Act
Benton Clean Air Authority Regulation 1
State Environmental Policy Act of 1971.

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14.0 PART B CERTIFICATION [K]

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

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

Date 5/22/98

Co-operator
H. J. Hatch,
President and Chief Executive Officer
Fluor Daniel Hanford, Inc.

Date May 14, 1998

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15.0 REFERENCES 15-1

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15.0 REFERENCES

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4A ENGINEERING DRAWINGS

4B DESIGN CALCULATIONS

7A BUILDING EMERGENCY PLAN FOR WRAP

8A TRAINING

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APPENDIX 2A

TOPOGRAPHIC MAP

APPENDIX 2A

H-13-000002 TOPOGRAPHIC MAP WASTE RECEIVING AND PROCESSING FACILITY

NOTES

1 ON 6-24-89. THE ORIGINAL TOPOGRAPHIC MAP WAS PREPARED
TIONAL MAP ACCURACY STANDARDS.
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CK WERE ADDED BY WESTINGHOUSE HANFORD COMPANY.

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AND USES X (EASTINGS) AND Y (NORTHINGS) COORDINATES.

WASHINGTON STATE PLANE COORDINATES ARE SHOWN IN METERS.

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ET.

WASTE RECEIVING AND PROCESSING FACILITY (WRAP).

THIS MAP IS TO BE USED FOR REFERENCE PURPOSES ONLY
DO NOT USE THIS MAP FOR CONSTRUCTION PURPOSES

	DATE
R. KAMPPI	4-25-91
G.D. TILLEY	5-30-91
J.T. SAMS	5-30-91
R.C. BOWMAN	5-30-91

IMPLEMENTATION

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
Lockhead Martin Hanford Company

WASTE RECEIVING AND PROCESSING FACILITY TOPOGRAPHIC MAP

SIZE F | BLDG. NO. 2336-W | SHEET NO. 1 of 1 | DRAWING H-13-000002 | REV 4

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APPENDIX 3A

WASTE ANALYSIS PLAN FOR WASTE RECEIVING AND PROCESSING FACILITY

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GLOSSARY

ALARA	as low as reasonably achievable
AWMP	alternative waste management plan
CAP	corrective action plan
CFR	Code of Federal Regulations
DOE-RL	U.S. Department of Energy, Richland Operations Office
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
GEA	gamma energy analysis
IPAN	imaging passive/active neutron
LDR	land disposal restriction
MSDS	material safety data sheet
NDA	nondestructive assay
NDE	nondestructive examination
PCB	polychlorinated biphenyl
PES	performance evaluation system
pH	negative logarithm of the hydrogen-ion concentration
PNNL	Pacific Northwest National Laboratory
PPE	personal protective equipment
QA/QC	quality assurance and quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
SWITS	solid waste information tracking system
TRU	transuranic
TSD	treatment, storage, and/or disposal
WAC	Washington Administrative Code
WAP	waste analysis plan
WRAP	Waste Receiving and Processing Facility

METRIC CONVERSION CHART

The following conversion chart is provided to the reader as a tool 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.

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1.0 UNIT DESCRIPTION

The purpose of this waste analysis plan (WAP) is to document the waste acceptance process, sampling methodologies, analytical techniques, and overall processes that are undertaken for dangerous, mixed, and radioactive waste accepted for confirmation, nondestructive examination (NDE) and nondestructive assay (NDA), repackaging, certification, and/or storage at the Waste Receiving and Processing Facility (WRAP). Mixed and/or radioactive waste is treated at WRAP. WRAP is located in the 200 West Area of the Hanford Facility, Richland, Washington (Figures 1-1 and 1-2). Because dangerous waste does not include source, special nuclear, and by-product material components of mixed waste, radionuclides are not within the scope of this documentation. The information on radionuclides is provided only for general knowledge.

1.1 DESCRIPTION OF UNIT PROCESSES AND ACTIVITIES

WRAP (2336-W Building) is a nonland-based unit used for the treatment and storage of waste subject to the *Dangerous Waste Regulations*, Washington Administrative Code (WAC) 173-303. WRAP has a waste shipping and receiving area; NDE and NDA area; process area having enclosures for opening and sorting the contents of waste containers; restricted waste management enclosures for waste sampling and treatment; and process support, sample management, and administrative areas (Figure 1-3 through 1-6).

WRAP is designed for opening, sorting, and sampling to characterize retrieved[1] waste; and to verify the characterization of newly generated[2] containers of transuranic, low-level, and mixed waste. Limited treatment of mixed waste is provided in the process area enclosures, including deactivation (neutralization, cementing, absorption, and controlled reaction with water), stabilization (cementing, absorption, and encapsulation), and amalgamation; volume reduction of waste (i.e., supercompaction); and repackaging of waste.

Management of waste within WRAP is outlined in Figure 1-7. Waste entering WRAP initially is segregated into low-level and transuranic waste types. This segregation is based either on prior knowledge of the waste or on information obtained by performing NDA. Waste generator information on the physical nature of the waste also might be verified by NDE. Boxed waste is brought into WRAP for NDE and/or NDA and is not transferred to the process area. Waste in metal drums brought into WRAP could be examined by NDA or NDE or sent directly to the process area if sufficient information already exists for the waste. Waste intended for processing or additional verification within WRAP is transferred to the process area. Low-level waste is taken to the low-level process gloveboxes and transuranic waste is taken to the transuranic process gloveboxes. The waste is sorted in these gloveboxes into compliant and noncompliant[3] fractions. Compliant waste is waste that can be disposed without further treatment. Field screening and

---

[1] Retrieved waste is defined as waste that has unknown, suspect, or limited characterization contents and has been retrieved from the Hanford Facility (e.g., Low-Level Burial Grounds or from other locations). All retrieved waste, after being characterized, is newly generated waste.

[2] Newly generated waste is defined as waste that has been certified as to content by a generator.

[3] Noncompliant waste refers to materials that cannot be accepted for transportation or disposal without further processing and does not refer to noncompliance with WAC 173-303.

sampling might be conducted within the gloveboxes to perform verification or to establish if a particular item is compliant. Noncompliant items are transferred to the low-level or transuranic restricted waste management gloveboxes. Additional field screening or sampling could occur in these gloveboxes to complete verification or assist in complete characterization of the waste. Noncompliant waste material also could be treated in the restricted waste management gloveboxes to meet land disposal restriction (LDR), 40 Code of Federal Regulations (CFR) 268 or other requirements. If sampling is necessary to verify treatment requirements, this will be conducted in the restricted waste management gloveboxes. Compliant waste, treated waste, and waste awaiting future treatment are transferred out of WRAP. Waste is examined using NDE before leaving WRAP if additional quality assurance (QA) verification is required. NDA is performed on waste exiting WRAP if the waste was sorted or combined such that a new radionuclide inventory must be determined for the waste container.

Additional description can be found in Chapter 2.0 of the *Hanford Facility Dangerous Waste Permit Application, Waste Receiving and Processing Facility* (DOE/RL-91-16).

1.1.1 How Waste is Accepted, Moved, Processed, and Managed

The following sections describe the process for waste acceptance and the different types of information and knowledge reviewed/required during the acceptance process. The process for management of waste is described in Chapter 4.0 of the WRAP dangerous waste permit application documentation (DOE/RL-91-16).

1.1.1.1 Narrative Process Descriptions. The onsite generating units, offsite generators, and treatment, storage, and/or disposal (TSD) units transferring waste to WRAP hereafter are referred to as the 'generator' unless otherwise denoted in this WAP.

Waste that does not meet LDR requirements, as specified in 40 CFR 268 and WAC 173-303-140, is stored in WRAP until the waste is processed for repackaging or further treatment. The WRAP operating record contains information necessary to meet LDR requirements (Sections 2.1.3.2 and 7.4). Containerized waste that is not fully characterized or is awaiting analytical results can be stored in WRAP (DOE/RL-91-16). The Hanford Facility is required to test certain mixed waste depending on the type of treatment standard to ensure that the waste or treatment residuals are in compliance with applicable LDR requirements (Section 2.1.3.2 and 4.5). Such testing is performed according to the frequency specified in this WAP.

1.1.1.2 Waste Acceptance Process. WRAP waste acceptance process consists of following activities:

- Waste Stream Approval. The generator provides information concerning each waste stream on a waste profile sheet. The waste stream information is reviewed against the WRAP waste acceptance criteria. If the waste stream information is sufficient and meets the applicable acceptance criteria, the waste stream is approved. In addition, the initial verification frequency for the waste is determined in accordance with the requirements found in the performance evaluation program (PES) (Section 1.1.1.3). For a more complete description of the waste stream approval process, refer to Section 2.1.1.

- Waste Shipment Approval. The generator provides specific data for each waste container on the container data sheet. The container data are reviewed against the waste profile sheet data and the

WRAP acceptance criteria before being approved for shipment. In addition, the WRAP operating organization determines if any of the containers require verification based on the verification frequency as determined by PES. For a more complete description of the waste shipment approval process, refer to Section 2.1.2.

- Verification. Verification activities include container receipt inspection, physical screening, and/or chemical screening. A percentage of waste shipments and containers are selected for receipt verification during the waste shipment approval process. These containers can be inspected visually, verified by NDE, or sampled for field or laboratory analysis to confirm that the waste matches the waste profile and container data information supplied by the generator. Any discrepancies between the verification results and the waste profile sheet must be resolved before final acceptance at WRAP in accordance with the conformance issue resolution process found in Section 1.1.1.3.3.

1.1.1.2.1 Types of Acceptable Knowledge. When collecting documentation on a waste stream or container, the WRAP operating organization or representative organization, hereafter referred to the 'WRAP operating organization', must determine if the information provided by the generator is acceptable knowledge. Acceptable knowledge requirements are met using any one or a combination of the following types of data:

- Mass balance from a controlled process that has a specified input for a specified output
- Material safety data sheets (MSDSs) on unused chemical products
- Test data from a surrogate sample
- Analytical data on the waste or a waste from a similar process.

In addition, acceptable knowledge requirements can be met using a combination of analytical data or screening results and one or more of the following:

- Interview information
- Logbooks
- Procurement records
- Qualified analytical data
- Radiation work package
- Procedures and/or methods
- Process flow charts
- Inventory sheets
- Vendor information
- Mass balance from an uncontrolled process (e.g., spill cleanup)
- Mass balance from a process with variable inputs and outputs (e.g., washing/cleaning methods).

If the information is sufficient to quantify constituents and characteristics as required by the regulations and WRAP acceptance criteria, the information is considered acceptable knowledge. The WRAP acceptance criteria is defined as the requirements found in the WAP and the associated Part A, Form 3, (DOE/RL-91-16, Chapter 1.0).

1.1.1.3 Description of Waste Profile System. A PES is used to determine initial physical screening frequency of the generator. PES provides a periodic status of an individual generator's performance for waste received. Also, PES provides a mechanism for determining corrective actions and physical screening frequency adjustments when a problem has been discovered after waste has arrived at WRAP.

1.1.1.3.1 Initial Physical Screening Frequency Determination. The initial physical screening frequency is determined based on the following process.

- WRAP operating organization reviews the generator waste profile information to determine the relative potential for misdesignation or inappropriate segregation based on all relevant information, including any previous experience with the generator. Based on this review, WRAP operating organization identifies any concerns associated with the following criteria:

  - documented waste management program
  - waste stream characterization information
  - potential for inappropriate segregation.

- Based on the identification of concerns during the review, the WRAP operating organization establishes the initial physical screening frequency for the new generator's waste stream based on the following criteria:

  - Initial physical screening frequency of, at a minimum, 20 percent: No concerns identified (e.g., cleanup of contaminated soil where the soil has been well characterized and no other waste generation processes are occurring at that location)

  - Initial physical screening frequency of, at a minimum, 50 percent: Concern(s) identified in one criterion (e.g., a facility with many different processes that generate debris that have differing management paths)

  - Initial physical screening frequency of 100 percent: Concerns identified in two or more criteria (e.g., a facility with many different process and questionable segregation controls).

1.1.1.3.2 Monthly Performance Evaluation. A performance evaluation is used to trend a generator's performance and is used to raise the generator's overall physical screening frequency. The evaluation should be objective and should consider the conformance issues documented during the Preshipment Review and Verification functions. These conformance issues are tracked and filed. The conformance report is used to complete the generator evaluation and determine an increase in the following physical screening rate. At no time will physical screening rate exceed 100 percent.

- If the generator fails to provide properly completed and/or correct information and the result of the error would have or did lead to a regulatory violation, the physical screening rate increases by 25 percent per subsequent evaluation.

- If the generator fails to provide properly completed and/or correct information and the result of the error would have or did lead to mis-management of the waste, the physical screening rate increases by 10 percent per subsequent evaluation.

- If the generator provides paperwork inconsistencies or improperly completed and/or incorrect information that results in no mis-management of waste, the physical screening rate increases by 1 percent per 5 evaluations.

1.1.1.3.3 Conformance Issue Resolution. Conformance issues during verification could result in a waste container that does not meet WRAP waste acceptance criteria. If a possible conformance issue is identified, the following actions are taken to resolve the issue.

- WRAP operating organization compile all information concerning the possible conformance issue(s).

- The generator is notified and requested to supply additional knowledge to assist in the resolution of the concern(s). If the generator supplies information that alleviates the concern(s) identified, no further action is required.

- On determination that a conformance issue has been identified, the WRAP operating organization personnel and the generator discuss the conformance issue and identify the appropriate course of action to resolve the container/shipment in question, i.e., pick another sample set, return the container/shipment, divert the container/shipment to another TSD unit that can accept the container/shipment and resolve the issue, or the generator resolves the issue at the TSD unit. If the conformance issue(s) results in the failure of a shipment, the physical screening frequency for all streams from the generator are adjusted to 100 percent until the issue(s) adequately can be addressed.

- On resolution of the initial conformance issue, WRAP operating organization requests the generator to provide a corrective action plan (CAP) that clearly states the reason for the failure and describes the actions to be completed to prevent re-occurrence. The generator could request a reduction in verification of unaffected streams. This request must be accompanied by a justification that identifies why this stream(s) would not exhibit the same conformance issue.

- WRAP operating organization reviews the CAP and stream justification for adequacy. If the CAP is inadequate, the generator remains at a physical screening rate of 100 percent. If the stream justification is adequate, WRAP operating organization could provide an alternative frequency as denoted in Section 1.1.1.3.2.

1.1.2 Process Flow Diagram

Refer to Figure 1-7 for WRAP waste analysis plan flowchart and Section 1.1 for description.

1.1.3 Operating Conditions

The following conditions and constraints apply to waste accepted at WRAP. Only waste contained in 208- and 322-liter metal drums can be received for management in the process area. The waste container weight must be known and proper handing procedures imposed to ensure safe operations. The waste container radiation dose must be known and procedures must ensure that personnel exposure is kept as low as is reasonably achievable (ALARA). The quantity of fissile material within the waste must be determined and must be low enough to prevent a criticality hazard. Liquid waste can be received if packaged in inner glass, metal, or plastic containers and surrounded by sufficient sorbent to sorb twice the amount of liquid present. Containers of waste that cause pressurization must be vented. Radionuclide and dangerous waste constituent

inventories in waste containers must be kept low enough to ensure that personnel emergency exposure limits are not exceeded.

1.2 IDENTIFICATION AND CLASSIFICATION OF WASTE

Waste is accepted for treatment (mixed waste) and/or storage (mixed and dangerous) in WRAP except for the following waste types:

- Bulk liquid waste
- Explosive waste
- Shock sensitive waste
- Class IV oxidizer waste
- Infectious waste.

Refer to DOE/RL-91-16, Chapter 4.0 for precautions that are taken when ignitable, reactive, or incompatible waste is stored.

WRAP manages the following waste types:

- Labpack liquids
- Solids/debris
- Sludges/soils.

These waste types could be classified as transuranic, low-level, mixed, and/or dangerous. Unless otherwise prohibited by this WAP, the waste could exhibit the characteristics of ignitable, toxic, corrosive, and/or reactive. In addition to the waste received at WRAP for verification or processing, WRAP generates mixed and dangerous waste. This waste material consists of items such as personal protective equipment (PPE), rags, and spent equipment contaminated with dangerous cleaning agents, lubricants, paints, or other dangerous materials. Process knowledge, field screening, or sampling and analysis are used as appropriate to characterize these waste materials. Field screening and sampling are in accordance with this WAP and occur at the point of waste generation or at the location where the waste materials are stored.

1.2.1 Dangerous Waste Numbers, Quantities, and Design Capacity

The Part A, Form 3, permit application for WRAP identifies dangerous waste numbers, quantities, and design capacity (DOE/RL-91-16, Chapter 1.0).

1.2.1 Alternative Waste Management Plan

For waste that cannot be stored and disposed in accordance with the requirements set forth in this WAP, an alternative waste management plan (AWMP) could be submitted to the Washington State Department of Ecology (Ecology) for review. Because many activities associated with or necessary to support waste management projects readily would not be predictable, some flexibility in timeframes for submitting, reviewing, and completing waste management plans would be necessary. In general, the following schedules should be observed.

- Submit the AWMP to the Ecology Project Manager at least 120 days before the project is expected to begin. The cover letter would state that "no reply within 45 days constitutes approval".

- Ecology reviews and provides comments (if any) within 45 days after receiving the AWMP.

- On receipt, comments would be resolved through project manager meetings or other workshops as agreed to by the U.S. Department of Energy, Richland Operations Office (DOE-RL) and Ecology. When the AWMP is resubmitted following resolution of Ecology's comments, the same review timeframes would be applicable.

- If no comments are received from Ecology within 45 days after the AWMP is submitted, the plan would be denoted as approved.

These timeframes could be adjusted by mutual agreement to account for project-specific needs and priorities. The AWMP review would ensure the following.

- The project does not endanger human health and the environment.
- The course of action chosen is well justified.

On gaining written or automatic approval, the DOE-RL would proceed as described in the AWMP. Should the plan require revision because of unforseen circumstances, the DOE-RL would resubmit the plan before continuing. On conclusion of the project, the DOE-RL would supply Ecology with a report outlining the activities performed and the results of these activities. During the next permit modification cycle and no later than 1 year, a modification to the WAP would be submitted. Approval for a AWMP that violates a specific prohibition outlined in the WAP is not permitted without first receiving a modification to the permit.

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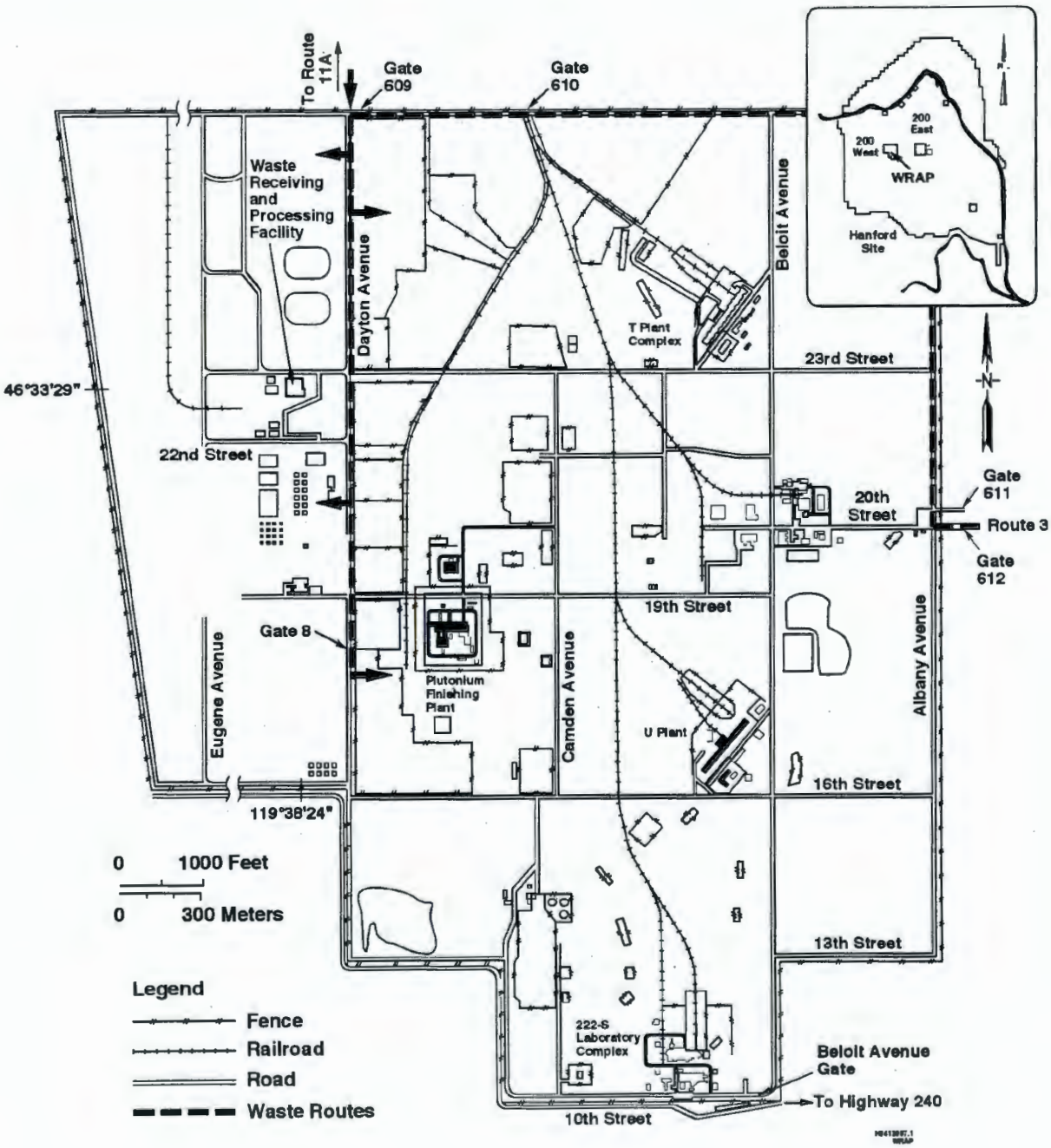


Figure 1-1. 200 West Area Site Plan.

Waste Receiving and Processing Facility (WRAP)

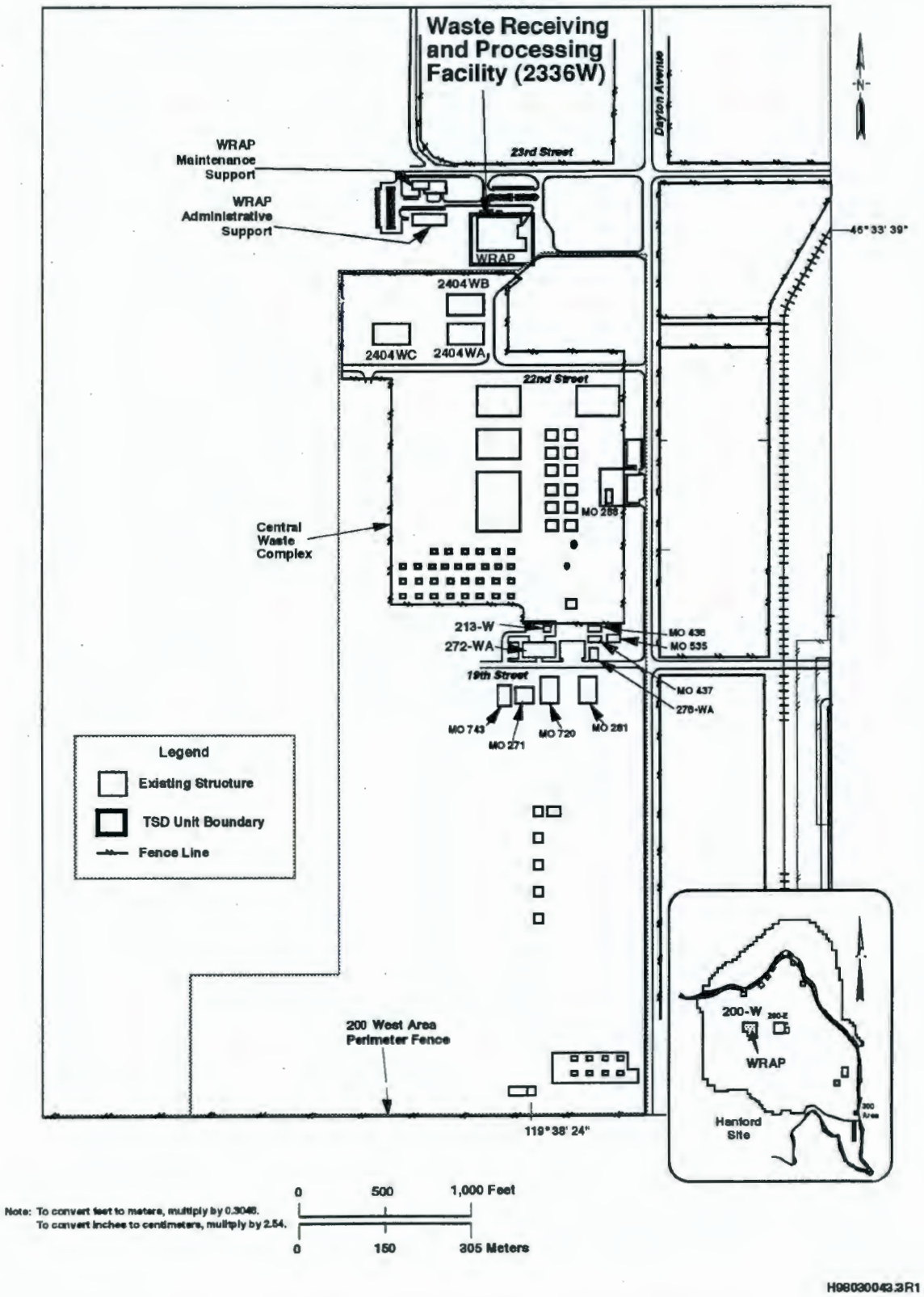


Figure 1-2. Waste Receiving and Processing Facility Location.

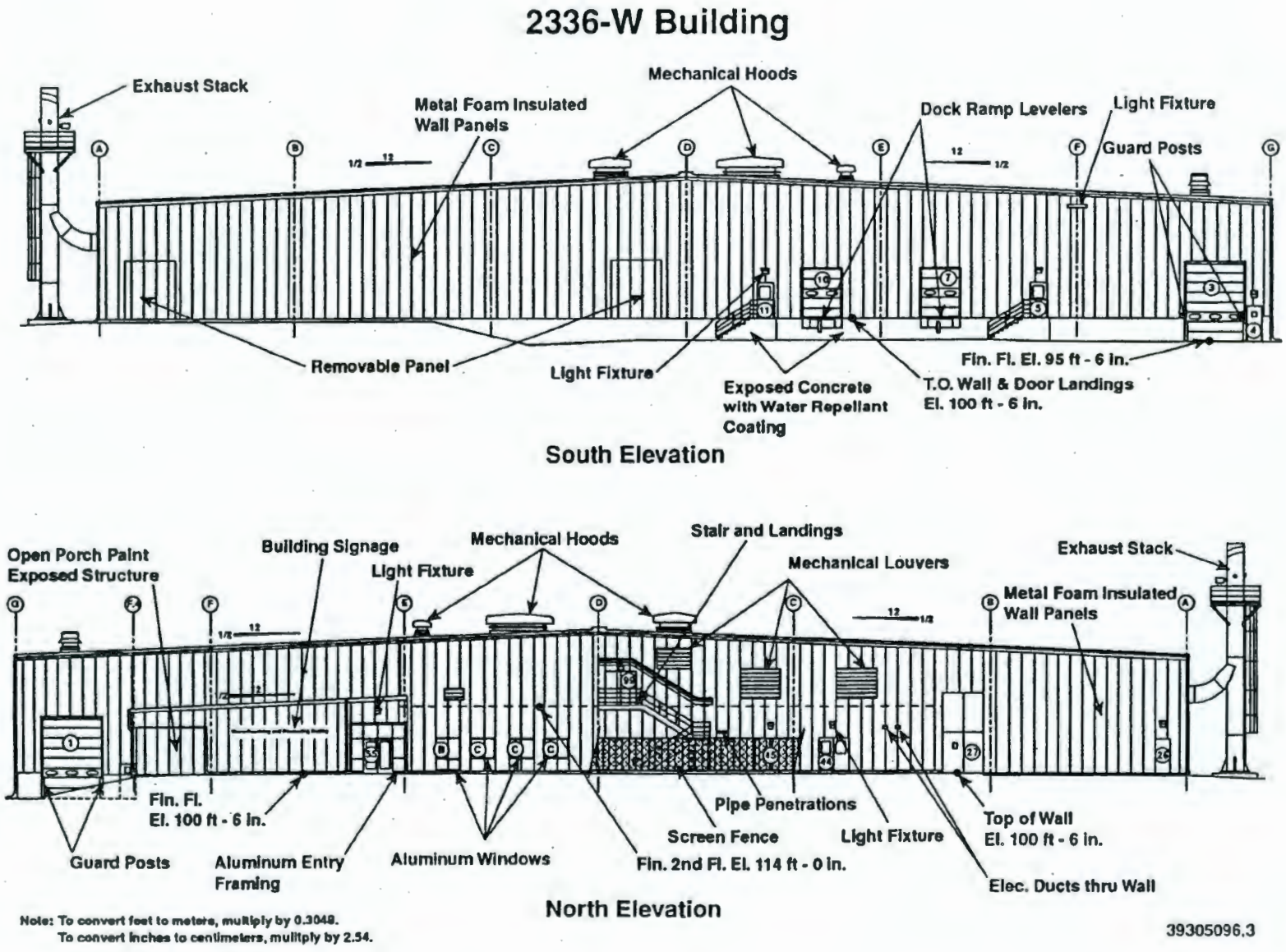


Figure 1-3. Waste Receiving and Processing Facility--2336-W Building (North and South Sections).

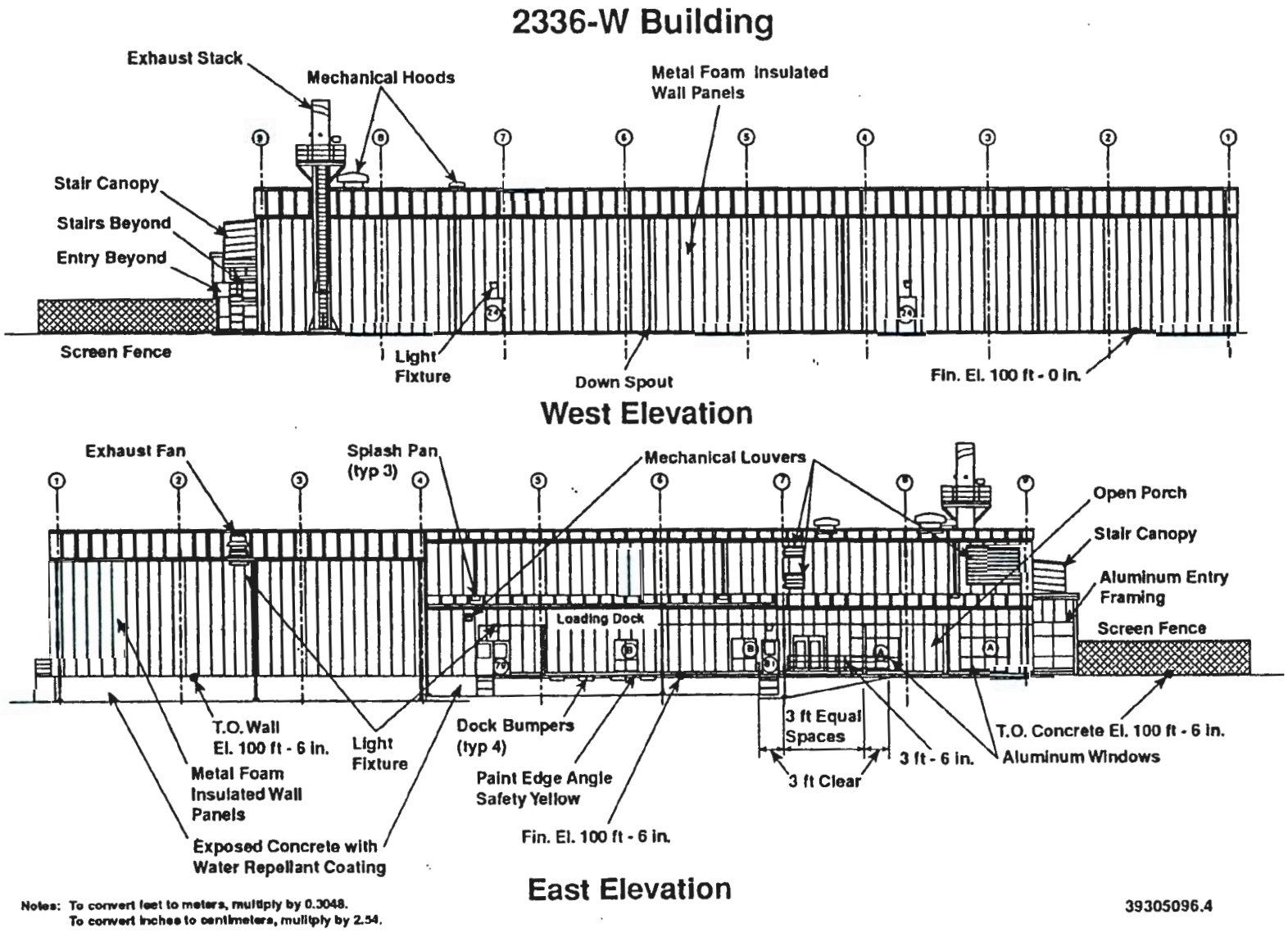


Figure 1-4. Waste Receiving and Processing Facility--2336-W Building (West and East Sections).

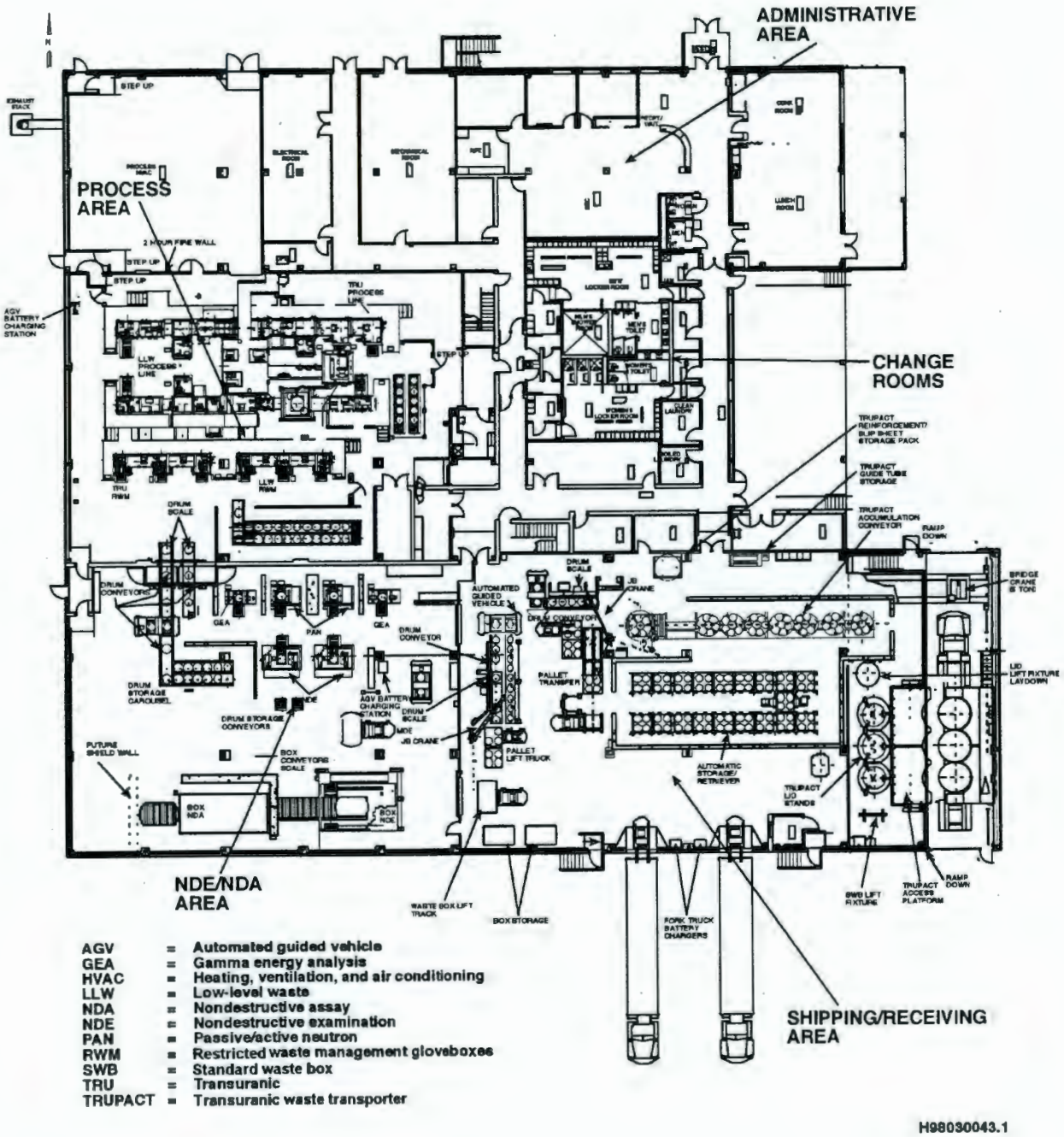
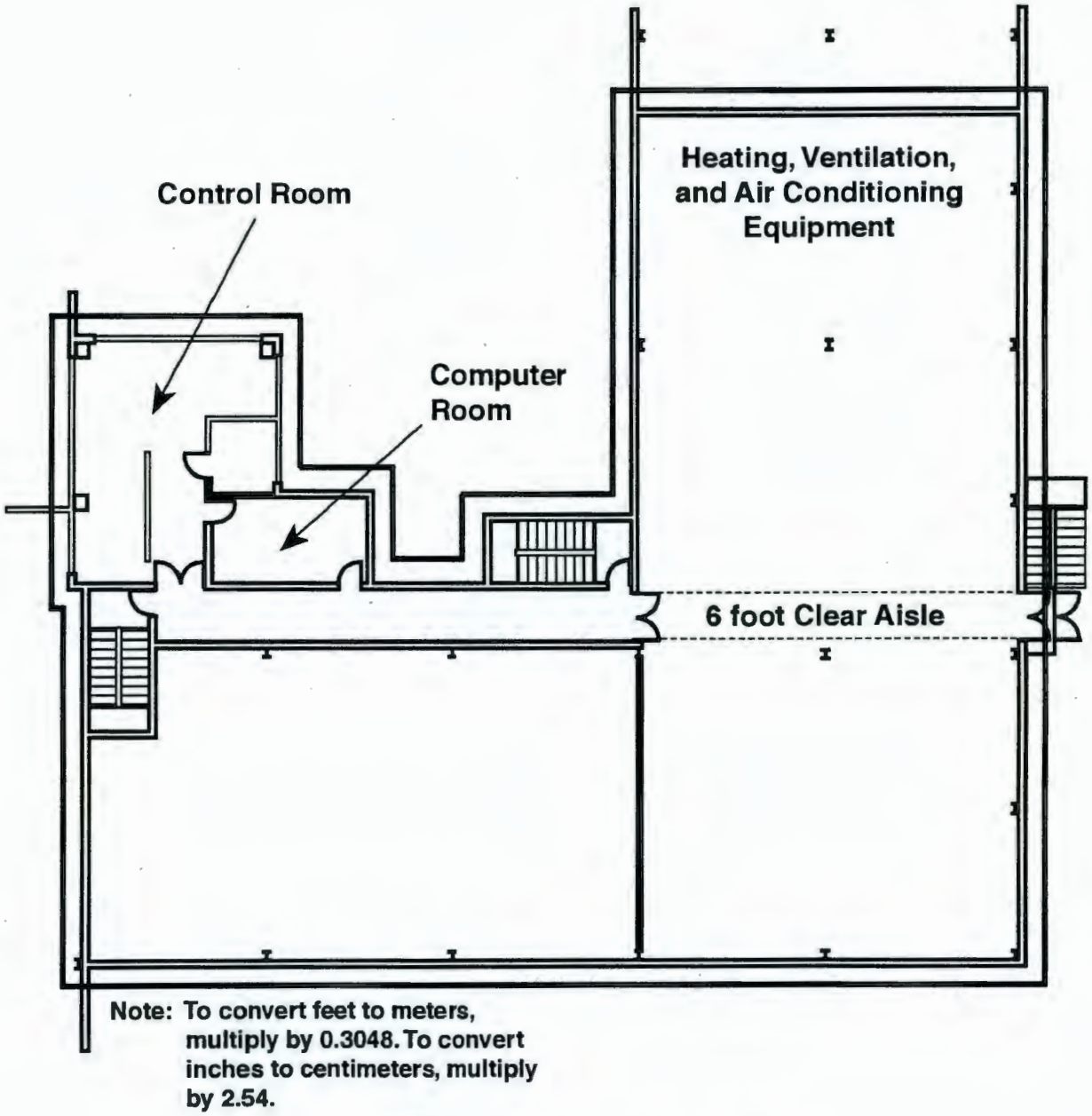


Figure 1-5. Waste Receiving and Processing Facility--2336-W Building Floor Plan.



Plan-Upper Level
(not to scale)

39305096.1R1

Figure 1-6. Waste Receiving and Processing Facility--2336-W Building Upper Level Plan.

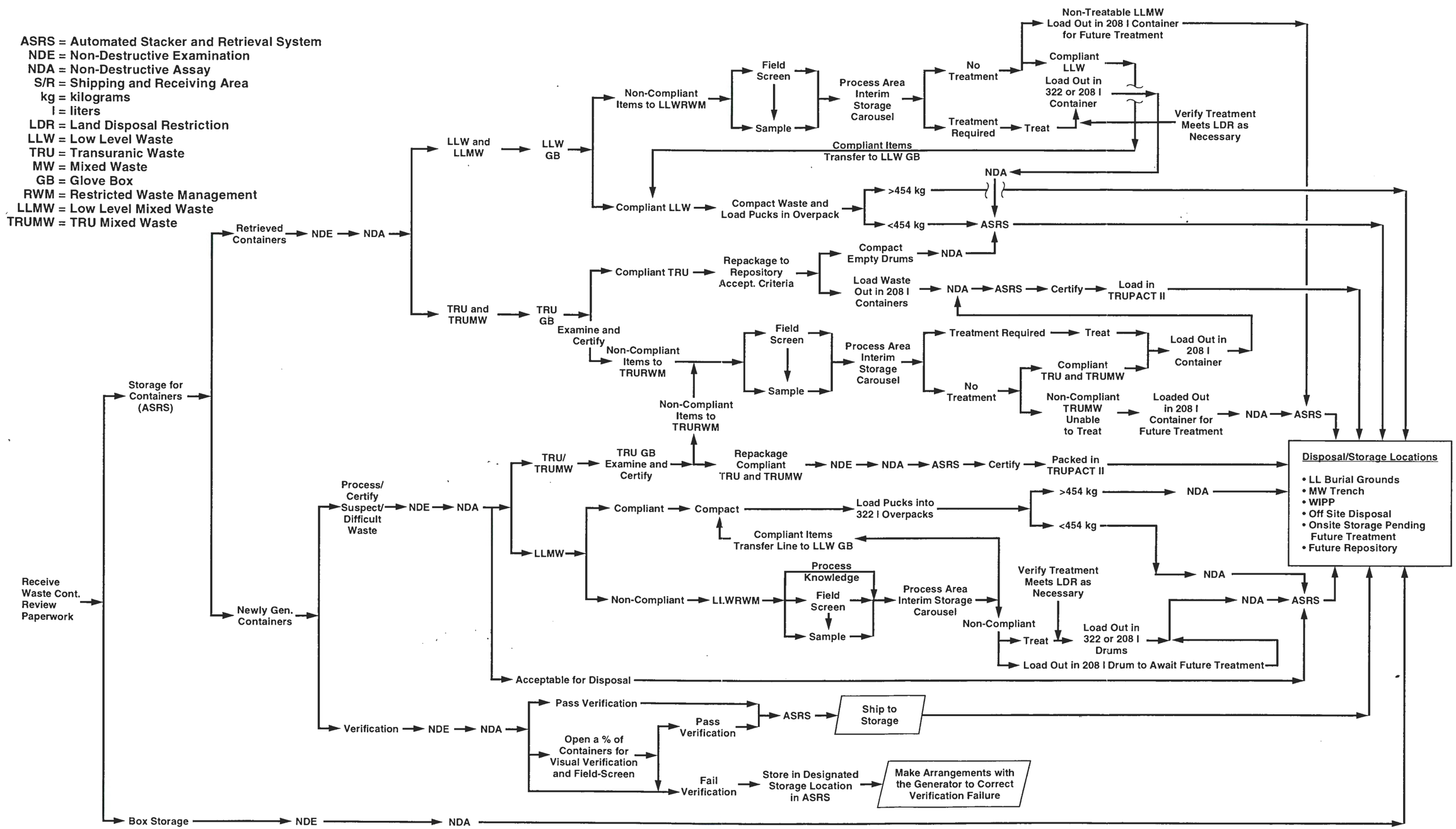


Figure 1-7. Waste Receiving and Processing Facility Waste Analysis Plan Flowchart.

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2.0 CONFIRMATION PROCESS

The confirmation process includes completing appropriate pre-shipment reviews and verification steps and/or parameters. The requirement to confirm appears twice in WAC 173-303-300 and applies to two different scenarios.

Scenario 1: The process that an owner or operator uses to ensure knowledge supplied by the generator or TSD unit is acceptable knowledge to ensure that the waste is managed properly [WAC 173-303-300(1)]. This is accomplished by a pre-shipment review.

Scenario 2: The process that a facility owner or operator receiving offsite facility shipments uses to determine, by analysis if necessary, that each waste received at the facility matches the identity of the waste specified on the accompanying manifest or shipping paper [WAC 173-303-300(3)]. This is accomplished during verification.

2.1 PRE-SHIPMENT REVIEW

Pre-shipment review takes place before waste can be scheduled for transfer or shipment to WRAP. The review focuses on whether the waste stream is defined accurately, meets the WRAP waste acceptance criteria, and the LDR status is determined correctly. Only waste determined to be acceptable for treatment and/or storage is scheduled. This determination is based on the information provided by the generator. The pre-shipment review consists of the waste stream approval and waste shipment approval process. The following sections discuss the pre-shipment review process. The information obtained from the generator during the pre-shipment review, at a minimum, includes all information necessary to safely treat and/or store the waste. The pre-shipment review ensures the waste has been characterized and the data provided qualify as 'acceptable knowledge' (Section 2.1.3).

2.1.1 Waste Stream Approval Process

The waste stream approval process consists of reviewing stream information supplied on a waste stream profile and attached analysis. At a minimum, the profile requests the following information:

- Generator information (e.g., name, address, point-of-contact, phone number)
- Waste stream name
- Waste generating process description
- Radiological knowledge (e.g., classification, reportable radionuclides, characterization method)
- Chemical characterization information (e.g., characterization method(s), chemicals present, concentration ranges)
- Designation information

- LDR information including identification of underlying hazardous constituents if applicable

- Waste type information (e.g., physical state, absorbents used, inert materials, stabilizing agents used)

- Packaging information (e.g., container type, maximum weight, size)

- Attachments could consist of container drawings, process flow information, analytical data, etc.

This information is reviewed against the WRAP waste acceptance criteria to ensure the waste is acceptable for receipt. If discrepancies are found during this review, additional information is requested that could include analytical data or a sample to be analyzed. If the waste cannot be received, the WRAP operating organization will pursue acceptance of the waste at an alternative TSD unit or request the generator to pursue acceptance at an offsite facility.

On determination that the waste is acceptable, the WRAP operating organization assigns the profile to a waste management path and establishes a waste verification frequency based on the requirements found in Sections 1.1.1.3 and 2.2.2.2.

2.1.2 Waste Shipment Approval Process

For each waste transfer or shipment that is a candidate for treatment and/or storage, the generator provides the following information:

- Container identification number
- Profile number
- Waste description
- Generator information (e.g., name, address, point-of-contact, telephone number)
- Container information (e.g., type, size, weight)
- Waste numbers
- Extremely hazardous waste or dangerous waste
- Dose rate information
- Reportable radionuclides and quantities
- Waste composition
- Packaging materials and quantities

The pertinent information is entered into Solid Waste Information Tracking System (SWITS).

Where potential nonconformances exist in the information provided, (i.e., waste characteristics do not match the waste profile information, or additional constituents are expected to be present that do not appear on the documentation), the generator is contacted by the WRAP operating organization or its representative for resolution. Refer to Section 6.0 for discussion on repeat and review frequency.

For each container, a technical review, physical screening determination, and chemical screening determination are performed as follows.

- **Technical review.** The individual container data are compared to the waste profile data to ensure the information is accurate. Every transfer or shipment is reviewed to ensure the waste meets the WRAP waste acceptance criteria.

  Based on waste identification information provided, the waste designation is reviewed to ensure consistency with waste designations per WAC 173-303-070, as well as for technical accuracy to ensure the waste meets the waste acceptance criteria.

  If the transfer or shipment information is found to be acceptable, the WRAP operating organization determines if any of the waste containers will be physically or chemically screened.

- **Physical screening determination.** Containers are chosen based on the methodology described in this section. The first criterion is based on whether pre-shipment review activities (document and characterization review) identify areas of potential concern. The second criterion is reviewing the current physical screening percentage (calculated using the following method) of containers received from said stream from said generator that have been received over the past 12 months as compared to those that have been physically screened. This criterion ensures that the minimum physical screening confirmation rates required by this WAP are met.

  - The number of containers selected for physical screening in shipments is determined by multiplying the total number of containers received during the previous 12 months for that stream including the containers identified in the shipment by the applicable verification rate, rounded up to the next integer. This selected group of containers constitutes a sample set.

  - Individual containers within a shipment are selected based on a review of the contents listed in the associated shipment documentation.

  - Containers are selected at random unless variability within the stream is noted. In this case containers representing different variations are selected (e.g., wood debris vs metallic debris).

- **Chemical screening determination.** Individual containers within a shipment are selected based on a review of the contents listed in the associated shipment documentation. Containers are selected at random unless variability within the stream is noted. In this case, containers representing different variations are selected (e.g., used oil, spent solvent).

On determining whether the shipment will be verified, the shipment is scheduled.

2.1.3 Acceptable Knowledge Requirements

The WRAP operating organization ensures that all information used to make waste management decisions will be based on the requirements found in the following sections. For information determined to be 'acceptable knowledge', the WRAP operating organization must determine if the information is adequate for management of the waste.

2.1.3.1 General Acceptable Knowledge Requirements. Adequate acceptable knowledge requires (1) general waste knowledge requirements, (2) LDR waste knowledge requirements, and/or (3) waste knowledge exceptions.

(1) **General Waste Knowledge Requirements**. At a minimum, the generator supplies enough information for the waste to be treated and/or stored at WRAP. The minimum level of acceptable knowledge consists of designation data where the constituents causing a waste number to be assigned are quantified, and data that address any WRAP operational parameters necessary for proper management of the waste.

Where the available information does not qualify as acceptable knowledge or is not sufficient to characterize a waste for management, the sampling and testing methods outlined in WAC 173-303-110 must be used to determine whether a waste designates as toxic characteristic, corrosive, and/or contains free liquids.

If a generator's process knowledge indicates that constituents, which if present in the waste might cause the waste to be regulated, are input to a process but not expected to be in the waste, sampling and analysis must be performed to ensure the constituents do not appear in the waste. This requirement can be met through chemical screening. This sampling and analysis is required only for initial characterization of the waste stream.

(2) **LDR Waste Knowledge**. Waste is stored in WRAP while awaiting analytical results for LDR requirements. The WRAP operating record contains all information required to document that the appropriate treatment standards have been met or will be met after the waste is treated.

For the purposes of this WAP, a representative sample is required to demonstrate compliance with a concentration-based treatment standard (refer to Section 4.5). Corroborative testing for the sample could be accomplished in the following manner:

- Generators could use onsite laboratories or other laboratories to certify that the waste meets LDR requirements. For waste that does not meet LDR requirements, the generator must supply information on the treatment methods necessary to meet LDR requirements and in accordance with WAC 173-303-380(1)(j)(k)(n)(o).

- The WRAP operating organization uses these analytical data to meet applicable requirements found in 40 CFR 268.7 and WAC 173-303-140(4).

(3) **Waste Knowledge Exceptions**. During waste retrieval from solid waste management unit trenches in the Low-Level Burial Grounds, waste can be transferred to WRAP provided the waste meets the WRAP waste acceptance criteria. In addition, hazardous debris, as defined in WAC 173-303-040, which is managed in accordance with 40 CFR 468.45, is not required to be sampled to meet federal and state-only LDR regulations.

2.1.3.2 Methodology to Ensure Compliance with Land Disposal Restrictions Requirements. All generators are subject to LDR requirements and are required to submit all information notifications and certifications described in WAC 173-303-380(1)(j)(k)(n) or (o). Mixed waste not meeting the treatment standards, but meeting the WRAP waste acceptance criteria, can be stored at WRAP (refer to Chapter 1.0, Section 1.1.1.1). The following are general requirements for offsite notifications or onsite information and supporting documentation.

- The waste is subject to LDR and the generator has treated the waste. The generator supplies the appropriate LDR certification information (40 CFR 268).

- The waste is subject to LDR and the generator has determined that the waste meets the LDR for disposal. The generator develops the certification based on process knowledge, and/or analytical data, and supplies the appropriate LDR certification information necessary to demonstrate compliance with the LDR treatment standards of 40 CFR 268 and WAC 173-303-140. State-only LDRs do not require this type of certification.

- The waste is subject to LDR and requires further treatment to meet applicable treatment standard.

  - The generator supplies additional information concerning the waste and details any treatment necessary to meet applicable treatment standards.

  - If waste is treated to meet state-only or federal LDRs at WRAP, the WRAP operating organization prepares information necessary to meet WAC 173-303-380(1)(k) (refer to Section 7.4).

A representative sample of the waste must be submitted for analysis to ensure that concentration-based LDR treatment standards are met. This sample could be taken by the WRAP operating organization or the generator, and is required to comply with the treatment standards contained in 40 CFR 268.40 and 268.48 for underlying hazardous constituents.

2.2 VERIFICATION

Verification is an assessment performed by the WRAP operating organization to substantiate that the waste received at WRAP is the same as represented by the analysis supplied by the generator for the pre-shipment review. Verification is performed on waste received by WRAP. Verification includes container receipt inspection, physical screening, and chemical screening. Waste is not accepted by WRAP for treatment and/or storage until required elements of verification have been completed, including evaluation of any data obtained from verification activities.

All discrepancies identified during the verification process are resolved in accordance with Section 1.1.1.3.3.

2.2.1 Container Receipt Inspection

The container receipt inspection is a mandatory element of the confirmation process. Therefore, 100 percent of the transfers/shipments are inspected for damage and to ensure the waste containers are those indicated on the documentation. This activity is a mechanism for identifying any document discrepancies or damaged containers before acceptance. The container receipt inspection is performed by the WRAP operating organization at WRAP or at another onsite location. When another onsite location is chosen, the container receipt inspection will be completed within 24 hours of waste receipt.

2.2.2 Physical Screening Process

Physical screening is considered an additional verification element. This section describes the requirement pertaining to methods, frequency, and exceptions concerning the use of physical screening as a

verification activity. Physical screening could be performed before the waste is shipped to WRAP. When screening is performed at a location not within the Solid Waste Project (e.g., Central Waste Complex, T Plant Complex, Low-Level Burial Grounds), tamper resistant seals are applied to each container examined.

2.2.2.1 Physical Screening Methods. Each of the following physical screening methods, listed in order of preference, complies with the requirement to verify a waste. If a method other than 1 or 2 is used, the reasoning behind the method chosen must be documented in the operating record. Choosing method 3 or 4 is not permitted if the basis for choosing 3 or 4 is because the NDE units are not functional.

1. Visual inspection (opening the container)
2. NDE
3. NDA
4. Dose rate profile.

Refer to Section 2.2.5 for quality control pertaining to physical screening.

2.2.2.2 Physical Screening Frequency. Physical screening frequency is 5 percent for onsite generating units, applied per waste stream per subcontractor per year. For offsite generators, the minimum physical screening frequency is 10 percent per waste stream per generator per year. The WRAP operating organization adjusts the physical screening frequency for generators based on objective performance criteria (refer to Section 1.1.1.3.1).

In the event that one of the containers in the original sample set fails, a second sample set of equal size, or a minimum of three additional containers, is selected from the shipment. First and second sample sets are selected using the rationale described in the pre-shipment review section (Section 2.1). A second failure in either the first or the second sample set constitutes failure of the shipment. If the second sample set passes the inspection the single failed container is considered an anomaly and the remainder of the shipment passes verification. All failed containers and shipments are dispositioned via the PES.

2.2.2.3 Physical Screening Exceptions. The following exceptions to the physical screening process outlined previously have been developed.

- Shielded, classified, and remote-handled mixed wastes are not required to be physically screened; however, the WRAP operating organization must perform a more rigorous documentation review and obtain the raw data used to characterize the waste (<1 percent of current waste receipts). Ecology will be notified and have the opportunity to review information on these wastes before shipment. For classified waste, it is necessary to have an appropriate U.S. Department of Energy security clearance and a need to know the information as defined by the classifying organization or agency.

- Waste that physically cannot be screened at WRAP or associated screening facility must be physically screened at the generator location (e.g., large components, containers that can not be opened, are greater than 20 mrem per hour, contain greater than 10 nanocuries per gram of transuranic radionuclides, or will not fit into the NDE unit). Physical screening at the generator location consists of observing the packaging of the waste. If no location can be found to perform the physical screening, no screening is required.

- Waste that is packaged by the TSD unit authorized independent agent are considered to have met the physical screening requirements denoted in this WAP [e.g., WRAP operating organization packaged waste that is transferred to Waste Management Federal Services of Hanford, Inc. managed TSD units or Pacific Northwest National Laboratory (PNNL) packaged waste that is transferred to PNNL operated TSD units]. On closure of the container, tamper-resistant seals must be applied to ensure the integrity of the contents.

2.2.3 Chemical Screening Process

Chemical screening is considered an additional verification element. This section describes methods, frequency, and exceptions for chemical screening. Chemical screening could be performed before the waste is shipped to WRAP. When screening is performed at a location not within the Solid Waste Project, tamper-resistant seals are applied to each outer container examined.

Selection and interpretation of chemical screening methods is conducted by qualified personnel. Unless otherwise noted, tests are qualitative, not quantitative. The objective of screening is to obtain reasonable assurance that the waste is generally consistent with the description in the shipping documentation. The following tests are selected depending on the waste matrix and the applicability of the method. A minimum of three listed screening tests, including pH screening, are conducted on each sample. If less than five of the following methods are selected, the rationale is recorded by the qualified analyst.

- pH
- HOC (chlor-n-oil/water/soil)
- Headspace testing (e.g., lower explosive limit, portable gas chromatograph, flame ionization detector, photoionization detector. Instrument must be appropriate for conditions)
- Peroxide
- Polychlorinated biphenyl (PCB)
- Oxidizer
- Sulfide
- Cyanide
- Paint filter
- Water reactivity.

Refer to Section 2.2.5 for quality control pertaining to chemical screening.

2.2.3.1 Chemical Screening Frequency. At a minimum, 10 percent of the mixed waste containers verified by physical screening (Section 2.2.2.2) must be screened chemically. Although grab samples are acceptable, the WRAP operating organization obtains a representative sample.

Small containers of waste (labpacks), not otherwise identified in the exceptions, packaged in accordance with 40 CFR 264.316, 40 CFR 265.316, and WAC 173-303-161 are screened chemically in accordance with waste stream's chemical screening frequency as determined by PES (Section 1.1.1.3). Inner containers are segregated by physical appearance. At least one container from each group (or three containers if all are similar) are screened chemically.

2.2.3.2 Chemical Screening Exceptions. There are cases in which chemical screening is not required. The exceptions are as follows:

- Small containers of waste in overpacked containers (labpacks) packaged in accordance with WAC 173-303-161 and not prohibited under LDR specified in WAC 173-303-140
- Waste exempted from the physical screening requirements (Section 2.2.2.3) is exempted from chemical screening
- Commercial chemical products in the original product container(s) (e.g., off-specification, outdated, or unused products)
- Chemical containing equipment removed from service, (e.g., ballasts, batteries, etc.)
- Waste containing asbestos
- Waste, environmental media, and/or debris from the cleanup of spills or release of single substance or commercial product or otherwise known material (e.g., material for which an MSDS can be provided)
- Confirmed noninfectious waste (e.g., xylene, acetone, ethyl alcohol, isopropyl alcohol) generated from laboratory tissue preparation, slide staining, or fixing processes
- Hazardous debris as defined in WAC 173-303-040
- Other special-case could be exempted on a case-by-case basis with prior approval by Ecology.

2.2.4 Sampling for Confirmation Screening

Sampling methods will be performed in accordance with WAC 173-303-110(2), with the following exceptions. At all times, a best effort is employed to obtain a representative sample. When a representative sample cannot be obtained, selective sampling is performed at a location in the matrix that visually appears to have the greatest potential for dangerous constituent contamination. The chemical screening methods described in Section 3.0 do not require any sample preservation methods because the screening tests are performed at the time and location of sampling, or as soon as possible thereafter. During the interim period, the samples are stored in a manner that maintains chain of custody and protects the sample composition.

2.2.5 Quality Assurance and Quality Control for Confirmation Process

The following QA and quality control (QC) elements are used by the WRAP operating organization to ensure confirmation activities provide sufficient data to provide an indication that waste received is as described in the shipping documentation.

2.2.5.1 Physical Screening Quality Control. If NDE is used to meet the physical screening requirements, 5 percent per year of the containers that have been nondestructively examined are opened to ensure the method is providing accurate data. Containers opened for other reasons, such as chemical screening or to investigate inconsistencies, could be used to meet this requirement. This requirement is based on the total number of containers reviewed, not on a shipment or general waste stream basis. The WRAP operating organization is required, at a minimum, to meet this requirement over a running 3-month average with a minimum of one container being opened for every month NDE is operated. If the evaluation of NDE shows that a false negative has occurred, a review of the NDE operation is required to determine if the false negative was due to operator error, equipment malfunction, or equipment limitations. Based on the review, corrective actions are required to be implemented before further use of NDE as a physical screening tool.

2.2.5.2 Chemical Screening Quality Control. The following QC elements are used when performing chemical screening parameters.

- Using appropriate sample containers and equipment. New disposable sampling equipment is used whenever possible.

- Using field QA/QC samples.

  - 5 percent of the total number of field samples taken are field blanks and field replicates. The percentage is calculated over a running 12-month period.

  - Field blanks--Field blanks refer to an artificial sample designed to monitor the introduction of artifacts into the sample preparation and analysis process. Typically reagent water is used as a blank matrix. A universal blank matrix however does not exist for solid samples. Results of the field blank analyses checks the water and reagents used for field screening.

  - Field replicates--Field replicates are defined as independent samples collected in such a manner that the samples are equally representative. For confirmation purposes, the field replicate is tested in the field for the same parameters for which the original sample was tested. If the field replicates do not agree, an additional two samples are tested. If the second duplicate pair of samples do not agree, all reagents for the test are checked and the test is not used until corrective action is taken. Replicates are run on an as-needed-basis to meet the requirement stated in this section.

- Equipment Checks

  Test kit reagents are checked regularly as recommended by the manufacturer. Field instrumentation have current calibrations, and reagents that are past their expiration dates, if applicable, are not used.

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3.0 SELECTING WASTE ANALYSIS PARAMETERS

Analytical screening parameters that could be used for waste received at the WRAP for confirmation purposes, waste designation requirements, and LDR requirements are discussed in the following sections.

3.1 PHYSICAL SCREENING PARAMETERS

The following methods could be used to perform physical screening. These methods are listed in order of preference. If a method other than 1 or 2 is used, the reasoning behind the method selection will be documented.

(1) Visual inspection (preferred method for physical screening):

Rationale. This method meets the requirement to ensure consistency between waste containers and the accompanying shipment documentation.

Method: The container is opened and the contents are removed as needed for visual examination. Homogenous loose solids could be probed to determine the presence of material not documented on the shipping documentation, or for improperly absorbed liquids. Visual observations are compared with the applicable profile information and the container specific information in the shipment documentation.

Failure criteria: A container fails the inspection for any of the following reasons; (a) undocumented, improperly packaged, or inadequately absorbed liquids; (b) discovery of prohibited articles or materials listed in Section 1.2; (c) discovery of material not consistent with the applicable waste stream profile; and (d) variability greater than 25 percent by volume in listed constituents (e.g., paper, plastic, cloth, metal).

(2) NDE:

Rationale. This method meets the requirement to ensure consistency between waste containers and the accompanying shipment documentation. This method also is subject to the QA checks listed in Section 2.2.5.1. Containers that are not easily amenable to visual inspection due to physical or radiological content, or facility availability, can be safely and economically examined.

Method: The container is scanned with a NDE system. Data are observed on a video monitor and captured on video tape. Personnel experienced with the interpretation of NDE imagery record their observations. These observations are compared to the contents listed on the shipping documentation.

Failure criteria: A container fails the inspection for any of the following reasons; (a) undocumented, improperly packaged, or inadequately absorbed liquids; (b) discovery of prohibited articles listed in Section1.2; (c) image data not consistent with the applicable waste stream profile; and (d) variability greater than 25 percent by volume in listed constituents (e.g., paper, plastic, cloth, metal).

(3) NDA:

Rationale. This method is available for obtaining data that can be compared with accompanying shipping documentation for consistency on containers that cannot be opened for visual inspection, and cannot be examined by NDE (e.g., high container dose rate, shielding.) The reason for selection of this method is documented.

Method. Radioactive waste is assayed in one or both of two different assay systems. The assay systems include gamma energy analysis (GEA) and imaging passive/active neutron (IPAN). Gamma emitting radionuclides are detected in the GEA assay system. This instrument determines the type and quantity of radionuclides based on their gamma energy spectrum. The IPAN uses passive and active neutron detection to determine the presence of fissionable radionuclides. Passive detection results are equated with Pu-240 and active detection results are equated with Pu-239. The curie amount of low energy gamma emitting radionuclides, other fissile and non-fissile alpha emitting radionuclides, and beta emitting radionuclides are calculated from the GEA and IPAN data and the generator supplied radionuclide information. Radionuclide ratios are calculated by dividing the activity of each radionuclide reported by the activity of the most prominent radionuclide.

Failure criteria. A container fails the assay if the difference between the reported radionuclide ratios and the measured ratios and the reported and measured curie amounts exceed 50 percent. The failure criteria are adjusted based on the density of the waste and the amount of fissionable material present.

(4) Dose rate profile:

Rationale. This method is used to obtain data that can be compared for consistency with the shipment documentation for a container. This method is used only when the previous three methods cannot be performed for technological or ALARA reasons (e.g., container size, weight, shielding, dose rate). The reason for selection of this method is documented.

Method. A portable dose rate meter is used to determine the contact dose rate at six evenly distributed points on the exterior of the waste package. The six readings obtained are recorded and averaged. The average reading is compared with the container contact dose rate recorded on the shipment documentation.

Failure criteria. If the average dose rate observed during the dose rate profile examination differs from that recorded on the shipping documentation by more than 100 percent, the container fails.

3.2 CHEMICAL SCREENING PARAMETERS

The following methods could be used to perform chemical screening.

(1) Ignitability and/or headspace volatile organic compound screening

Rationale: To determine the potential ignitability and the presence or absence of volatile organic compounds in waste, and to ensure personnel adequately are protected. This method is used when containers are opened for inspection. This method can be applied to any matrix.

Method: A sample of the headspace gases in a container is analyzed by one or more of the following types of portable instrumentation: organic vapor monitor, colorimetric gas sampling tubes, or a lower explosive level meter.

Tolerance: High organic vapor readings in matrices not documented as having volatile organic content constitutes failure.

(2) Peroxide screening:

Rationale: To determine the presence of organic peroxides in solvent wastes, to alert personnel to potential hazards, to ensure safe segregation and storage of incompatible wastes, and to confirm consistency with the shipping documentation. The test is sensitive to low parts per million ranges.

Method: A peroxide test strip is dampened with a pipet sample of liquid waste. Solids are tested by first wetting the test strip with water and contacting a small sample of the waste. A blue color change indicates a positive reaction. The color change can be compared with a chart on the packaging to determine an approximate organic peroxide concentration.

Tolerance: Peroxide concentrations greater than 20 parts per million in liquid waste constituents that are known organic peroxide formers not documented as having been stabilized constitutes failure.

(3) Paint filter liquids test:

Rationale: To verify the presence or absence of free liquid in solid or semisolid material.

Method: To a standard paint filter, 100 cubic centimeters or 100 grams of waste are added and allowed to settle for 5 minutes. Any liquid passing through the filter signifies failure of the test.

Tolerance: Failure of the test in waste matrices not documented as having free liquids constitutes failure of the container. Small quantities of condensate trapped in inner plastic liner folds are acceptable.

(4) pH screen:

Rationale: To identify the pH and corrosive nature of an aqueous or solid waste, to ensure safe segregation and storage of incompatible waste, and to confirm consistency with the shipping documentation.

Method: Full range pH paper is used for the initial screening. If the initial screen indicates a pH below 4 or above 10, a pH meter could be used, or a narrow range pH paper. Solids are mixed with an equal weight of water and the liquid portion of the solution is tested. The extractant of the sample is placed on the pH paper and not dipped into the sample.

Tolerance: pH paper for this test has a sensitivity of +/-1.0 pH units. If the pH of a matrix appears to exceed regulatory limits (<2.0 or >12.5) in waste not documented as being regulated for this property, the container fails the test.

(5) Oxidizer screen:

Rationale: To determine if a waste exhibits oxidizing properties to ensure safe segregation and storage of incompatible waste, and to confirm consistency with the shipping documentation. This test can be applied to waste liquids, solids, and semisolids.

Method: Acidified potassium iodide (KI) test paper is applied to solid or liquid waste. A darkening of the paper is a positive indication.

Tolerance: This method is very sensitive to oxidizing properties. A positive indication in a waste that can not be explained by documented constituents constitutes failure.

(6) Water reactivity screen:

Rationale: To determine if the waste has the potential to vigorously react with water, form gases, or other reaction products. This information is used to ensure safe segregation and storage of incompatible waste, and to confirm consistency with the shipping documentation.

Method: Water is added to a sample of solid or liquid waste. The solution is observed for evidence or fuming, bubbling, spattering, or temperature change. These reactions are considered to be positive evidence that the waste is water reactive.

Tolerance: A positive indication in a waste that cannot be explained by documented constituents constitutes a failure.

(7) Cyanide screen:

Rationale: To indicate if waste could release hydrogen cyanide upon acidification near pH 2. This information is used to ensure safe segregation and storage of incompatible waste, and to confirm consistency with the shipping documentation.

Method: To a test tube or watch dish containing approximately 2 milligrams of sample, an equal amount of freshly prepared ferrous ammonium citrate is added. 3 Normal hydrochloric acid is used to reduce the pH of the solution to near 2.0. A deep blue color indicates the presence of cyanide.

Tolerance: A positive indication in a waste that can not be explained by documented constituents constitutes a failure.

(8) Sulfide screen:

Rationale: To indicate if the waste could release hydrogen sulfide upon acidification near pH 2. This information is used to ensure safe segregation and storage of incompatible wastes, and to confirm consistency with the shipping documentation.

Method: Approximately 2 milligrams of sample is added to a watch dish or test tube and enough 3 Normal hydrochloric acid is added to bring the pH down to near 2.0. A sulfide test strip is placed in the solution. If the paper turns brown or silvery black, the presence of sulfides in the sample is indicated.

Tolerance: A positive indication in a waste that can not be explained by documented constituents constitutes a failure.

(9) HOC screen:

Rationale: To indicate whether PCBs or other chlorinated solvents are present in the waste. This information is used to ensure safe segregation and storage of incompatible waste, to confirm consistency with the shipping documentation, and to determine if the waste needs to be managed in accordance with the regulations prescribed in the *Toxic Substance Control Act of 1976*.

Methods: Field organic chlorine tests appropriate to the matrix, such as those offered by the Dexsil Corporation (e.g. Chlor-N-Oil, Chlor-N-Soil) are used. These screening tests are available with several detection limits. At a minimum, the 50 parts per million test is performed on oily matrices.

Tolerance: A positive indication of chlorinated organics in a waste not documented as having chlorinated organic content constitutes failure.

3.3 OTHER SAMPLE AND ANALYSIS PARAMETERS

Sampling and analysis parameters used to meet LDR requirements for waste stored and treated at WRAP are detailed in Attachment A. Refer to Attachment A for parameters, methods, and rationale.

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4.0 SELECTING SAMPLING PROCESSES FOR DESIGNATION

Specific sampling procedures and techniques depend on both the nature of the material and the type of packaging. This section describes the sampling methodology used to obtain representative samples.

4.1 SAMPLING STRATEGIES

Table 4-1 contains waste forms and sample equipment used to sample referenced waste. Sampling of these waste forms is performed in accordance with Table 4-1.

4.2 SAMPLING METHODS

The appropriate personnel are responsible for arranging all sampling and laboratory support for sample analysis. Samples are processed at one of several laboratories qualified to perform analysis of waste samples (refer to Section 5.0). Sampling methods are those described in WAC 173-303 110(2).

The basic sampling sequence is as follows:

- Obtain a unique sample number and complete the sample tag before sampling
- Obtain a precleaned sampler and sample bottles
- Attach sample label to sample bottles
- For sampling liquid waste, a sampler or pipet will be used to sample for two phase liquids. Homogeneous liquids in small containers will be poured into a sample bottle
- For sampling solid waste, use a scoop, trier, or hand auger to obtain a sample of the waste. For large containers of waste, composite several augers or scoops to ensure samples are representative
- Fill sample containers in the following sequence: volatile organics, semivolatile organics, metals, ignitability, pH (corrosivity)
- For solid waste, wipe the exterior surfaces of the sample bottles with a dry rag
- Place samples in an appropriate receptacle for transfer to the laboratory
- Complete the chain-of-custody forms
- Seal and mark the receptacle in accordance with WAC 173-303-071(3)(1)
- Transfer receptacle to the analytical laboratory as appropriate to meet sample holding times
- Properly clean and decontaminate nondisposable sampling equipment or package for return to central sampling equipment decontamination area according to onsite requirements.

4.3 SELECTING SAMPLING EQUIPMENT

Sampling equipment selection is detailed in Table 4-1. Sampling equipment needed to sample waste is maintained and decontaminated as necessary by the WRAP operating organization.

4.4 SAMPLE PRESERVATION

Sample preservation follows SW-846 protocol or other approved sample preservation method for waste in accordance with 62 FR 62079.

4.5 ESTABLISHING QUALITY AND QUALITY CONTROL FOR SAMPLING

The sampling team ensures all samples are labeled with a unique identifier.

Sample collectors prepare a permanent log of sampling activities. Log entries include as appropriate: date of collection, time of collection, location, batch number, sample number, tank number, copy of the chain-of-custody form, sampling methodology, container description, waste matrix (liquid), description of generating process (e.g., decontamination activities), number and volume of samples, field observations, field measurements (e.g., pH, percent lower explosive limit), laboratory destination and laboratory number, and signature. These logs entries are made by the appropriate personnel while the sampling is performed. The logs or copies of logs are maintained by the appropriate personnel after completion of sampling activities.

A chain-of-custody record accompanies samples at all times. The record contains a unique sample number for each sample, date and time of collection, sample type, sample location, methods of transfer, and signatures (or electronic equivalent, e.g., signature password) of the collector and all subsequent custodians.

During all sampling activities, strict compliance with applicable industrial hygiene and safety standards is mandatory. If samplers accidentally contact waste material and sampling personnel, decontamination of sampling personnel is performed immediately. Transportation of samples is performed in accordance with all applicable Hanford Site and U.S. Department of Transportation requirements.

The following QA/QC elements are used by the WRAP operating organization to ensure sampling activities for designation purposes result in acceptable laboratory data:

- Representative sampling methods as defined by WAC 173-303-110(2), 40 CFR 261 Appendix I, and/or SW-846 Chapter 9
- Appropriate sample containers and equipment
- Samples numbered
- Traceable labeling system
- Field QA/QC samples (applicable sampling and analysis plan)

- Equipment calibration (current as appropriate)
- Chain of custody.

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Table 4-1. Waste Receiving and Processing Facility Chemical Screening Sampling Equipment.

Waste form	Reference in SW-846	
	Waste type	Equipment*
Liquids	Free-flowing liquids and slurries	COLIWASA, SW-846, Chapter 9, glass thief or pipet
Solidified liquids	Sludges	Trier, SW-846, Chapter 9, scoops and shovels
Sludges	Sludges	Trier, SW-846, Chapter 9, scoops and shovels
Soils	Sand or packed powders and granules	Auger, SW-846, Chapter 9, scoops and shovels
Absorbents	Large-grained solids	Large trier, SW-846, Chapter 9, scoops and shovels
Wet absorbents	Moist powders or granules	Trier, SW-846, Chapter 9, scoops and shovels
Process solids and salts	Moist powders or granules	Trier, SW-846, Chapter 9, scoops and shovels
	Dry powders or granules	Thief, SW-846, Chapter 9, scoops and shovels
	Sand or packed powders and granules	Auger, SW-846, Chapter 9, scoops and shovels
	Large-grained solids	Large trier, SW-846, Chapter 9, scoops and shovels
Ion exchange resins	Moist powders or granules	Trier, SW-846, Chapter 9, scoops and shovels
	Dry powders or granules	Thief, SW-846, Chapter 9, scoops and shovels
	Sand or packed powders and granules	Auger, SW-846, Chapter 9, scoops and shovels

COLIWASA = composite liquid waste sampler.
* other ASTM approved equipment could be used to collect samples.

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5.0 SELECTING A LABORATORY, LABORATORY TESTING, AND ANALYTICAL METHODS

The following sections discuss selecting a laboratory for analyzing samples for QA/QC elements.

5.1 SELECTING A LABORATORY

The following laboratory QA/QC requirements apply to laboratory analyses of generator waste.

- The daily quality of analytical data generated in contracted analytical laboratories is controlled by the implementation of an analytical laboratory QA plan.

- Before commencement of the contract for analytical work, the laboratory submits their QA plan for approval. At a minimum, the plan documents the following:
  - Sample custody and management practices
  - Sample preparation and analytical methods
  - Instrument maintenance and calibration methods
  - Internal QA/QC measures, including the use of method blanks
  - Sample preservatives used
  - Analyses requested.

When required, replicate testing usually is accomplished by analyzing two samples, one by the generator and another by the WRAP operating organization.

5.2 SELECTING TESTING AND ANALYTICAL METHODS

WRAP identifies the type of testing and analytical method to be used at the laboratory (e.g., for metals analysis, the type of determination method will be stated, such as inductively coupled plasma metals by atomic absorption).

WRAP identifies the decision level necessary for each analytical parameter. If the decision level is found in a regulation, the generator references the regulation.

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6.0 SELECTING WASTE RE-EVALUATION FREQUENCIES

The re-evaluation (repeat and review) frequency to review profile information is yearly, or more often if the waste generation process changes.

WRAP re-evaluates a waste profile if:

- A generator notifies WRAP operating organization that the generating process has changed
- Inspection or analysis indicates that the waste received at WRAP does not match the profile and/or shipping documentation.

When a waste profile is re-evaluated, the WRAP operating organization could request the generator to do one of the following:

- Verify the current waste profile is accurate
- Supply a new waste profile
- Submit a sample for parameter analysis.

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7.0 SPECIAL PROCEDURAL REQUIREMENTS

This section discusses any special process requirements for receiving mixed waste at WRAP.

7.1 PROCEDURES FOR RECEIVING WASTE GENERATED ONSITE

In general, mixed waste received from onsite generator units is managed the same as waste received from offsite generators. Differences include, but not limited to, verification rates, shipping documentation, and LDR requirements.

7.2 PROCEDURES FOR RECEIVING WASTE GENERATED OFFSITE

Waste received from offsite is handled in the same manner as mixed waste received from onsite except as denoted in Section 7.1.

7.3 PROCEDURES FOR IGNITABLE, REACTIVE, AND INCOMPATIBLE WASTE

WRAP accepts ignitable, reactive, or incompatible waste (refer to Section 1.2). The following precautions are taken before ignitable, reactive, or incompatible waste is accepted at WRAP.

- Pre-shipment review and/or chemical screening identifies whether the waste is ignitable, reactive, or incompatible.

- WRAP waste acceptance criteria identifies storage requirements for ignitable, reactive, and incompatible waste, ensuring the waste is stored in a safe manner.

The types of prohibited waste not accepted at WRAP are listed in Section 1.2.

7.4 PROVISIONS FOR COMPLYING WITH FEDERAL AND STATE LAND DISPOSAL RESTRICTION REQUIREMENTS

State-only and federal LDR requirements restrict the land disposal of certain types of waste subject to *Resource Conservation and Recovery Act* (RCRA) *of 1976* and the *Hazardous Waste Management Act*. Waste managed on the Hanford Facility falls within the purview of these LDRs per 40 CFR 268 and WAC 173-303-140. Waste constituents that are subject to LDRs are identified in 40 CFR 268.40 and referenced by WAC 173-303-140. Waste must meet certain treatment standards, as specified in 40 CFR 268.40 and WAC 173-303-140, if the waste is to be land disposed.

Generators (as defined in the regulation and not per Section 1.1.1.1) determine if LDRs apply to the waste based on knowledge or testing [40 CFR 268.7(a)]. Each waste is analyzed for those LDR constituents contained in the listed and characteristic waste numbers identified by the generator, if the generator's knowledge is not sufficient to make a determination. If the LDR waste does not meet the applicable treatment standards, the generator (Section 1.1.1.1) provides with each shipment of waste information stating so, in

accordance with WAC 173-303-380(1)(j)(k)(n) or (o). If the waste meets the standards, the generator must send a certification that the waste meets the treatment standards.

7.4.1 Waste Treatment

Retrieved and newly generated waste is treated to meet LDR as specified in 40 CFR 268.40 and WAC 173-303-140 with the exception of transuranic mixed waste. Transuranic mixed waste is treated to the applicable standards required by Waste Isolation Pilot Plant or other generator requirements. WRAP potentially can pretreat certain waste before shipment to a permitted offsite facility that could perform full treatment of the specific waste to meet full LDR. Waste requiring treatment other than what WRAP can provide is repackaged, labeled, and transferred to a TSD unit for storage pending identification or development of an appropriate treatment.

LDR requirements apply to all mixed waste except a small class of state-only waste. When evaluating the treatability of certain characteristic waste, consideration must be given to any additional underlying hazardous constituents that might be found in the waste. The treatment standards, for the most part, are concentration-based. If the constituent concentrations for the waste fall below those specified in 40 CFR 268.40 and/or 268.48 for underlying hazardous constituents and in WAC 173-303-140, the waste can be land disposed without being treated. If the concentrations exceed these limits, the waste must be treated before disposal.

Specific treatments performed in WRAP include deactivation, encapsulation, stabilization, and amalgamation.

Deactivation is used to remove the hazardous characteristics of the waste due to its ignitability (D001), corrosivity (D002), solid corrosive acid (WSC2), and/or reactivity (D003). Treatment techniques include neutralization, cementing, absorption, controlled reaction with water, and macroencapsulation.

- Neutralization is the primary method of treatment for corrosive waste that has a pH ≤ 2 and/or ≥ 12.5. Examples of bases that could be used as neutralizing agents include sodium hydroxide, calcium hydroxide, or calcium carbonate. Examples of acids that could be used to neutralize bases are hydrochloric acid and sulfuric acid.

- Absorption is the primary method of treatment for ignitable waste, which include waste that is liquid and has a low total organic carbon content (<10 percent). Absorbent material that could be used includes polyacrylates, polypropylene, polymer type, superabsorbent polymer, cellulose, or other absorbent materials meeting various disposal requirements.

- Cementing or grouting is the primary method of treatment for ignitables consisting of metal fines or other corrosive materials. These types of waste are deactivated by mixing and binding it with an inert cementacious material.

- Controlled reaction with water is the primary method of treatment for reactive materials such as sodium metal. This process will deactivate the material and allow for further disposition.

- Macroencapsulation with polyethylene plastic containers is the primary treatment for debris. For elemental lead, macroencapsulation is performed in accordance with Table 1 of 40 CFR 268.42.

Stabilization methods used at WRAP include cementing or grouting, sealing, and absorption. Particulates and/or liquid waste containing hazardous constituents could be cemented or grouted in WRAP to meet either RCRA LDR, Waste Isolation Pilot Plant waste acceptance criteria, and/or the disposal criteria of future TSD units. These types of waste are stabilized by mixing and binding the waste with an inert material. The inert material generally used is Portland cement. When dealing with some waste streams such as sludges that might contain an inconsistent or excess liquid content, absorbent could be added to the waste to provide a drier matrix to allow identification of the proper combination of ingredients to ensure a successful stabilization effort.

Amalgamation of liquid elemental mercury (D009) is achieved using inorganic reagents such as copper, zinc, nickel, gold, and sulfur. The resultant matrix is a nonliquid, solid, or semi-solid visually inspected to verify compliance.

Treatment of state-only extremely hazardous waste (WT01, WP01, and WP03) will be performed in accordance with RCW 70.105.050(2) and/or WAC 173-303-140(4)(a) as applicable.

Waste managed in WRAP is treated to meet either concentration-based treatment standards or technology-based standards. When dealing with underlying dangerous constituents or mixtures, both standards could apply, requiring a treatment train for ultimate compliance to LDR. In most cases, stabilization treatment will be at the end of the treatment train. In some instances, as with the cementing process, treatability studies could be performed to ensure that when the waste is treated, LDR requirements are met.

Grab samples are collected on each batch of concentration-based treated waste to ensure that the treatment process was successful. Methods used to ensure compliance include visual inspection, pH, and toxicity characteristic leaching procedure. For specified technologies, the WRAP operating record will contain information to demonstrate the treatment process was well designed and well operated.

7.4.2 Sampling and Analytical Methods

If waste is sampled and analyzed to demonstrate an LDR has been met, only U.S. Environmental Protection Agency or equivalent methods are used. Waste is analyzed using the methods outlined in 40 CFR 268.40 and WAC 173-303-140(4)(b) or any other reliable method allowed by regulations.

Samples of waste are transferred to the sample management area for packaging and transferred to an onsite laboratory or shipped offsite to a laboratory for analysis. Samples are collected and analyzed in accordance with SW-846 or any other method allowed by regulations. Storage is provided for waste containers while waiting for laboratory analysis results.

7.4.3 Land Disposal Restriction Certification of Treatment

When LDR treatment has been completed and sample results (if applicable per 40 CFR 268.40 and WAC 173-303-140) have verified the LDR treatment is successful, certification of the LDR treatment is required by WRAP. The certification statement is prepared by the WRAP operating organization in accordance with 40 CFR 268.7.

Where a LDR waste does not meet the applicable treatment standards set forth in 40 CFR 268.40 and WAC 173-303-140, or exceeds the application prohibition levels set forth in 40 CFR 268.32 or Section 3004(d) of RCRA, this information is placed in the WRAP operating record, in accordance with WAC 173-303-380(1)(k) and (o).

8.0 RECORDKEEPING

Recordkeeping requirements that are applicable to this WAP are described in Chapter 12.0, Table 12-1, *Hanford Facility Dangerous Waste Permit Application, General Information Portion* (DOE/RL-91-28) and within this WAP.

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H 020131760 002 1/1 4 2336W 0900 11/96 *

H 020131760 003 1/1 4 2336W 0900 11/96 *

H 020131789 001 1/1 4 2336W 0900 11/96 *

H 020131789 002 1/1 5 2336W 0900 11/96 *

H 020131789 003 1/1 4 2336W 0900 11/96 *

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212-32
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9.0 REFERENCES

DOE/RL-91-16, *Hanford Facility Dangerous Waste Permit Application, Waste Receiving and Processing Facility*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-91-28, *Hanford Facility Dangerous Waste Permit Application, General Information Portion*, U.S. Department of Energy, Richland Operations Office, Richland, Washington, revised periodically.

EPA SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* Third Edition, as amended, U.S. Environmental Protection Agency, Washington, D.C.

EPA-600/4-7-020, *Methods for Chemical Analysis of Water and Wastes*, U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio.

62 FR 62079, *Mixed Waste Testing Guidance*, November 20, 1997.

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APPENDIX A

ANALYTICAL PARAMETERS, METHODS, AND RATIONALE FOR WASTE RECEIVED AT WASTE RECEIVING AND PROCESSING FACILITY

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Analytical Parameters, Methods, and Rationale for Waste Received at Waste Receiving and Processing Facility. (sheet 1 of 4)

Parameter		Analytical method[a]	Media type	Rationale for selection of waste acceptance parameters	Rationale for analysis
General chemistry					
Flashpoint		1010/1020	Liquid	To provide documentation for safe storage conditions	To determine regulatory status as D001 waste, to provide proper waste designation and applicability of LDR requirements
pH	Liquid	9040	Liquid, sludge	To indicate the degree of corrosivity for safe handling; to provide for proper waste designation; and to identify waste that might compromise container integrity	To determine regulatory status as D002 waste, to provide proper waste designation, applicability of LDR requirements and state-only requirements.
	Solid	9045c	Solid		
Hydroxide		9040	Liquid	To provide documentation for safe treatment and storage conditions; and to comply with WRAP waste acceptance criteria.	To provide proper waste designation and applicability of LDR requirements.
Water reactivity		Field method	Liquid, sludge	To determine whether the waste has a potential to violently react with water to form gases or generate heat; to provide documentation for safe treatment and/or storage conditions for waste designation; and to comply with WRAP waste acceptance criteria.	To provide proper waste designation; safe storage and management.
Free liquids		9095A	Liquid, sludge, solid	To determine applicability of LDRs and for characterization of appropriate treatment	To determine appropriate state-only LDR status of the waste.
Cyanide		9010B/9012A	Liquid, sludge, solid	For safe storage; for proper waste designation; applicability of LDR; and characterization of appropriate treatment	To provide proper waste designation and applicability of LDR requirements.

Analytical Parameters, Methods, and Rationale for Waste Received at Waste Receiving and Processing Facility. (sheet 2 of 4)

Parameter	Analytical method[a]	Media type	Rationale for selection of waste acceptance parameters	Rationale for analysis
Sulfide	9030B	Liquid, sludge, solid	For safe storage; for proper waste designation; applicability of LDR; and characterization of appropriate treatment	To provide proper waste designation and applicability of LDR requirements.
Organic analyses				
PCBs	8081A/8082	Liquid, sludge, solid	To determine proper waste designation for management of waste in accordance with the *Toxic Substance Control Act of 1976 (TSCA)* and WAC 173-303.	To provide proper waste designation and to meet TSCA and LDR requirements.
Total organic carbon	9060	Liquid, sludge, solid	To determine applicability of LDR and applicability to state-only requirements.	To provide proper waste designation and applicability to state-only requirements, to meet LDR requirements, and comply with WRAP waste acceptance criteria.
Total organic halides	9020B/9021/9022	Liquid, sludge	To determine proper waste designation and applicability to state-only requirements.	To provide proper waste designation and applicability to state-only requirements.
Persistent constituents	9075/9076/9077/ 9211/9212/9214/ 9250/9251/9253			
Total suspended solids	160.2[b]	Liquid, sludge	To determine applicability of LDR and status as a wastewater	To provide applicability of LDR and status as a wastewater.
Volatile organic compounds	1311/8260B	Liquid, sludge, solid	To determine proper waste designation, applicability of LDRs, and characterization of appropriate treatment.	To provide proper waste designation, regulatory status, and applicability of LDR requirements.

Analytical Parameters, Methods, and Rationale for Waste Received at Waste Receiving and Processing Facility. (sheet 3 of 4)

Parameter	Analytical method[a]	Media type	Rationale for selection of waste acceptance parameters	Rationale for analysis
Semivolatile organic compounds	1311/8270A	Liquid, sludge, solid	To determine proper waste designation, applicability of LDRs, and characterization of appropriate treatment.	To provide proper waste designation, regulatory status, and applicability of LDR requirements.
Chlorinated herbicides	8151A	Liquid	Not applicable	To provide proper waste designation and applicability to state-only requirements.
Inorganic analyses				
Arsenic	1311/6010B	Liquid, sludge, solid	To provide for proper waste designation, applicability of LDRs, and for characterization of appropriate treatment.	To determine proper waste designation, regulatory status as a toxic characteristic waste, and applicability of LDR requirements.
Barium	1311/6010B	Liquid, sludge, solid	To provide for proper waste designation, applicability of LDRs, and for characterization of appropriate treatment.	To determine proper waste designation, regulatory status as a toxic characteristic waste, and applicability of LDR requirements.
Cadmium	1311/6010B	Liquid, sludge, solid	To provide for proper waste designation, applicability of LDRs, and for characterization of appropriate treatment.	To determine proper waste designation, regulatory status as a toxic characteristic waste, and applicability of LDR requirements.
Chromium	1311/6010B	Liquid, sludge, solid	To provide for proper waste designation, applicability of LDRs, and for characterization of appropriate treatment.	To determine proper waste designation, regulatory status as a toxic characteristic waste, and applicability of LDR requirements.
Lead	1311/6010	Liquid, sludge, solid	To provide for proper waste designation, applicability of LDRs, and for characterization of appropriate treatment.	To determine proper waste designation, regulatory status as a toxic characteristic waste, and applicability of LDR requirements.

Analytical Parameters, Methods, and Rationale for Waste Received at Waste Receiving and Processing Facility. (sheet 4 of 4)

Parameter	Analytical method[a]	Media type	Rationale for selection of waste acceptance parameters	Rationale for analysis
Mercury	1311/7470	Liquid, sludge, solid	To provide for proper waste designation, applicability of LDRs, and for characterization of appropriate treatment.	To determine proper waste designation, regulatory status as a toxic characteristic waste, and applicability of LDR requirements.
Silver	1311/6010	Liquid, sludge, solid	To provide for proper waste designation, applicability of LDRs, and for characterization of appropriate treatment.	To determine proper waste designation, regulatory status as a toxic characteristic waste, and applicability of LDR requirements.
Selenium	1311/6010	Liquid, sludge, solid	To provide for proper waste designation, applicability of LDRs, and for characterization of appropriate treatment.	To determine proper waste designation, regulatory status as a toxic characteristic waste, and applicability of LDR requirements.
Nickel	6010	Liquid, sludge, solid	To determine applicability of LDRs, and for characterization of appropriate treatment.	To meet LDR requirements.

[a] EPA SW-846, unless otherwise noted.
[b] EPA-600/4-7-020, unless otherwise noted.
LDR = land disposal restriction.
PCB = polychlorinated biphenyls.

APPENDIX 4A

ENGINEERING DRAWINGS

APPENDIX 4A

CONTENTS

H-2-131760, Rev. 4, Sheets 1 through 3 WRAP Module 1 Foundation Plan

H-2-131789, Rev. 4, Sheets 1 and 3 WRAP Module 1 Ground Floor Slab Plan
Rev. 5, Sheet 2

APPENDIX 4B

DESIGN CALCULATIONS

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WMI-S4

TASK NO. 6237.001

SUBJECT BUILDING FOUNDATION

United Engineers & Constructors
A Raytheon Company
Stearns-Roger Division

CALCULATION DISCLOSURE SHEET

SHEET 1 OF ~~66~~ 69

ITEM #	CALC. SHEET #	ITEM DESCRIPTION	CALC. SET REV. # (Item Resolved)	REMARKS
1.	24	ASSUMED FLOOR SURCHAGE ON FOOTINGS AS 500 PSF. TO BE VERIFIED AFTER FLOOR DESIGNS ARE COMPLETED.	1	FLOOR SURCHARGE ON FOOTINGS WAS ALLOWED TO ~~[illegible]~~ be less Than 500 PSF WHEN condition Existed which would make IT unlikely That 500 PSF could EXIST on Floor OVER FOOTINGS.

TOTAL NUMBER OF CALCULATION SET SHEETS ~~66~~ ~~69~~ ~~73~~ ~~80~~ 81 CALC. SET REV. ~~0~~ ~~1~~ ~~2~~ ~~3~~ 4

CALCULATION DONE BY T.S. Trumbell W.L. Warner DATE 11/18/91 11/18/91

CALCULATION CHECKED BY T.S. Trumbell L.H. Bennett W.L. Warner DATE 11/18/91 11/18/91 3/4/93

CONCURRED BY T.S. Trumbell DATE 11/18/91
LEAD DISCIPLINE ENGINEER

WMI-54

A04901081

TASK NO. 6237.001

SUBJECT BUILDING FOUNDATION

United Engineers & Constructors
A Raytheon Company
Stearns-Roger Division

CALCULATION CONTROL SHEET

PROBLEM STATEMENT

DESIGN FOUNDATION FOR THE WRAP MODULE 1 PRE-ENGINEERED METAL BUILDING.

DESIGN BASIS

1. FOUNDATION LOADS FROM CALC SET NO. WMI-51, "BUILDING ANALYSIS"
2. SOIL PROPERTIES FROM GEOTECHNICAL REPORTS FOR THE NON-DRAG-OFF LANDFILL SITE AND THE WASTE VITRIFICATION PLANT SITE AS REFERENCED.
3. CONCRETE: SPECIFIED 28 DAY COMPRESSIVE STRENGTH $F_c' = 3000$ PSI
4. REINFORCING BARS: ASTM A615 GRD 60. ($F_y = 60$ KSI)

TOTAL NUMBER OF CALCULATION SET SHEETS ~~66~~ ~~69~~ ~~73~~ ~~80~~ 81 CALC. SET REV. ~~0~~ ~~1~~ ~~2~~ ~~3~~ 4

CALCULATION DONE BY T.S. Trumbell W.L. Wurm DATE 11/18/91 11/18/91

CALCULATION CHECKED BY T.S. Trumbell A.H. Bennett W.L. Wurm DATE 11/18/91 11/18/91

CONCURRED BY T.S. Trumbell DATE 11/18/91
LEAD DISCIPLINE ENGINEER

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-S4	2	TST	WLW
FINAL	✓	3	DATE 11/18/91	DATE 11/18/91
VOID		4		
SHEET 3 OF 669			DATE	DATE
J.O 6237.001				

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT BUILDING FOUNDATION

CALCULATION SUMMARY

FOUNDATION DESIGN CONSISTS OF SPREAD FOOTINGS WITH PIERS AND GRADE BEAMS FOR COLUMN LINES ON THE PERIMETER OF THE BUILDING AND PIERS ON SPREAD FOOTINGS FOR INTERIOR COLUMN LINES.

FOUNDATION FOOTINGS WERE DESIGNED TO HAVE 1'-0" CLEARANCE TO THE BOTTOM OF THE ASSUMED 6" THICK INTERIOR SLAB-ON-GRADE. IT WAS ANTICIPATED THAT THE FLOOR SLAB MIGHT BE AS THICK AS 1'-0". THE CLEARANCE OVER THE FOOTING WOULD BE 6" IN THIS CASE. A 6" CUSION OF COMPACTED FILL BETWEEN THE SLAB AND FOOTING IS DESIREABLE TO AVOID SLAB CRACKING DUE TO FLOOR SETTLEMENT.

FOOTING THICKNESSES RANGE FROM 1'-0" TO 2'-0" THICK WITH THE MAJORITY 1'-6" THICK. THE THICKER FOOTINGS (2'-0") WERE MADE THICKER TO GAIN WEIGHT FOR UPLIFT RESISTANCE.

GRADE BEAMS ARE GENERALLY DESIGNED WITHOUT FOOTINGS EXCEPT WHERE THEY ACT AS RETAINING WALLS. RETAINING WALLS HAVE BEEN DESIGNED WITH FOOTINGS TO PREVENT OVERTURNING.
GRADE BEAMS ARE GENERALLY SUPPORTED ON SOILS.

COLUMN PIERS APPROXIMATELY 1'-3" SQ. WILL EXTEND FROM FOOTINGS TO THE COLUMN BASE ABOVE THE ADJACENT FLOOR SLAB.

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CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	2	V.L.L.	H.J.F
FINAL	✓	3	DATE 9/3/92	DATE 9.3.92
VOID		4		
SHEET 4 OF 69			DATE	DAT
J.O 6237.001				

REFERENCES

1. CALCULATION SET NO. WMI-51, "BUILDING ANALYSIS, REV. 1 DATED ~~9/11/92~~ 9/16/92 TET 10/23/92
2. REPORT OF GEOTECHNICAL INVESTIGATION PROPOSED HANFORD WASTE VITRIFICATION PLANT HANFORD, WASHINGTON BY DAMES & MOORE, NOVEMBER 15, 1989
3. T.H. WU, SOIL MECHANICS, ALLYN AND BACON, INC, 1966
4. SITE INVESTIGATION REPORT NON-DRAG-OFF LANDFILL SITE LOW-LEVEL BURIAL AREA NO. 5, 200 WEST AREA BY GOLDER ASSOCIATES INC., DEC 4, 1989
5. LETTER FROM D.R. LUCAS, WESTINGHOUSE HANFORD COMPANY TO MIKE WOLTERS UE&C, OCTOBER 18, 1991 (# 9155823)
6. ACI 318-89, BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE
7. ACI DESIGN HANDBOOK, PUBLICATION SP-17 (81)
8. 1988 UBC
9. PROJECT DESIGN CRITERIA FOR PROJECT 6237.001

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD.1

SUBJECT BUILDING FOUNDATION

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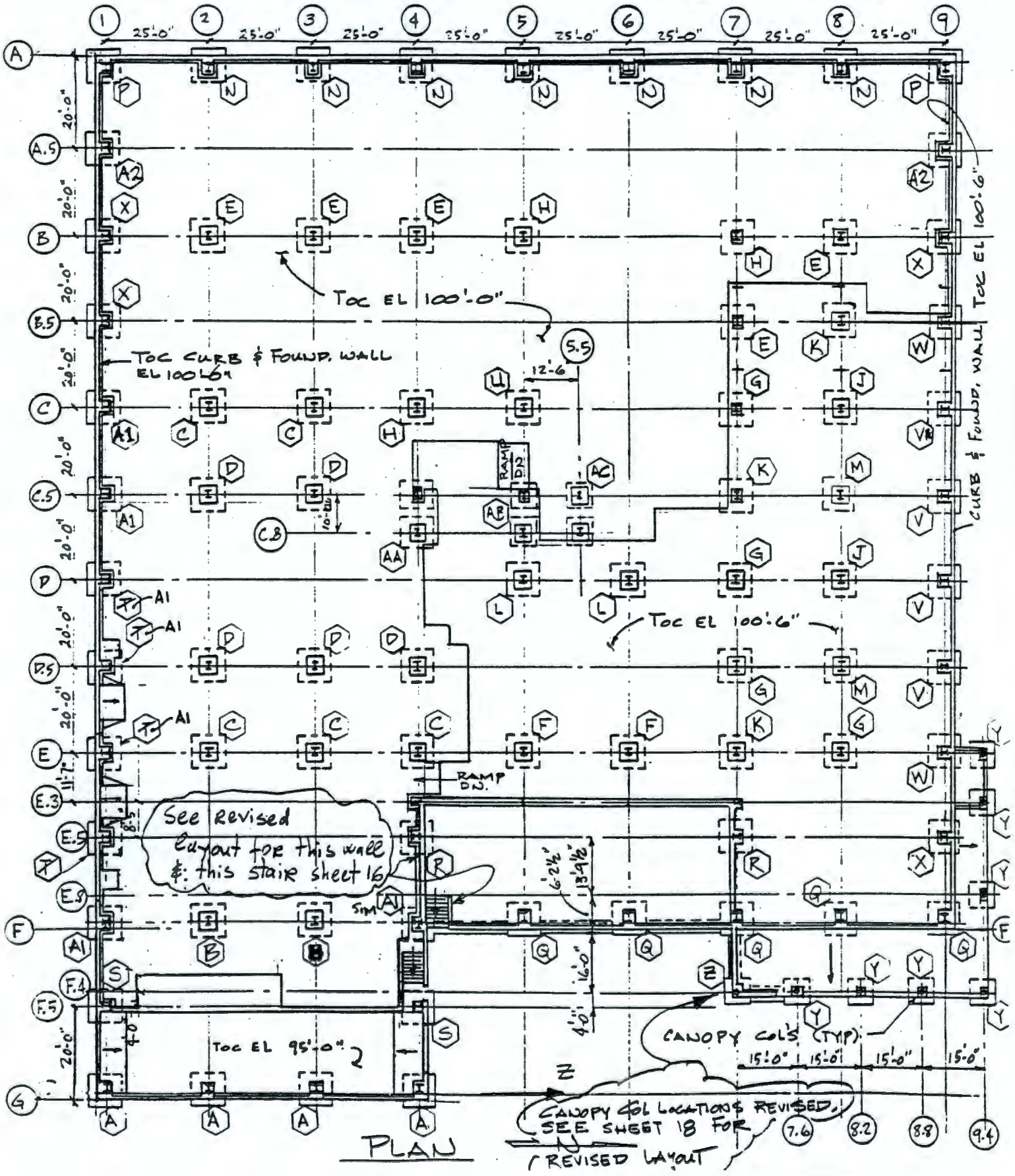
CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-S4	2	V.L.L.	W.J.F.
FINAL	✓	3	DATE 9/3/92	DATE 9.3.92
VOID		4	TST	LHG
SHEET	5 OF 69		DATE 6/8/93	DATE 6/8/93
J.O	6237.001			



PLAN

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TST 5/17/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	3	DATE 9/3/92	DATE 9.3.92
VOID		4		
SHEET 6 OF 69			DATE	DATE
J.O 6237.001				

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT BUILDING FOUNDATION

* (DL+LL) = DL COMBINED WITH LIVE LOAD AND/OR WIND AND SEISMIC LOADS.

FOUNDATION DESIGN LOADS (REF 1, Page 1 To 89)

Jt. No.	Col No.	Load Case	Fx (KIPS)	Fy (DL) (KIPS)	Fy (DL+LL)* (KIPS)	Fz (KIPS)	Remarks
1	G-1	36	0.39	3.85	24.39	11.92	CRANE LOADS NOT INCLUDED
		35	-0.21		-17.85	-11.54	UP LIFT
2	G-2	20	4.25	5.22	38.99	0.21	MAX CRANE LOAD AT "G"
		35	0.65		25.66	-11.91	
		26	3.07		-15.55	7.35	UPLIFT
3	G-3	20	3.67	6.38	26.06	0.35	USE SAME AS COL G-2
		28	-5.25		-2.19	0.38	MAX LAT. LOAD
		25	3.03		-14.66	-6.84	UPLIFT
4	G-4	35	0.37	3.36	23.79	-11.63	CRANE LOADS NOT INC'D
		36	-0.04		-18.09	11.81	UPLIFT
5	F.5-1	15	0.61	4.75	13.69	0.0	
		28	-1.70			3.65	MAX LAT & UPLIFT
6	F.5-4	33	-0.05	4.51	11.13	0.0	
		34	0.05		-3.45	0.0	UPLIFT
7							NEGLIGIBLE LOADS
8							
9							
10							
12	F-1	33	-3.88	4.58	12.09	0.0	CRANE LOAD NOT INCLUDED
		27	1.96		-4.87	3.78	UPLIFT
13	F-2	15	-0.77	8.95	62.24	0.0	MAX. CRANE LOAD AT "F"
		28	0.0			0.0	UPLIFT
14	F-3	15	-0.26	8.89	47.83	0.0	USE SAME AS COL F-2
		27	0.0		-11.10	0.0	UPLIFT
15	F-4	15	0.01	5.87	17.09	-0.03	MAX CRANE LOAD AT COL F-2
		28	-0.16		-2.05	-2.62	MAX UPLIFT

Note 1. Load combinations with wind or seismic cases, except combinations 25 to 28 & 33 to 36, have been reduced by 0.75

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CALC. SET NO.		REV	COMP. BY	CHK'D. BY
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FINAL	✓	3	DATE 9/3/92	DATE 9.3.92
VOID		4		
SHEET 7 OF 69			DATE	DATE
J.O 6237.001				

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT BUILDING FOUNDATION

* (DL + LL) = DL COMBINED WITH LIVE LOAD AND/OR WIND AND SEISMIC LOADS.

FOUNDATION DESIGN LOADS (REF 1, Page 1 To 89)

Jt. No.	COL No.	LOAD CASE	Fx (KIPS)	(DL) Fy1 (KIPS)	(DL+LL)* FY (KIPS)	Fz (KIPS)	REMARKS
16	F-5	20	7.99	4.20	20.10	0.0	
		28	-4.37		-4.57	0.0	UPLIFT
17	F-6	14	7.16	4.17	19.59	0.0	
		28	-3.46		-4.08	0.0	UPLIFT
18	F-7	19	0.0	3.60	11.48	0.0	
19	F-8	14	0.0	6.19	25.86	0.0	
		26	2.32		-5.53	0.0	uplift
20	F-9	14	0.0	3.79	11.58	0.0	
22	E.5-1	20	0.0	4.56	12.11	0.0	
		27	0.0		-0.80	3.91	UPLIFT
23	E.5-4	14	0.0	6.88	23.71	-0.11	-0.14
		27	0.17		-2.56	-3.44	UPLIFT
24	E.5-7	14	0.0	5.66	27.03	0.0	
		28	0.0		-7.06	1.81	UPLIFT
25	E.5-9	14	0.0	3.45	13.73	0.0	
		28	-0.29		-2.86	-1.50	UPLIFT
27	E-1	28	0.0	4.81	-0.55	4.04	MAX LATERAL
28	E-2	20	0.0	6.01	26.28	0.0	
		25	0.0		-6.39	0.0	UPLIFT
29	E-3	15	0.0	6.00	26.29	0.0	$F_{uplift} = -6.41^K$ load 26 $F_x = F_z = 0$
30	E-4	15	-0.01	5.67	21.17	-0.03	
		28	-0.49		-2.62	-0.08	uplift
31	E-5	14	-5.42	9.34	48.94	-0.02	
		27	3.42		-8.35	-0.10	Uplift
32	E-6	14	-6.17	9.39	47.79	0.01	
		25	2.12		-8.28	-0.38	Uplift

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SUBJECT BUILDING FOUNDATION

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 8 OF 69		3	DATE	DATE
J.O 6237.001		4		

* (DL + LL) = DL COMBINED WITH LIVE LOAD AND/OR WIND AND SEISMIC LOADS.

FOUNDATION DESIGN LOADS (REF 1, Page 1 To 89)

Jt. No.	COL No.	LOAD CASE	Fx (KIPS)	(DL) Fy1 (KIPS)	(DL+LL)* FY (KIPS)	Fz (KIPS)	REMARKS
33	E-7	14	1.53	35.54	90.49	-0.01	
34	E-8	14	6.19	34.94	125.39	0.60	
35	E-9	14	0.12	22.64	70.34	-5.04	
		31	0.01		50.44	-12.58	
		35	0.03		28.94	-12.81	max Lateral
37	D.5-1	14	0.0	4.71	12.22	0.0	
		28	0.0		0.64	4.17	MAX LATERAL
38	D.5-2	14	0.0	6.45	29.50	0.0	
		26	0.0		-7.86	0.0	Uplift
39	D.5-3	14	0.0	6.54	29.70	0.0	
		25	0.0		-7.68	0.0	UPLIFT
40	D.5-7	14	0.0	48.87	101.37	0.0	
41	D5-8	14	0.0	43.39	148.39	0.0	
42	D.5-9	14	-0.18	25.26	83.26	-0.09	
43	D-1	15	0.0	4.83	12.56	0.0	
44	D.5-4	20	0.75	7.19	33.65	0.0	
		26	-0.21		-8.95	0.0	UPLIFT
45	D-5	20	0.0	8.37	39.45	0.0	
		27	0.0		10.01	0.0	UPLIFT
46	D-6	14	0.0	9.73	46.07	0.0	
		27	0.0		-11.31	0.0	Uplift
47	D-7	14	0.10	43.93	127.10	0.0	
48	D-8	20	0.36	49.36	185.37	0.0	
49	D-9	20	4.03	26.61	94.09	0.02	
50	C.5-1	34	3.34	4.73	12.03	0.0	
		28	-1.59		-4.41	4.17	UPLIFT

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54		V.L.L.	H.J.P
FINAL	✓		DATE 9/3/92	DATE 9.3.92
VOID				
SHEET 9 OF 69			DATE	DATE
J.O 6237.001				

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT BUILDING FOUNDATION

* (DL + LL) = DL COMBINED WITH LIVE LOAD AND/OR WIND AND SEISMIC LOADS.

FOUNDATION DESIGN LOADS (REF 1, Page 1 To 89)

Jt. No.	COL No.	LOAD CASE	Fx (KIPS)	(DL) Fy1 (KIPS)	(DL+LL)* FY (KIPS)	Fz (KIPS)	REMARKS
51	C.5-2	15	0.0	6.45	29.57	0.0	
		26	0.0		-7.85	0.0	UPLIFT
52	C.5-3	15	0.0	6.56	29.80	0.0	
		25	0.0		-7.68	0.0	UPLIFT
53	C.5-4	14	1.38	26.24	75.82	2.04	
54	C.5-5	14	2.10	38.59	97.43	-1.20	
55	C.5-7	14	4.92	22.29	79.32	0.0	
		33	-19.51		-7.99	0.0	UPLIFT
		34	21.00		45.95	0.0	MAX. LATERAL
56	C.5-8	14	0.0	43.39	148.39	0.0	
57	C.5-9	14	2.40	26.52	83.34	0.03	
		34	19.05		-2.83	0.18	Uplift
		33	-18.51		45.82	-0.16	Lateral
58	C-1	20	0.52	4.69	13.14	0.0	
		27	1.47		-4.51	4.04	UPLIFT
59	C-2	14	0.0	5.81	26.07	0.0	
		25	0.0		-6.54	0.0	Uplift
60	C-3	14	0.0	5.75	25.9	0.0	
		26	0.0		-6.57	0.0	Uplift
61	C-4	14	-1.15	22.52	59.94	-0.05	
62	C-5	20	-3.02	50.67	108.5	-0.06	
64	C-7	34	20.41	33.91	2.24	0.04	
		14	3.07		124.18	0.02	
65	C-8	14	0.36	48.75	182.86	0.02	
66	C-9	14	0.05	25.75	86.53	0.14	

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE - RL UNIT/S WRAP MOD. 1

SUBJECT BUILDING FOUNDATION

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 10 OF 69		3	DATE	DATE
J.O 6237.001		4		

* (DL + LL) = DL COMBINED WITH LIVE LOAD AND/OR WIND AND SEISMIC LOADS.

FOUNDATION DESIGN LOADS (REF 1, Page 1 To 89)

Jt. No.	COL No.	LOAD CASE	Fx (KIPS)	(DL) Fy1 (KIPS)	(DL+LL)* FY (KIPS)	Fz (KIPS)	REMARKS
67	B.5-1	20	0.0	4.56	12.10	0.0	
68	B.5-7	14	0.0	11.22	53.35	0.0	
69	B.5-8	14	0.0	22.68	107.26	0.0	
70	B.5-9	14	0.05	15.06	64.77	0.19	
71	B-1	20	0.0	4.42	11.82	0.0	
		25	0.0		-0.96	2.55	UPLIFT
72	B-2	15	0.0	8.75	41.98	0.0	
		27	0.0		-10.28	0.0	UPLIFT
73	B-3	15	0.0	8.81	42.25	0.0	
		28	0.0		-11.44	0.0	UPLIFT
74	B-4	15	0.0	8.81	44.06	0.0	
		28	0.0		-10.74	0.0	UPLIFT
75	B-5	14	0.0	13.36	61.74	0.0	
		28	0.0		-12.60	0.0	UPLIFT
77	B-7	14	-0.05	13.41	60.88	0.0	
		28	0.45		-12.72	0.0	UPLIFT
78	B-8	14	0.0	8.48	40.52	0.0	
		27	0.0		-9.77	0.0	UPLIFT
79	B-9	14	0.0	4.44	11.98	0.0	
		26	0.0		-0.91	2.56	UPLIFT
80	A.5-1	34	4.08	4.59	13.31	0.0	
		28	-2.05		-5.26	3.65	UPLIFT
		33	-4.06		-5.49	0.0	uplift

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE - RL UNIT/S WRAP MOD. 1

SUBJECT BUILDING FOUNDATION

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 11 OF 69		3	DATE	DATE
J.O 6237.001		4		

* (DL + LL) = DL COMBINED WITH LIVE LOAD AND/OR WIND AND SEISMIC LOADS.

FOUNDATION DESIGN LOADS (REF 1, Page 1 To 89)

Jt. No.	COL NO.	LOAD CASE	Fx (KIPS)	(DL) Fy1 (KIPS)	(DL+LL)* FY (KIPS)	Fz (KIPS)	REMARKS
81	A.5-9	34	10.21	5.37	27.64	0.0	
		28	3.69		-9.13	-3.65	UPLIFT
		33	-9.68		-18.72	0.0	UPLIFT
82	A-1	36	-2.06	3.78	25.42	10.3	
		35	1.76		-19.03	-10.11	UPLIFT & MAX. LATERAL
83	A-2	35	-0.71	5.91	23.17	-10.17	
		36	-0.23		-13.10	10.22	UPLIFT
		26	-3.00		-9.46	3.90	uplift
84	A-3	36	-0.57	6.12	23.15	10.21	
		35	-0.27		-12.78	-10.02	UPLIFT
		27	5.07		-2.29	0.25	uplift
85	A-4	35	-0.68	5.88	23.06	-10.17	
		36	-0.15		-13.03	10.17	UPLIFT
		27	5.06		-3.33	0.35	uplift
		26	-3.01		-9.30	3.84	uplift
86	A-5	14	-2.56	5.96	19.33	0.0	
		27	4.51		-2.54	0.0	UPLIFT
87	A-6	20	-6.17	7.25	25.55	0.49	
		25	-2.21		-10.56	-3.72	UPLIFT
		27	4.88		-3.19	0.14	uplift
88	A-7	35	-0.64	5.98	22.59	-9.90	
		36	-0.27		-12.39	9.87	UPLIFT
		27	4.09		-2.50	0.25	uplift
89	A-8	36	-0.97	6.17	22.7	9.74	
		35	0.03		-12.23	-9.61	UPLIFT
		25	-2.99		-9.22	-3.69	uplift
90	A-9	35	-1.96	2.74	24.17	-9.74	
		34	10.72		-21.32	0.41	UPLIFT

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(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	1	DATE 9/3/92	DATE 9.3.92
VOID		3		
SHEET 12 OF 69		4	DATE	DATE
J.O 6237.001				

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT BUILDING FOUNDATION

* (DL + LL) = DL COMBINED WITH LIVE LOAD AND/OR WIND AND SEISMIC LOADS.

FOUNDATION DESIGN LOADS (REF 1, Page 1 To 89)

Jt. No.	COL No.	LOAD CASE	Fx (KIPS)	(DL) Fy1 (KIPS)	(DL+LL)* FY (KIPS)	Fz (KIPS)	REMARKS
91	C.8-4	15	0.77	7.80	13.37	0.80	
		34	5.47		17.82	0.03	
92	C.8-5	14	0.28	10.73	24.90	-0.48	
93	C.8-5.5	31	0.71	4.46	5.33	-0.71	LATERAL FORCES WILL BE CARRIED BY CONC. BLK SHEAR WALLS (NOT COL).
244	C.5-5.5	20	-0.05	4.04	2.95	0.25	
245		32	-0.32		17.57	7.22	
246		14	0.0		36.96	0.23	
		32	0.0		27.72	8.06	
		36	0.0		9.59	10.62	
247		31	0.0		16.34	-7.03	

FORM 5007 REV. 7/79 **GENERAL COMPUTATION SHEET**

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT BUILDING FOUNDATION

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	3	TST	WLW
FINAL	✓	0	DATE 11/18/91	DATE 11/18/91
VOID		1		
SHEET 13 OF 669		3 4	TST	LHP
J.O 6237.001			DATE 6/8/93	DATE 6/8/93

TST 10/21/91

COLUMN FOUNDATION GROUPS

ALL FOUNDATIONS IN A GROUPING WILL HAVE THE SAME DESIGN FOR COLUMN REACTIONS OF THE MOST SEVERE LOAD CASE.

GROUP NO.		COLUMNS	DESIGN LOADS FOR COL. NO.
A	36.7	G-2, G-3, G-1, G-4, ~~F-1, F-4~~	G-2
B	56.7	F-2, F-3, 56.7 43.2	F-2
C	32.3	E-2, E-3, E-4, C-2, C-3	E-3
D	29.2	D.5-2, D.5-3, D.5-4, C.5-2, C.5-3	D.5-4
E	36.8	B-2, B-3, B-4, B-8, B.5-7	B-5-7
F	43.2	E-5, E-6	E-6
G	120	D.5-7, D-7, E-8, C-7	E-8
H	58	B-5, C-4, B-7, 52 58 32	C-4
J	178	D-8, C-8	D-8
K	86	C.5-7, B.5-8, E-7	E-7
L	40	D-5, D-6	D-6
M	146	D.5-8, C.5-8	D.5-8
N	23	A-2, A-3, A-4, A-5, A-6, A-7, A-8	A-6
P	25 (-21)	A-1, A-9	
Q	24	F-5, F-6, F-7, F-8, F-9	F-8
R		E.5-4, E.5-7	E.5-7

FORM 5007 REV. 7/79 **GENERAL COMPUTATION SHEET**

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT BUILDING FOUNDATION

TST 10/22/91 14

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	2	TST	WLW
FINAL	✓	0	DATE 11/18/91	DATE 11/18/91
VOID		1		
SHEET 14 OF ~~66~~ 69		3	TST	LH
J.O 6237.001		4	DATE 6/8/93	DATE 6/8/93

GROUP No.		COLUMNS	DESIGN LOADS FOR COL NO
S	18	F.5-1, F.5-4	F.5-4
~~T~~	13	~~E.5-1, E-1, D.5-1, D-1~~, (DELETED.)	~~D.5-1~~
U	104.	C-5	C-5
V	87	D.5-9, D-9, C.5-9, C-9	C.5-9
W	68	E-9, B.5-9	E-9
X	27	B-9, B.5-1, B-1, E.5-9	
Y	4	F.4-7.6, F.4-8.2, F.4-8.8, F.4-9A E.8-9.4, E.3-9.4, E-9.4	
Z	4	F.4-7	
A1		C.5-1, C-1, D-1, D.5-1, E-1, E.5-1, F-1, F-4 (SIM) ~~C.5-1~~	C-1
A2		A.5-1 & A.5-9	A.5-9

WCW 10/29/91

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

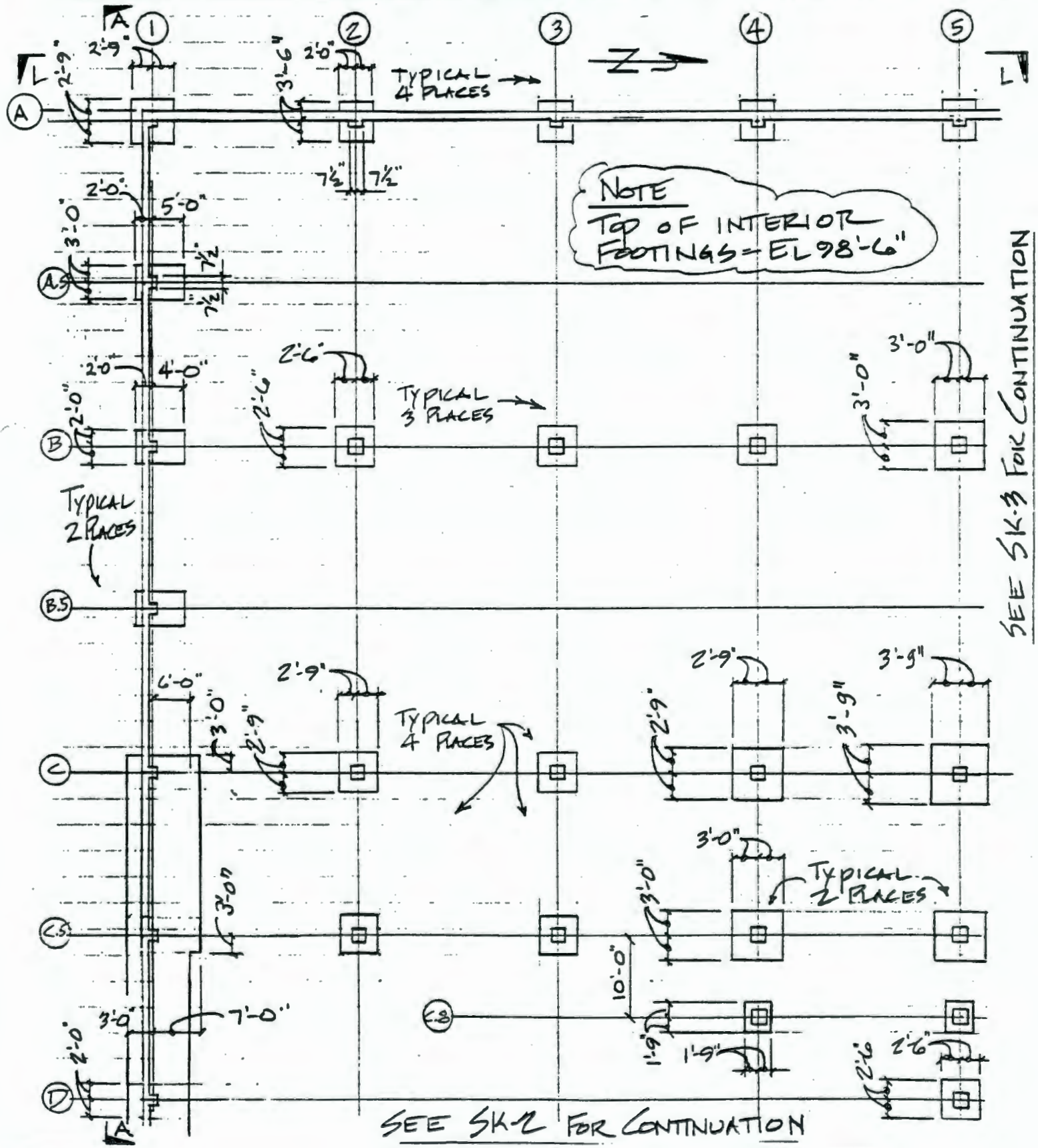
United Engineers & Constructors
A Raytheon Company

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 15 OF 69		3		
J.O 6237.001		4	DATE	DATE

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

PARTIAL PLAN - FOUNDATIONS - SKETCH SK-1 (SLABS NOT SHOWN)



FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

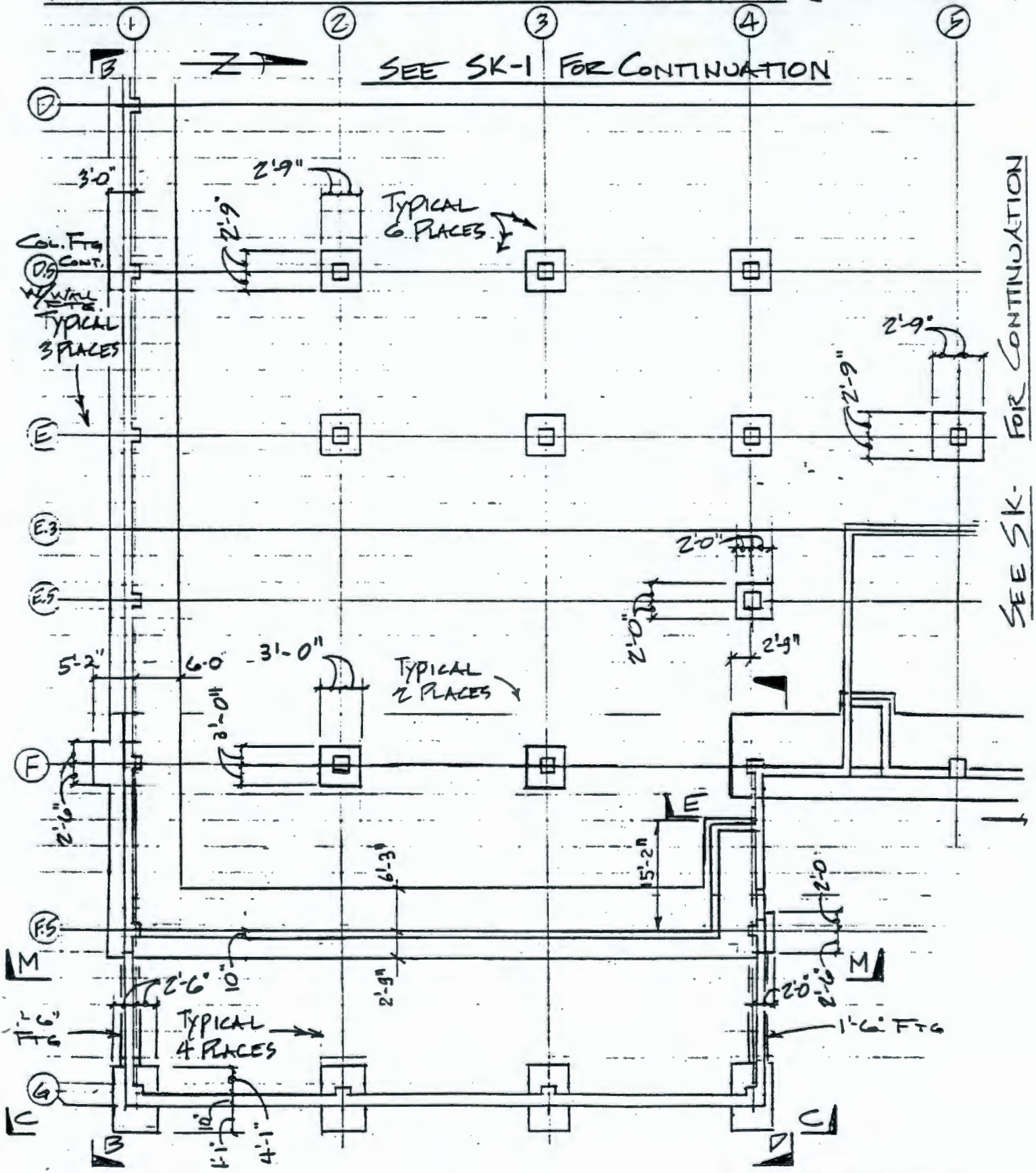
NAME OF COMPANY DOE-RL UNIT/S WRAP Mod 1

SUBJECT BUILDING FOUNDATION

WLW 10/29/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	3	DATE 9/3/92	DATE 9.3.92
VOID		4		
SHEET 16 OF 69			DATE	DATE
J.O 6237.001				

PARTIAL PLAN ~ FOUNDATIONS ~ SKETCH SK-2 ~ (SLAB NOT SHOWN)



FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

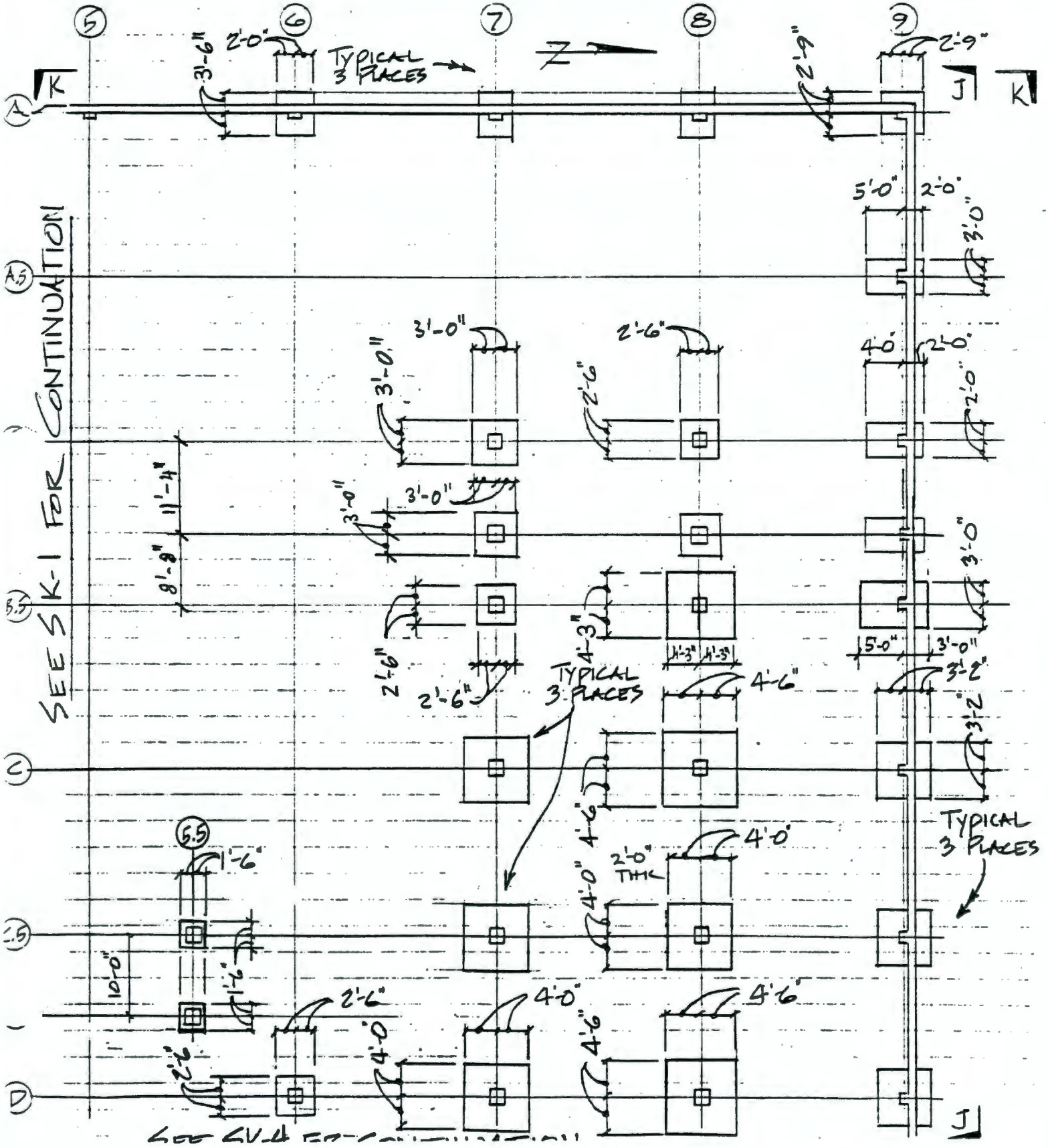
NAME OF COMPANY DOE-RL UNIT/S WRAP Mod 1

SUBJECT BUILDING FOUNDATION

WLW 10/29/9

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 17 OF 69		3		
J.O 6237.001		4	DATE	DATE

PARTIAL PLAN-FOUNDATIONS-SKETCH SK-3 - (SLAB NOT SHOWN)



FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

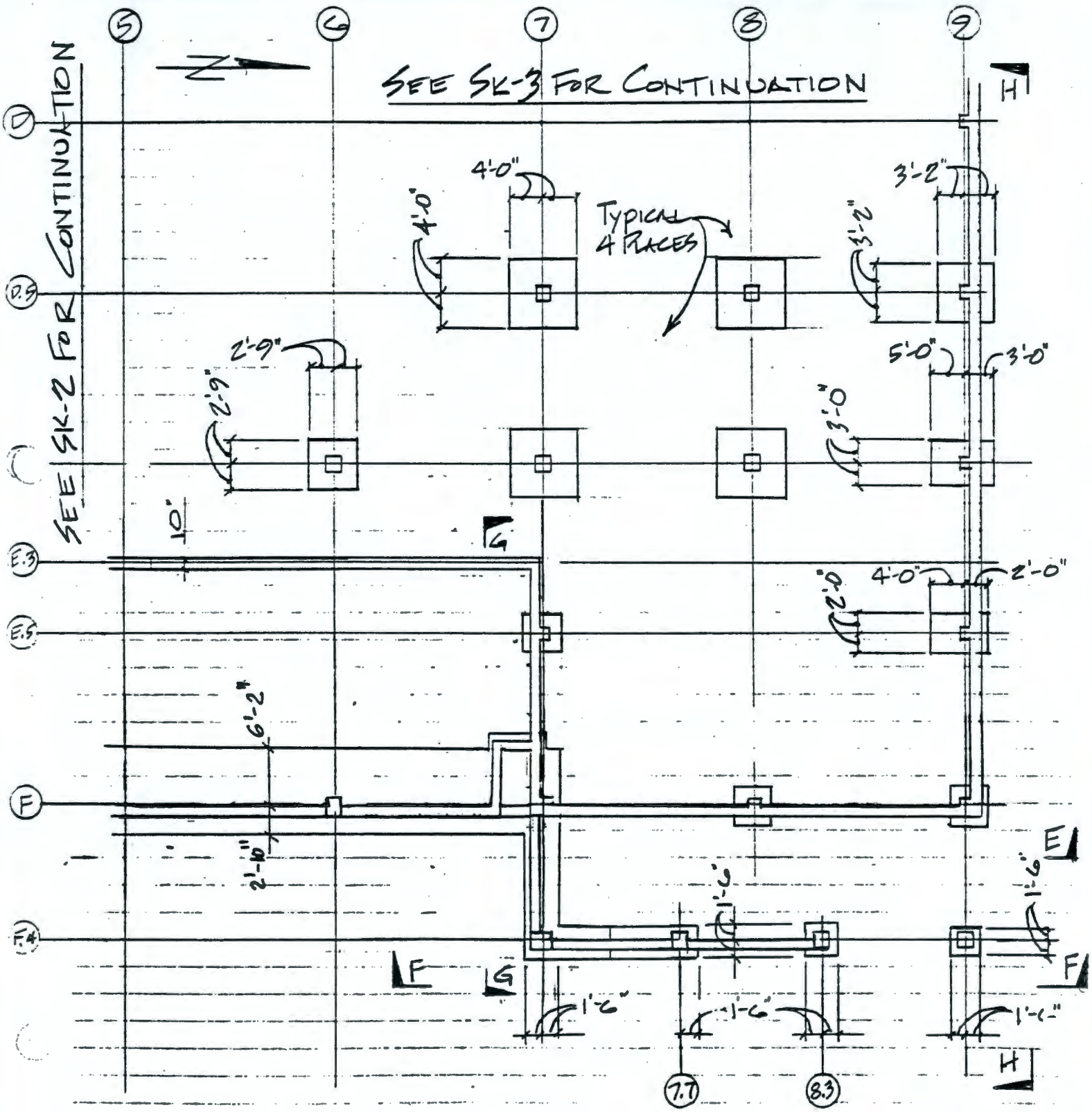
NAME OF COMPANY DOE - RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

WLW 10/31/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	J.J.F.
FINAL	✓	1	DATE 9/3/92	DATE 9.3.92
VOID		3		
SHEET 18 OF 69		4	DATE	DATE
J.O 6237.001				

PARTIAL PLAN - FOUNDATIONS - SKETCH SK-4 - (SLAB NOT SHOWN)



FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

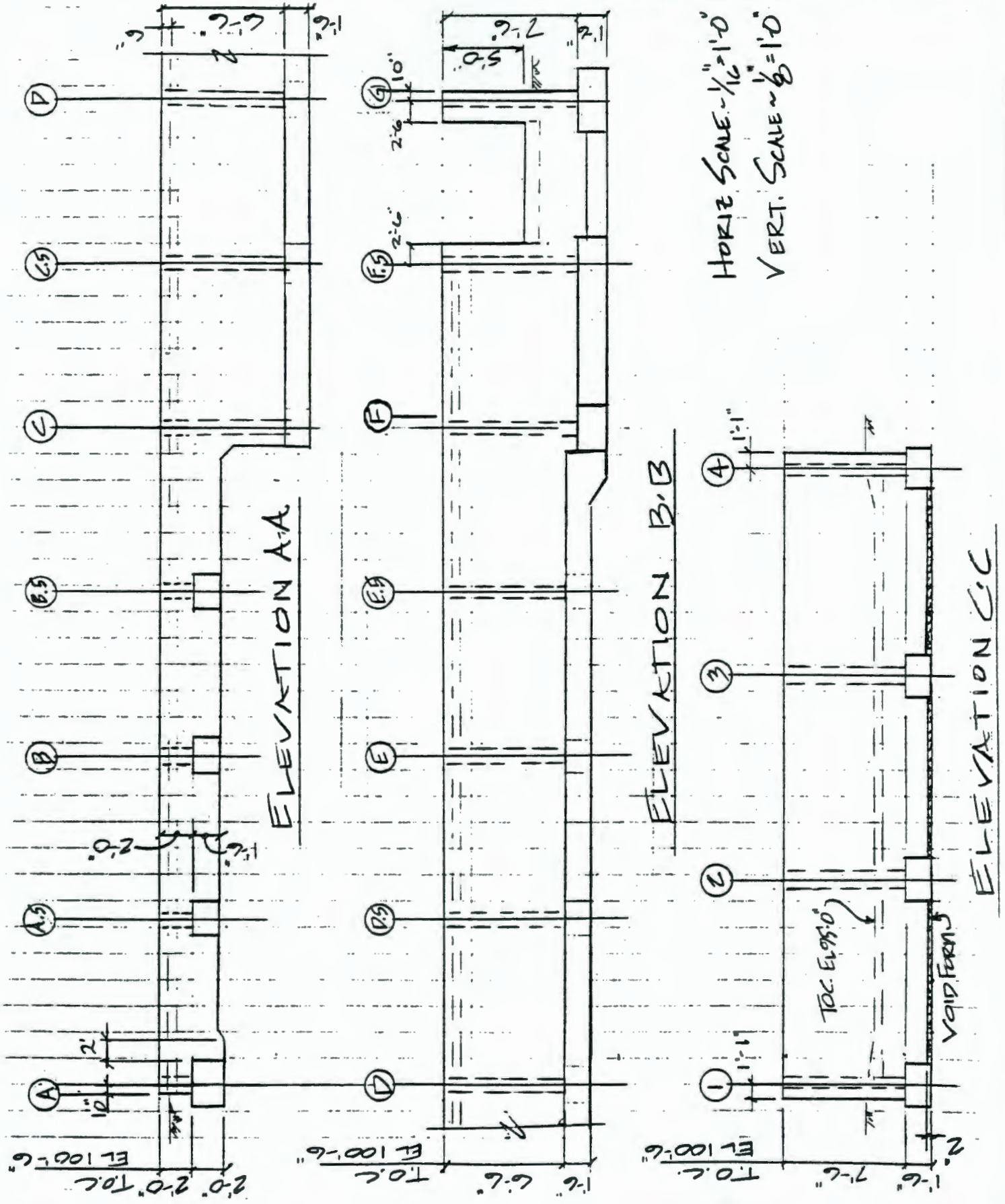
United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

WLW 10/31/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	3	DATE 9/3/92	DATE 9.3.92
VOID		4		
SHEET 19 OF 69			DATE	DATE
J.O 6237.001				



WCW 10/31/91

FORM 5007 REV. 7/79 **GENERAL COMPUTATION SHEET**

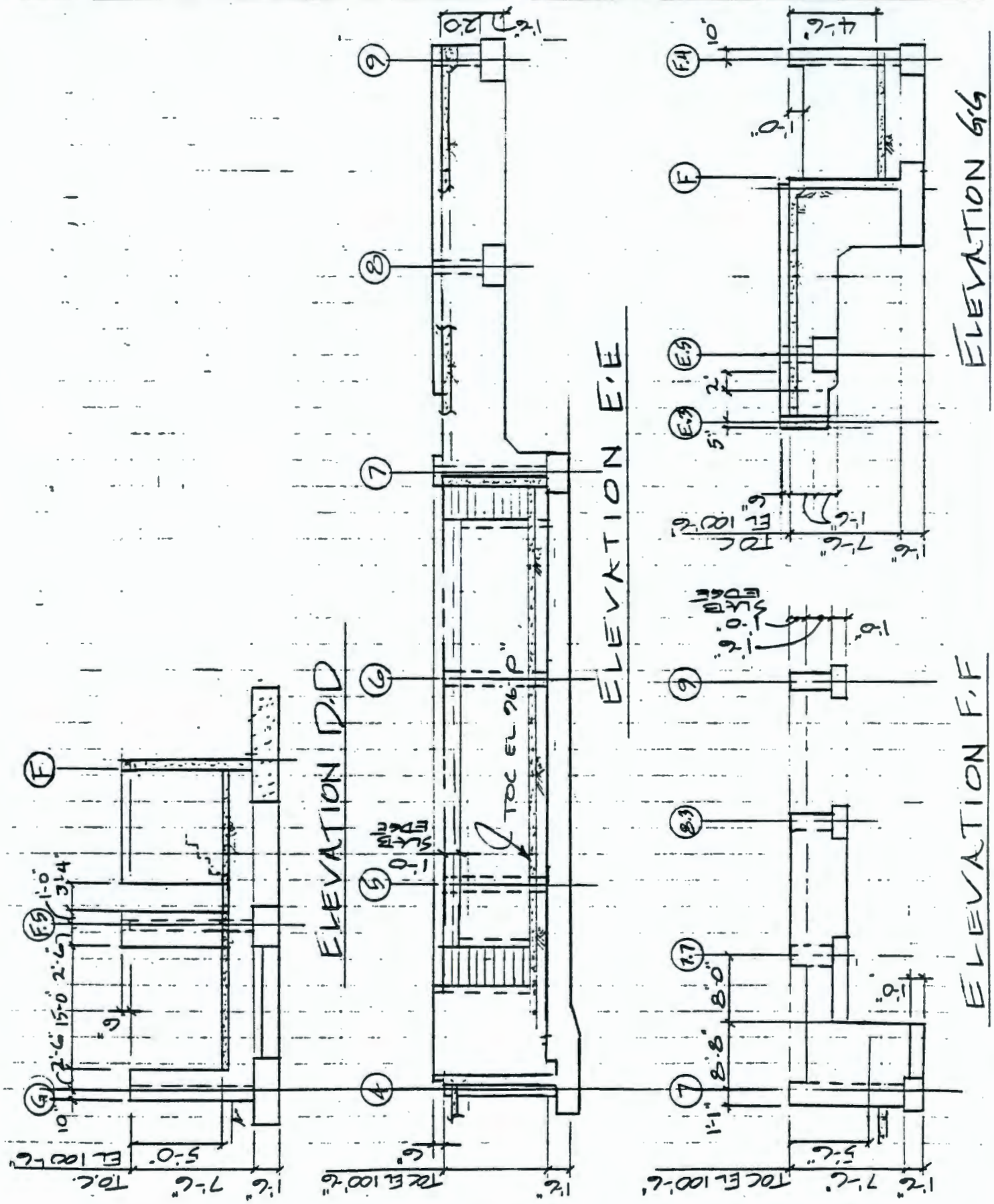
(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE - RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 20 OF 69		3 4	DATE	DATE
J.O. 6237.001				



FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

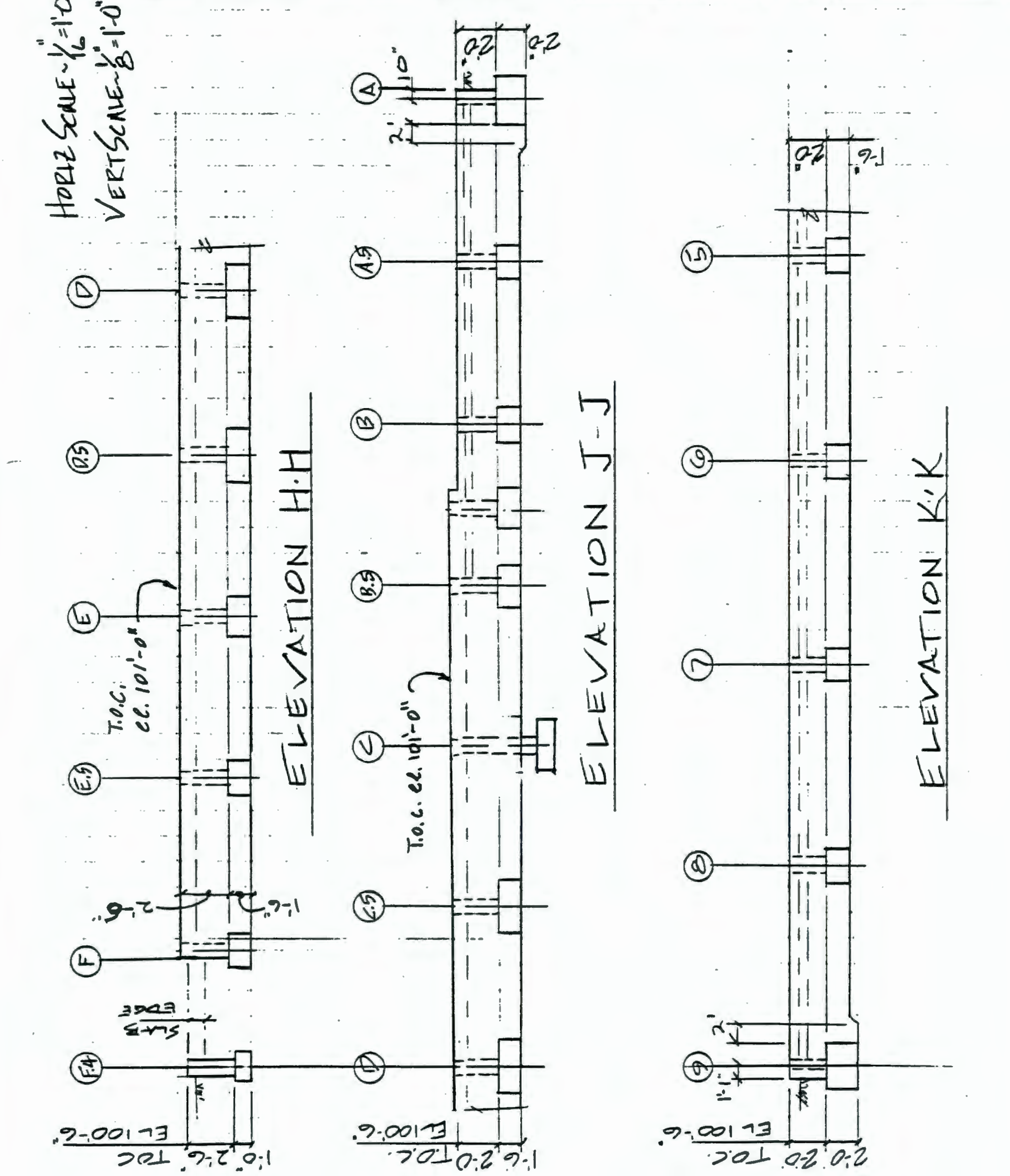
DLW 10/31/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-S4	2 / 0	V.L.L.	H.J.F.
FINAL	✓	1	DATE 9/3/92	DATE 9.3.92
VOID		3		
SHEET 21 OF 69		4	DATE	DATE
J.O. 6237.001				

NAME OF COMPANY: DOE-RL

UNIT/S: WRAP MOD 1

SUBJECT: BUILDING FOUNDATION



FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL

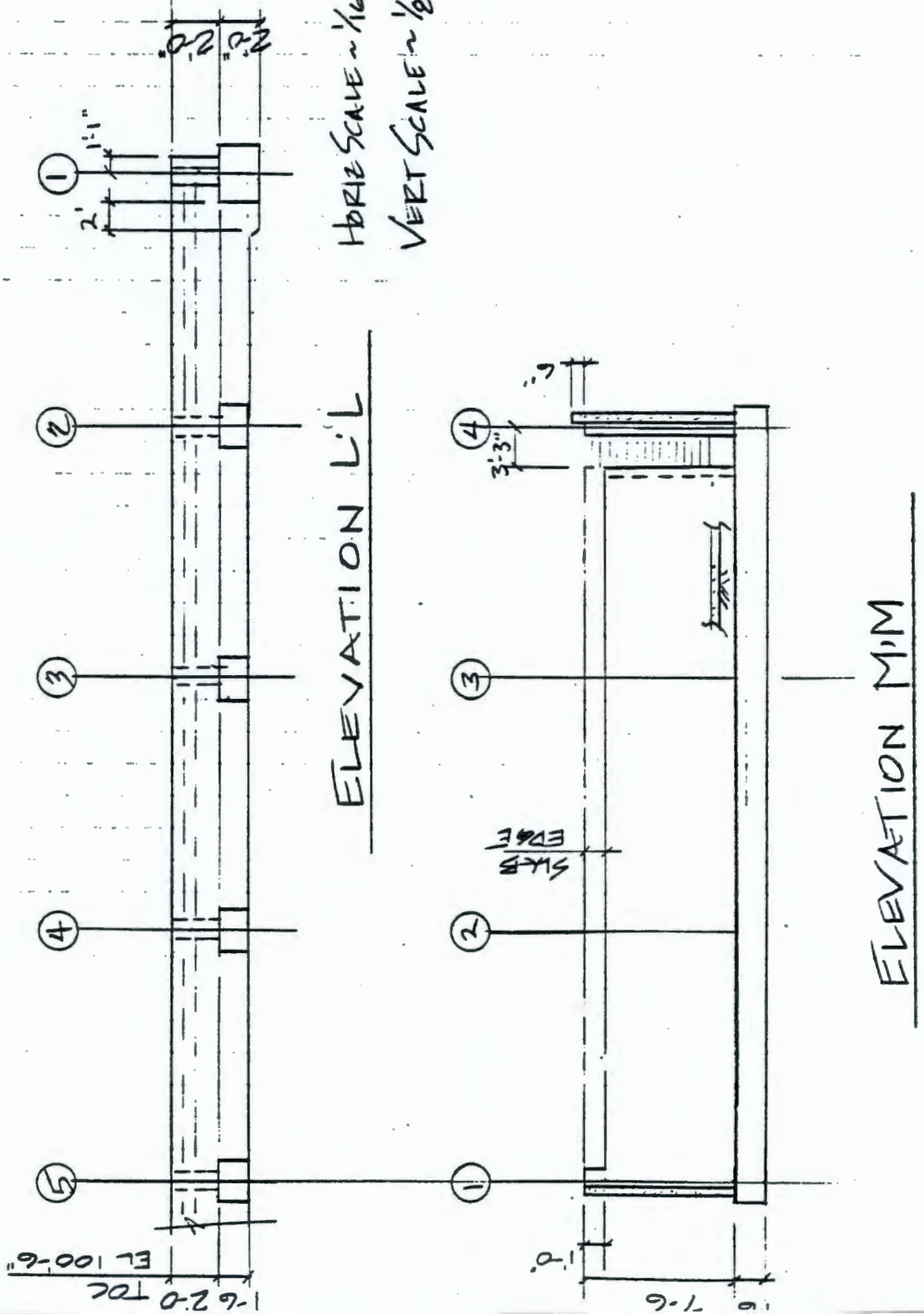
UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

LLW 10/31/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.9
VOID		1		
SHEET 22 OF 69		3		
J.O 6237.001		4	DATE	DATE

HORIZ SCALE ~ 1/16" = 1'-0"
VERT SCALE ~ 1/8" = 1'-0"



FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

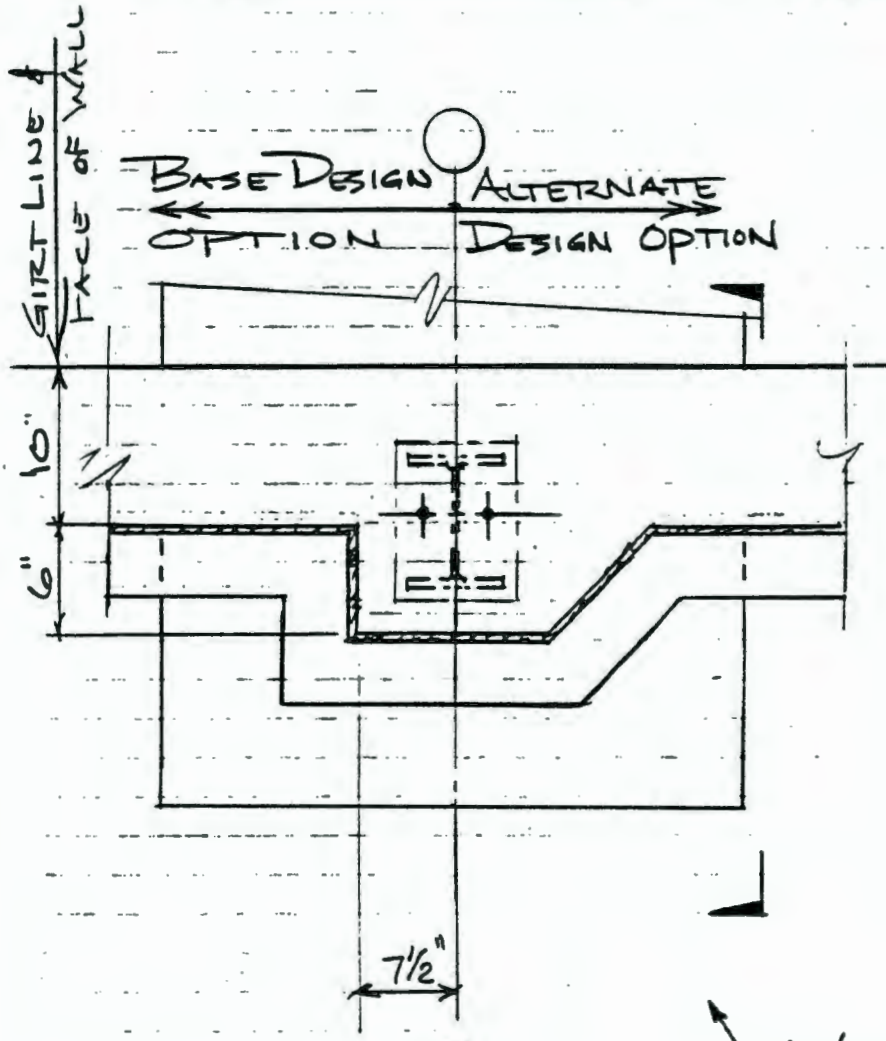
(DISCIPLINE)

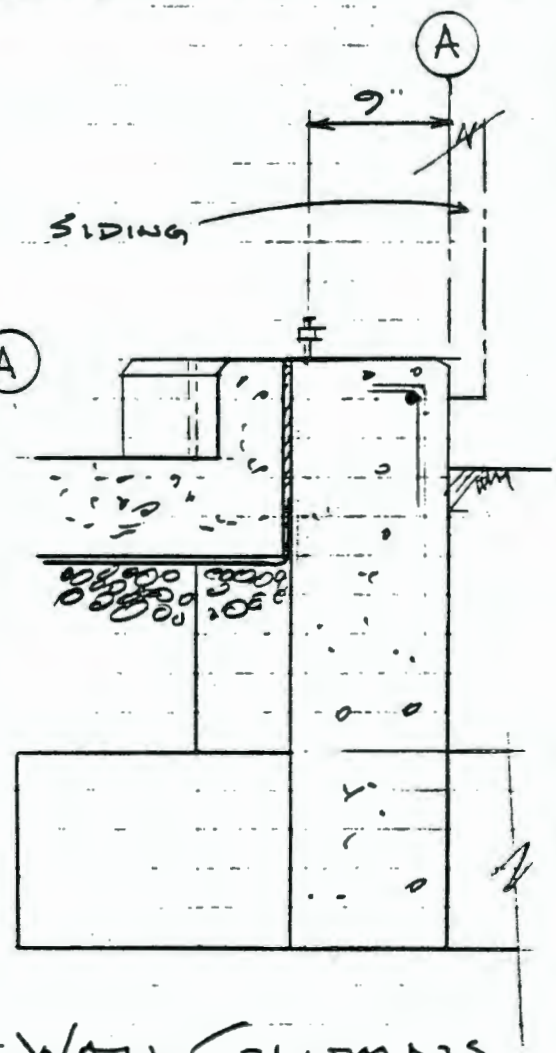
United Engineers & Constructors
A Raytheon Company

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V. L. L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 23 OF 69		3 4	DATE	DATE
J.O 6237.001				

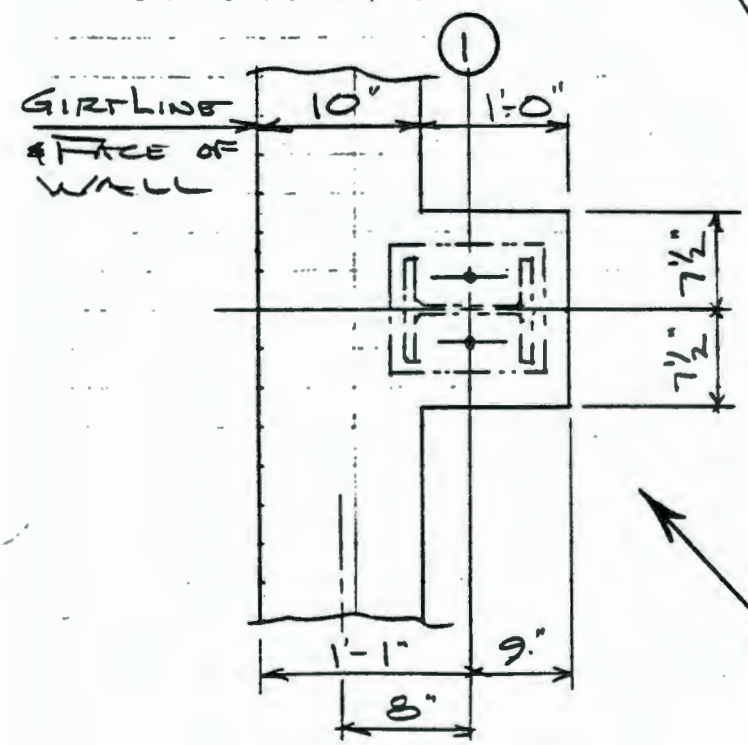
NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT BUILDING FOUNDATION





WEST WALL COLUMNS



LINE 1, 4 PARTIAL, 7 PARTIAL & 9 COLUMNS

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

WLW 10/23/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 24 OF 69		3	DATE	DATE
J.O 6237.001		4		

INTERIOR COLUMN FOOTINGS - REF: PAGES 5-14

TYPE E & L FOOTINGS - COLS B-2, B-3, B-4, B-8, B.5-7, D.5 & D-6

CRITICAL LOADINGS - COL B.5-7 53.35K↓ 0 →

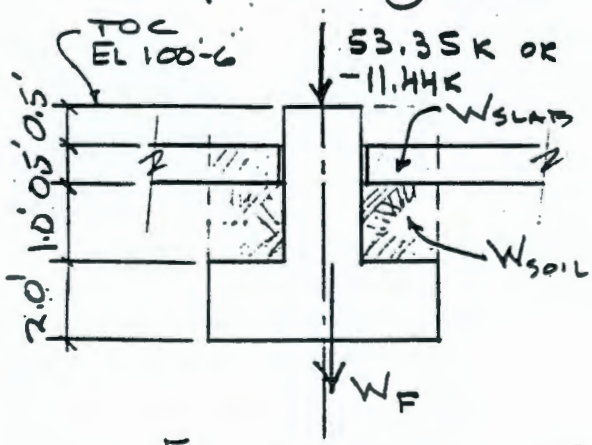
COL B-3 11.44K↑ 0 →

ALLOWABLE TOTAL SOIL BEARING = 3.0 KSF REF. 4. PAGE 8 FOR NATIVE DENSE SAND & GRAVELS

TO ALLOW FOR HEAVY FLOOR LOADING IN THE PROCESS AREAS ADJACENT TO THE COLUMNS, A SURCHARGE LOADING ON THE SUBGRADE OF 500 PSF WILL BE ASSUMED

NET ALLOWABLE BEARING UNDER FOOTINGS = 3.0 KSF − 0.5 = 2.5 KSF

NO INCREASE FOR WIND OR SEISMIC LOADING WILL BE USED, AS THE COMPUTER ANALYSIS OF THE BUILDING FRAME HAS INCLUDED A REDUCTION FACTOR FOR LOAD COMBINATIONS INCLUDING WIND OR SEISMIC (UPLIFT LOADS MUST BE MULTIPLIED BY 1.33 FOR LOAD COMB 16-24 & 29-32 GET ACTUAL VALUES).



TRIAL DESIGN

FOOTING 5' × 5' × 2.0'
PIER 1.25' SQ × 2.0 HIGH

W_{SLAB} & W_{SOIL} NOT INCLUDED IN FOOTING LOAD - DESIGN FOR SUPERIMPOSED LOAD USING NET VALUE OF SOIL BEARING ALLOWAE

$$W_F = \left[(5.0)^2(2.0) + (1.25)^2(2.0)\right]0.15 = 8.0^K$$

$$P_{TOTAL} = 53.35 + 8.0 = 61.35K$$

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CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	0	V.L.L.	H.J.F.
FINAL	✓	1	DATE 9/3/92	DATE 9.3.92
VOID		2	TST	VAP
SHEET 25 OF 69		3	DATE 2/1/93	DATE 2/1/93
J.O 6237.0001				

W.W 10/23/91

SHEET 25a Follows

TYPE E&L FOOTING (CONT.)

$$f_{soil} = \frac{P}{A} = \frac{61.35}{25\ SF} = 2.45^{ksf} < 2.5^{ksf} \quad ok$$

CHECK UPLIFT RESISTANCE

$P \uparrow = 11.44K$

SOIL WEIGHT ASSUMED = 110 pcf PER REF. 5 PAGE 7

$W_F = 8.0^K$

$W_{soil} = [(5)^2 - (1.25)^2](1.0)(0.11) = 2.6^K$ (23.4)

$W_{slab} = [23.4](0.5)(0.15) = 1.8^K$

$W_{TOTAL} = 8.0 + 2.6 + 1.8 = 12.4^K > 11.44K$ ~~OK~~ (NG)

OK FOR B.5-7 ONLY

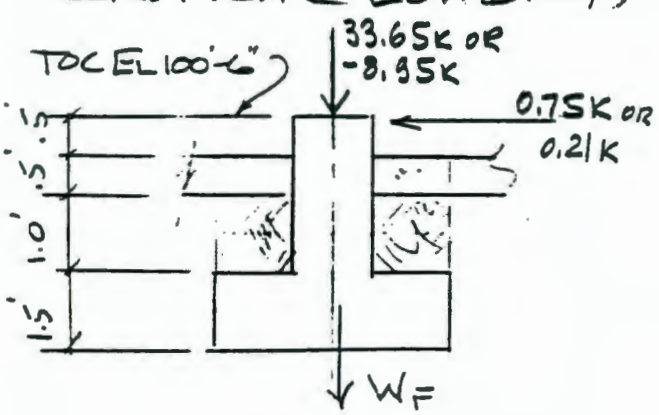
~~USE 5.0' × 5.0' × 2.0' THICK FOOTING WITH A NOMINAL PIER 1.25' SQUARE~~

SEE SHEET 25a FOR CONTINUATION

TYPE C&D FOOTINGS – COLS. C-2, C-3, C.5-2, C5-3, D.5-2, D.5-3, D.5-4, E-2, E-3 & E-4

CRITICAL LOADINGS COL D.5-4 LOAD #1 $33.65^K \downarrow$ $0.75^K \xrightarrow{E-W}$

LOAD #2 $8.95^K \uparrow$ $0.21^K \xrightarrow{E-W}$



TRIAL DESIGN

FOOTING 4' × 4' × 1.5'

PIER 1.25' SQ × 2.0' HIGH

FORM 5007 REV. 7/79 **GENERAL COMPUTATION SHEET**

(DISCIPLINE)

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CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-S4	3	TST	VAT
FINAL	✓	2	DATE 2/1/93	DATE 2/1/93
VOID		4		
SHEET	25a OF 69		DATE	DATE
J.O	6237.001			

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

TYPE E & L FOOTING CONTINUED

SIZE FOOTING TO PROVIDE MIN FACTOR OF SAFETY OF 1.5 FOR PULL OUT DUE TO UPLIFT FORCES.

$P\uparrow = 11.44^K$

FOOTING SIZE. (DL REQ'D = 11.44(1.5) = 17.16^K

TRY 6'x6' x 2' THICK

$W_F = 10.8^K$

$W_{soil} = 6^2(1.0)(0.11) = 3.96$

$W_{slab} = (36 - 1.25^2)(0.15)(0.5) = 2.58$

$W_{TOTAL} = 10.8 + 3.96 + 2.58 = 17.34^K$ (OK)

USE 6x6 x 2' FOOTING

(FOR COL B-2, B-3, B-4, B-8
D-5 & D-6)

WLW 10/23/91

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

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CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 26 OF 69		3	DATE	DATE
J.O. 6237.001		4		

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

TYPE C&D FOOTINGS (CONT.)

$W_F = [(4.0)^2(1.5) + (1.25)^2(2.0)]0.15 = 4.1^K$

$P_{TOTAL} = 33.65 + 4.1 = 37.75^K$

$M = 0.75 \times (3.5)' = 2.63^{K\,FT}$

$f_{SOIL} = P/A \pm M/S$

$A = 16^{FT^2}$

$S = \frac{4^3}{6} = 10.7^{FT^3}$

$f_{SOIL} = \frac{37.75}{16} \pm \frac{2.63}{10.7} = 2.36 \pm 0.25 = 2.61^{ksf}$ OR 2.11^{ksf}

O.K. since footing size increased to 5.5' x 5.5' (see sheet 27)

CHECK UPLIFT RESISTANCE.

$P_{\uparrow} = 8.96^K$

$W_F = 4.1^K$

$W_{SOIL} = [(4.0)^2 - \overset{14.4}{(1.25)^2}](1.0)(0.11) = 1.6^K$

$W_{SLAB} = [14.4](0.5)(0.15) = 1.1^K$

$W_{TOTAL} = 4.1 + 1.6 + 1.1 = 6.8^K < 8.96^K$

INCREASE FOOTING SIZE TO 5.0' x 5.0' x 2.0'

$W_F = [(5.0)^2(2.0) + (1.25)^2(2.0)]0.15 = 8.0^K$

$W_{SOIL} = [(5.0)^2 - \overset{23.4}{(1.25)^2}](1.0)(0.11) = 2.6^K$

$W_{SLAB} = [23.4](0.5)(0.15) = 1.8^K$

$W_{TOTAL} = 8.0 + 2.6 + 1.8 = 12.4^K > 8.95^K$ ok

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD

SUBJECT BUILDING FOUNDATION

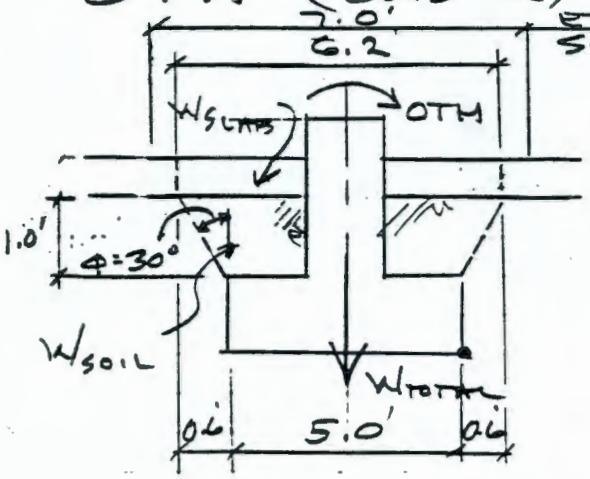
WLW 9/23/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 27 OF 69		3	DATE	DATE
J.O 6237.001		4		

TYPE C & D FOOTINGS (CONT.)

CHECK OVERTURNING FACTOR OF SAFETY

OTM ~ (LOAD #2) = $8.95^K(2.5) + 0.21^K(4.0) = 23.22^{IK}$



CONSIDER SOIL & SLAB VOLUMES AS SHOWN TO RESIST FOUNDATION OVERTURNING

$\phi = 30°$ PER REF 2

$W_F = 8.0^K$

$W_{SOIL} = \left[\frac{(6.2)^2 + (5.0)^2}{2} - (1.25)^2\right](1.0)(0.11)$

$W_{SOIL} = 3.3^K$

$W_{SLAB} = \left[(7.0)^2 - (1.25)^2\right](0.5)(0.15)$

$W_{SLAB} = 3.6^K$

$W_{TOTAL} = 8.0 + 3.3 + 3.6 = 14.9^K$

RESISTING MOMENT = $14.9(2.5) = 37.25^{K\,FT}$

FACTOR OF SAFETY = $\frac{37.25}{23.22} = 1.6 > 1.5$

INCREASE FOOTING SIZE TO 5.5' SQ

USE 5.5' × 5.5' × 2.0' THICK FOOTING WITH A NOMINAL PIER 1.25' SQUARE

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

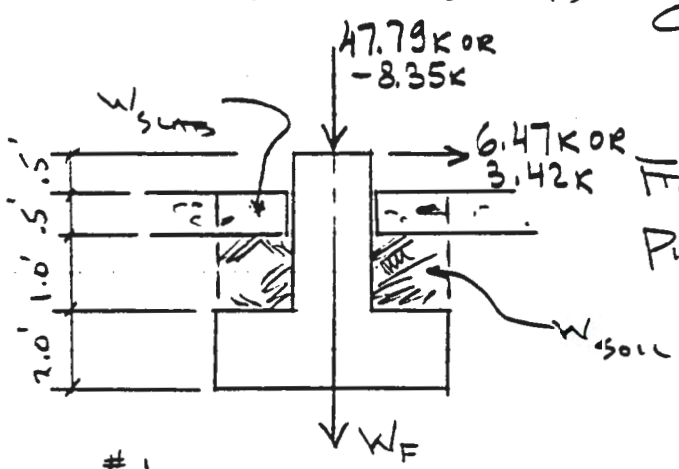
SUBJECT BUILDING FOUNDATION

WLW 10/23/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.T.
FINAL	✓	1	DATE 9/3/92	DATE 9.3.92
VOID		3		
SHEET 28 OF 69		4	DATE	DATE
J.O 6237.001				

TYPE F FOOTING ~ COLS E-5 & E-6

CRITICAL LOADINGS ~ COL E-6 LOAD #1 47.79K↓ 6.47K E-W →
COL E-5 LOAD #2 8.35K↑ 3.42K E-W →



TRIAL DESIGN

FTG ~ 5.5' x 5.5' x 2.0'

PIER 1.25' SQ x 2.0' HIGH

LOAD #1

$W_F = [(5.5)^2(2.0) + (1.25)^2(2.0)]0.15 = 9.5^K$

$P_{TOTAL} = 47.79 + 9.5 = 57.29\ K$

$M = 6.47 \times (4.0) = 25.88^{IK}$

$f_{soil} = P/A \pm M/S$

$A = 30.25\ FT^2$

$S = \frac{(5.5)^3}{6} = 27.7\ FT^3$

$f_{soil} = \frac{57.29}{30.25} \pm \frac{25.88}{27.7} = 1.89 \pm 0.93 = 2.82\ KSF$ OR $0.96\ KSF$ $< 3.0\ KSF$

O.K. since foundations are not in the storage area.

LOAD #2

CHECK UPLIFT RESISTANCE

$W_F = 9.5^K$

$W_{soil} = [(5.5)^2 - (1.25)^2](1.0)(0.11) = 3.2^K$

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

WLW 10/23/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	3	DATE 9/3/92	DATE 9.3.92
VOID		4		
SHEET 29 OF 69		3/4	DATE	DATE
J.O				

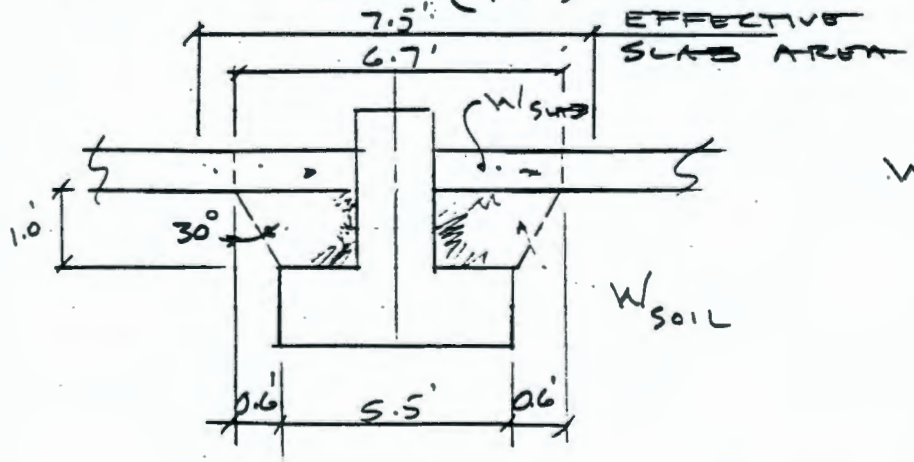
TYPE E FOOTING (CONT.)

$W_{SLAB} = [28.7](0.5)(0.15) = 2.2^K$

$W_{TOTAL} = 9.5 + 3.2 + 2.2 = \underline{14.9^K} > 8.35^K$ uplift ok

CHECK OVERTURNING FACTOR OF SAFETY

$OTM = 3.42^K(4.0') = 13.68^{K\,FT}$



$W_F = 9.5^K$

$W_{SOIL} = \left[\frac{(6.7)^2 + (5.5)^2}{2} - (1.25)^2\right](1.0)(0.11) = 4.0^K$

$W_{SLAB} = [(7.5)^2 - (1.25)^2](0.5)(0.15) = 4.1^K$

$W_{TOTAL} = 9.5 + 4.0 + 4.1 = 17.6^K$

RESISTING MOMENT $= \underset{W_{total}}{17.6^K}(2.75) - \underset{F_y}{8.35^K}(2.75) = 25.44^{K\,FT}$

FACTOR OF SAFETY $= \frac{24.75}{13.68} = 1.86 > 1.5$ ok

USE 5.5' x 5.5' x 2.0' FOOTING WITH A 1.25' SQUARE (NOMINAL) PIER

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NAME OF COMPANY DOE - RL UNIT/S WRAP Mod 1

SUBJECT BUILDING FOUNDATION

JWW 10/24/91

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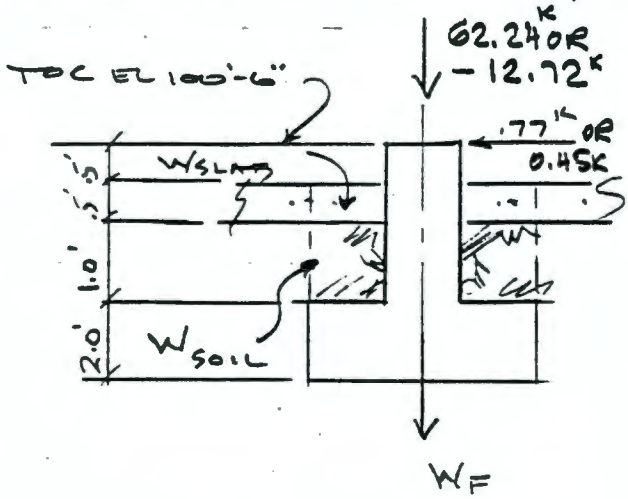
PRELIM.	WMI-54	0	V.L.L. DATE 9/3/92	H.J.F. DATE 9.3.92
FINAL	✓	1		
VOID		2	TST DATE 2/1/93	VAP DATE 2/1/93
SHEET 30 OF 69		3		
J.O 6237.001				

SHEET 30a FOLLOWS

TYPE B & H FOOTINGS - COL. B-5, B-7, C-4, F-2 & F-3

CRITICAL LOADING - COL F2 62.24K ↓ 0.77K EW →
COL B7 12.72K ↑ 0.45K →



TRIAL SECTION

FOOTING 5.5' x 5.5' x 2.0'
PIER 1.25' Sq x 2.0' HIGH

$W_F = 9.5^K$

$W_{SOIL} = 3.2$

$W_{SLAB} = 2.2$

$W_{TOTAL} = 14.9^K$

$P_{TOTAL} = 62.24 + 14.9 = 77.14K$

$M = 0.77^K(4.0') = 3.08^{KFT}$

$A_{FTG} = 5.5^2 = 30.25^{FT^2}$

$S_{FTG} = \frac{(5.5)^3}{6} = 27.7^{FT^3}$

$f_{SOIL} = P/A \pm M/S = \frac{77.14}{30.25} \pm \frac{3.08}{27.7} = 2.55 \pm 0.11 =$
$= 2.66^{KSF}$ OR $2.44^{KSF} > 2.5^{KSF}$ ok

CHECK UPLIFT RESISTANCE - COL B7

~~$W_{TOTAL} = 14.9^K > 12.72^K$ UPLIFT~~ ~~ok~~ NG

CHECK OVERTURNING FACTOR OF SAFETY

OTM = 3.08^K

RESISTING MOMENT = (62.24 + 14.9)(2.75') = 212.14 ok

~~USE 6.0x6.0 x 2.0' THICK FOOTINGS WITH NOMINAL PIER 1.25' SQUARE~~

SEE SHEET 30a FOR CONTINUATION

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

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SUBJECT BUILDING FOUNDATION

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-S4	3	TST	VAP
FINAL	✓	0	DATE 2/1/93	DATE 2/1/93
VOID		2		
SHEET 30a OF 69		4	DATE	DATE
J.O 6237.001				

TYPE B & H FOOTINGS CONTINUED

SIZE FOOTING TO PROVIDE MINIMUM FACTOR OF SAFETY OF 1.5 FOR PULLOUT DUE TO UPLIFT FORCES

$$P\uparrow = 12.72^{K}$$

DL REQUIRED $= 12.72(1.5) = 19.08^{K}$

TRY 6'-6" x 6'-6" x 2'-0" FOOTING

$$W_F = 6.5(6.5)(2)(0.15) = 12.68^{K}$$

$$W_{SOIL} = 6.5^2(0.11)(1.0) = 4.65^{K}$$

$$W_{SLAB} = [6.5^2 - 1.25^2](0.5)(0.15) = 3.05^{K}$$

$$W_{TOTAL} = 12.68 + 4.65 + 3.05 = 20.3^{K} \text{ (OK)}$$

USE 6'-6" x 6'-6" x 2'-0" FOOTING

(FOR COL'S B-5, B-7, F-3)

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
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NAME OF COMPANY DOE-RL UNIT/S WRAP No. 1

SUBJECT BUILDING FOUNDATION

WLW 10/24/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	2	V.L.L.	H.J.F.
FINAL	✓	3	DATE 9/3/92	DATE 9.3.92
VOID		4		
SHEET 3	OF 69		DATE	DATE
J.O 6237.001				

Sheet 3la follows.

TYPE U FOOTING - COL C-5

CRITICAL LOADING 108.5^K ↓ 3.02 K →

No uplift

TRIAL DESIGN

FOOTING 7.0' x 7.0' x 2.0'
PIER 1.25' SQ x 2.0' HIGH

$W_F = [(7.0)^2(2.0) + (1.25)^2(2.0)]\,0.15 = 15.2^K$

$P_{TOTAL} = 108.5 + 15.2 = 123.7K \quad M = 3.02 \times 4 = 12.08^{IK}$

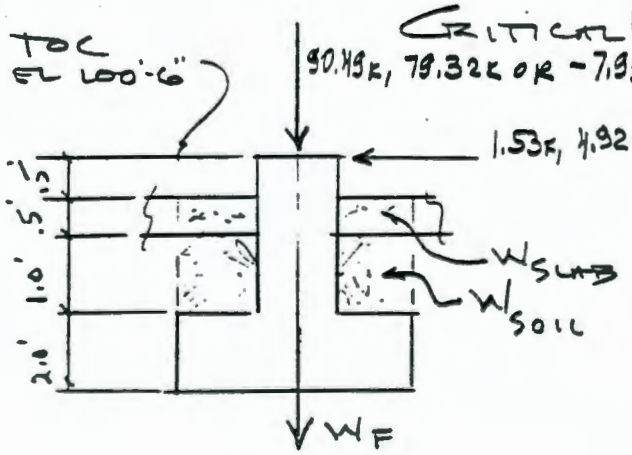
$f_{SOIL} = \frac{123.7}{7.0^2} \pm \frac{12.08 \times 6}{7^3} = 2.52 \pm 0.21 = 2.73 ksf$ OR $2.31 ksf > 2.5 ksf$

USE 7.5 x 7.5 x 2.0 THICK FOOTING WITH 1.25' SQ (NOMINAL) PIER

See sheet 3la for additional design.

TYPE K FOOTING - COL B.5-8, C.5-7 & E-7

CRITICAL LOADING - COL E-7 - 90.49K ↓ 1.53K EW →
COL C.5-7 - LOAD 1 [illegible] ↓ 4.92K EW →
- LOAD 2 [illegible] ↑ 19.51K EW →
COL. B.5-8 107.26K ↓ O.K. by inspection



TRIAL DESIGN

FOOTING 7.0' x 7.0' x 2.0' THICK
PIER 1.25' SQ x 2.0' HIGH

$W_F = 15.2^K$ SEE TYPE U FOOTING CALC. ABOVE

COL E-7 LOADING

$P_{TOTAL} = 90.49 + 15.2 = 105.69^K$

$M = 1.53 \times 4.0 = 6.12^{KFT}$

FORM 5007 REV. 7/79 **GENERAL COMPUTATION SHEET**

(DISCIPLINE)

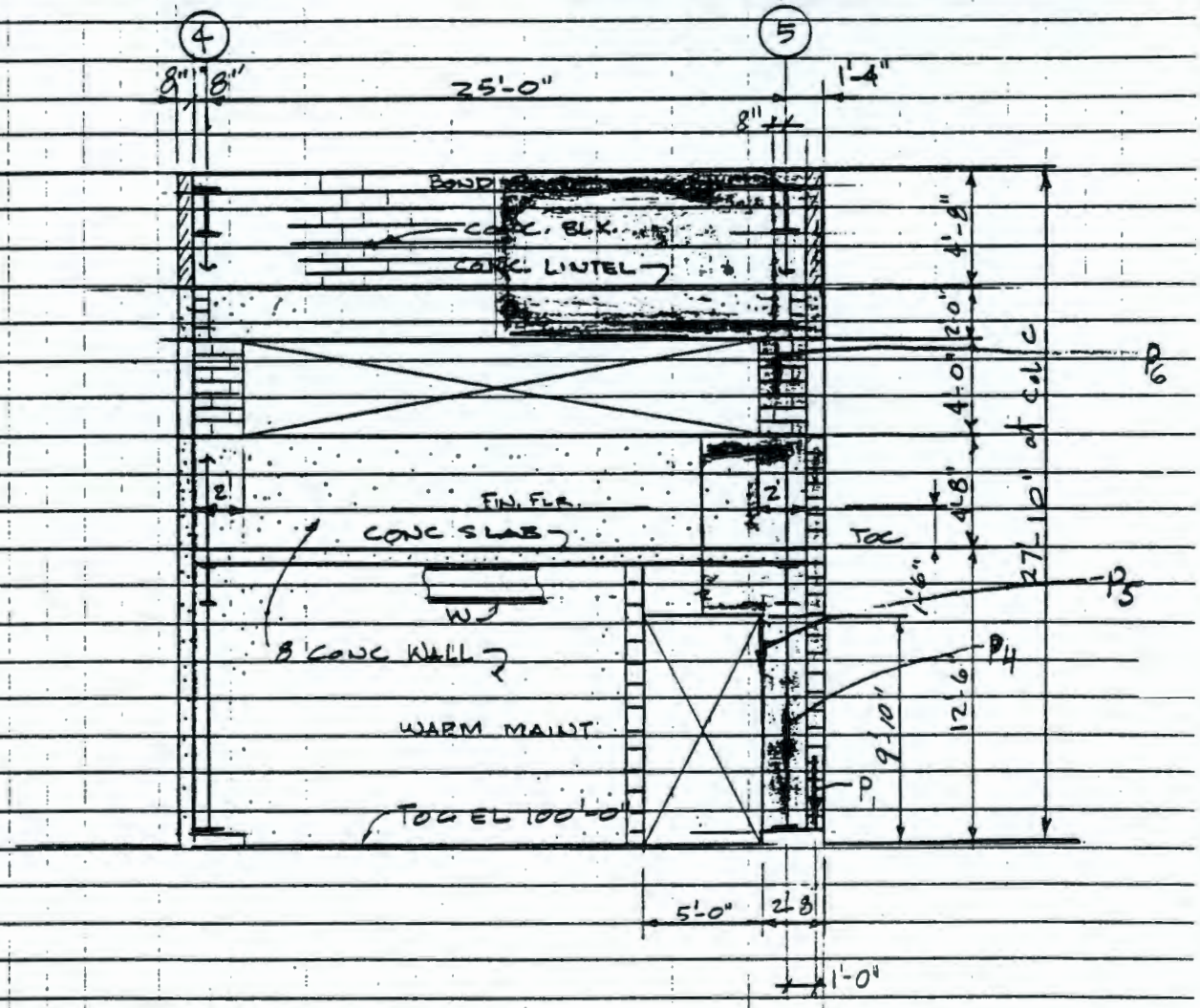
United Engineers & Constructors
A Bechtel Company

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-S4	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9/3/92
VOID		1		
SHEET 31a OF 69		3	DATE	DATE
J.O 6237007		4		

NAME OF COMPANY DOE-RL UNIT/S WRAP Mod.1

SUBJECT Building Foundation.

Sheet 31b follows.



Wall @ column line C

Looking west.

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

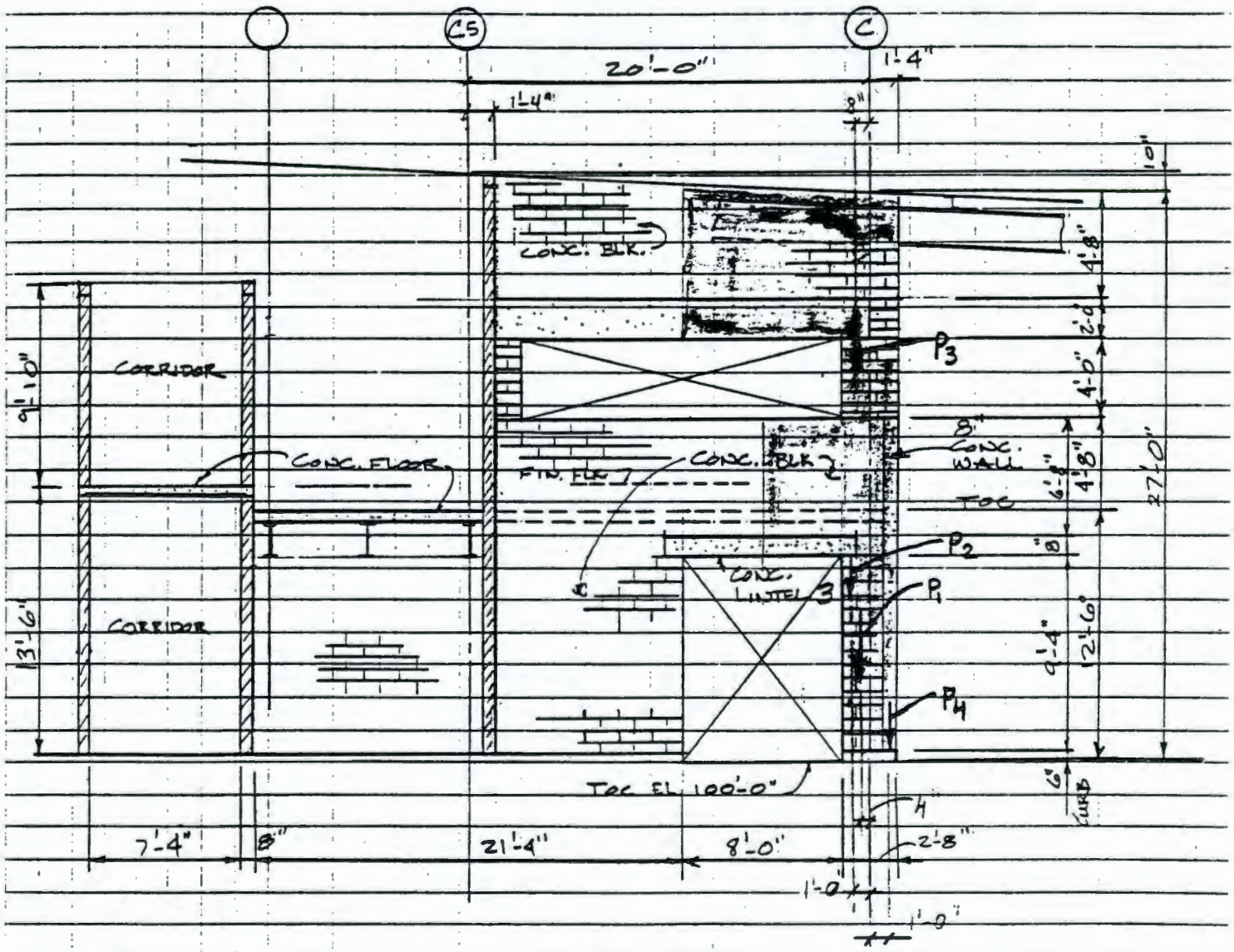
United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE - RL UNIT/S WRAP

SUBJECT Building foundation

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	2	V.L.L.	H.J.F.
FINAL	✓		DATE 9/3/92	DATE 9.3.92
VOID				
SHEET 31b OF 69			DATE	DATE
J.O 6237007				

Sheet 31c follows.



Wall @ column line 5.

Looking south.

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

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CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-SH	2	V.L.L.	H.J.F.
FINAL	✓	1	DATE 9/3/92	DATE 9.3.92
VOID		3		
SHEET 3|c OF 69		4	DATE	DATE
J.O 6237.007				

NAME OF COMPANY DOE-RL UNIT/S WRAP Mod. 1

SUBJECT Building Foundation

Sheet 3\|d follows.

Foundation type U - col. C-5.

Additional loads from CMU & concrete walls.

Loads:

From WMI-518 sheet 20 & 26:

Concrete block weight 46.4 #/ft of 1 foot of height.

Window shutter 100 #/ft } 301 #/ft

Lintel 2'-0" deep 201 #/ft

Lintel 8" deep 67 #/ft

Concrete wall 0.67 x 1.0 x 1.0 x 150 = 100.5 /ft of 1 foot of height.

P_1 = 46.4 x 2.0 x 27.0 = 2506# Use 2.5k

P_2 = 67.0 x 4.0 + 46.4 x 4.0 x 6.67 = 1506# Use 1.5k

P_3 = 301.0 x 8.0 + 46.4 x 8.0 x 4.67 = 4142# Use 4.2k

P_4 = 100.5 x 2.67 x 17.17 + 46.4 x 2.67 x 10.67 = 5929# Use 6.0k

P_5 = 100.5 x 2.5 x 7.33 = 1842# Use 1.9k

P_6 = 301.0 x 11.17 + 46.4 x 11.17 x 4.67 = 5783# Use 5.8k

Total 21.9k

Additional moments on foundation.

M_x = 1.0 x (2.5 + 1.5 + 4.2) − 1.9 x 1.33 − 4.7 x 0.67 = 2.52 ^k

M_z = −1.0 x (6.0 + 1.9 + 5.8) + 2.5 x 0.33 + 1.5 x 1.0 + 4.2 x 0.67 =

= −8.56 ^k

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE - RL UNIT/S WRAP Mod. 1

SUBJECT Building Foundation.

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-S4	2	V.L.L.	H.J.F.
FINAL	✓	1	DATE 9/3/92	DATE 9.3.92
VOID		3		
SHEET 31d OF 69		4	DATE	DATE
J.O 6237.007				

SHEET 31e FOLLOWS

Check foundation:

Total vertical load:

$W_F = (7.5^2 \times 2.0 + 1.25^2 \times 2.0) \times 0.15 = 17.34^K$

$P_{TOT} = 17.34 + 108.5 + 21.9 = 147.74^K$

$M_X = 2.52^{1K}$

$M_Z = 3.02 \times 4 - 8.56 = 3.52^{1K}$

$$f_{soil} = \frac{147.74}{7.5^2} \pm \frac{2.52 \times 6}{7.5^3} \pm \frac{3.52 \times 6}{7.5^3} = 2.63 \pm 0.04 \pm 0.05 =$$

$$= \frac{2.72 \text{ ksf (max)}}{2.54 \text{ ksf (min)}} > 2.5 \text{ ksf}$$

∴ Increase footing size to 8.0' x 8.0' x 2.0' thick.

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

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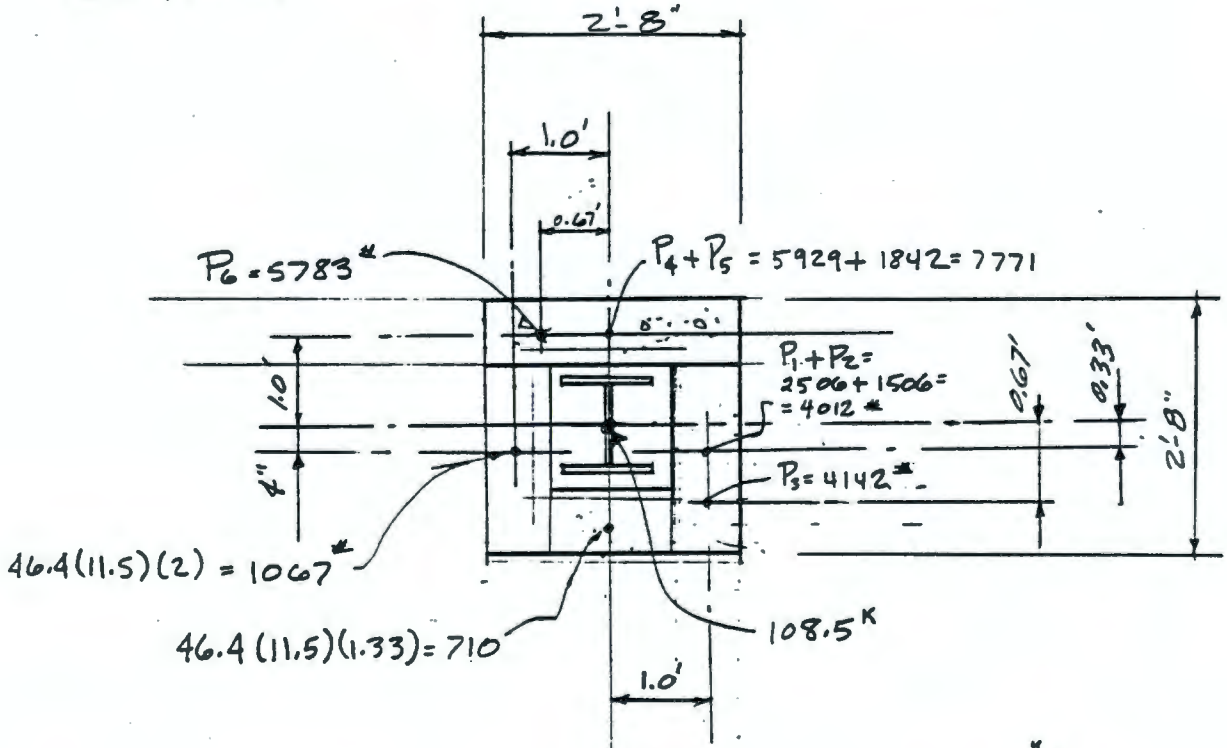
CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	~~3~~	TST	VAP
FINAL	✓	~~0~~ 2	DATE 2/1/93	DATE 2/4/93
VOID		4		
SHEET 31e OF			DATE	DATE
J.O 6237.00T				

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD1

SUBJECT BUILDING FOUNDATION

TYPE U FOOTING

CHECK ECCENTRICITY OF RESULTANT LOAD FROM CONCRETE AND MASONRY WALLS ON FOOTING.



LOCATE RESULTANT LOAD FROM COL LINES

P	x	y	P_x	P_y
4012	1.0	-0.33	4012	-1324
4142	1.0	-0.67	4142	-2775
7771	0	1.0	0	7771
5783	-0.67	1.0	-3875	5783
1067	-1.0	-0.33	-1067	-352
710	0	-1.0	0	-710
108500	0	0	0	0
131985			3212	8393 ← Σ

$$\bar{x} = \frac{\Sigma P_x}{\Sigma P} = \frac{3212}{131985} = 0.02'$$

$$\bar{y} = \frac{\Sigma P_y}{\Sigma P} = \frac{8393}{131985} = 0.06'$$

NEGLIGIBLE ECCENTRICITY

USE 8' x 8' x 2' FOOTING AS DESIGNED.

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE - RL UNIT/S WRAP M001

SUBJECT BUILDING FOUNDATION

WLW 10/24/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54		V.L.L.	H.J.R.
FINAL	✓		DATE 9/3/92	DATE 9.3.92
VOID				
SHEET 32 OF 69			DATE	DATE
J.O 6237.001				

TYPE K FOOTING (CONT.)

$A_{FOOTING} = 49^{FT^2}$

$S_{FOOTING} = \frac{(7)^3}{6} = 57.2^{FT^3}$

$f_{SOIL} = P/A \pm M/S = \frac{105.69}{49} \pm \frac{6.12}{57.2} = 2.16 \pm 0.11$

$= 2.27^{KSF}$ OR $2.05^{KSF} < 2.5^{KSF}$ OK

COL C.5-7 LOAD #1

$P_{TOTAL} = 79.32 + 15.2 = 94.52^K$

$M = 4.92 \times 4.0 = 19.68^{K\,FT}$

$f_{SOIL} = \frac{94.52}{49} \pm \frac{19.68}{57.2} = 1.93 \pm 0.34$

$= 2.27^{KSF}$ OR $1.59^{KSF} < 2.5^{KSF}$ OK

COL C.5-7 LOAD #2 (UPLIFT)

FOR UPLIFT CALCULATIONS, WEIGHT OF SOIL & SLAB ABOVE THE FOOTING WILL BE INCLUDED IN THE NET LOAD AT BOTTOM OF FOOTING

$W_F = 15.2^K$

$W_{SOIL} = [(7.0)^2 - \overset{47.4}{(1.25)^2}](1.0)(0.11) = 5.2^K$

$W_{SLAB} = [\ 47.4\ ](0.5)(0.15) = 3.6^K$

$W_{TOTAL} = 15.2 + 5.2 + 3.6 = 24^K$

$P_{NET} = -7.99 + 24 = 16.01^K \downarrow$

$M = 19.51^K(4.0') = 78.04^{K\,FT}$

$e = M/P = \frac{78.04}{16.01} = 4.87'$ RESULTANT FORCE ACTS OUTSIDE FOOTING - NG. INCREASE SIZE

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
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NAME OF COMPANY DOE - RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 33 OF 69		3	DATE	DATE
J.O 6237.001		4		

WMI 10/28/9

TYPE K FOOTING (CONT.)

INCREASE FOOTING SIZE TO 8.0' x 8.0' x 2.0'

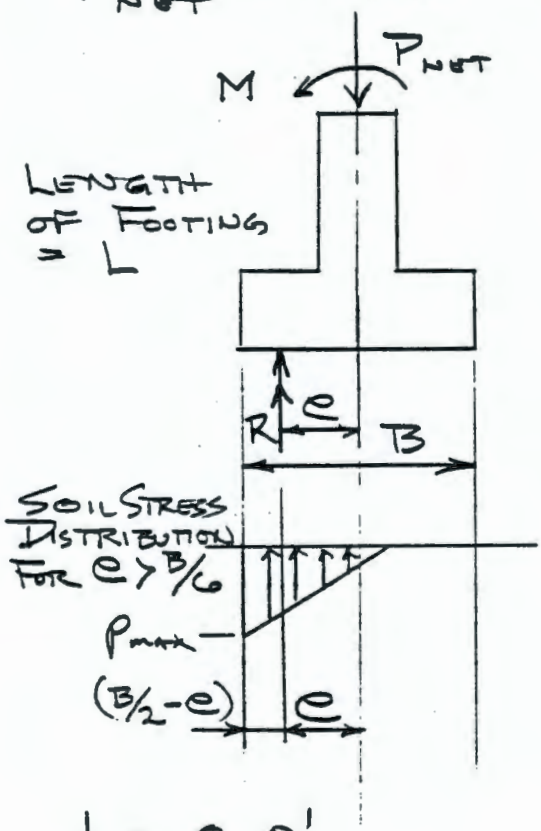
$$W_F = [(8.0)^2(2.0) + (1.25)^2(2.0)]0.15 = 19.7^K$$

$$W_{SOIL} = [(8.0)^2 - (1.25)^2](1.0)(0.11) = 6.9^K$$

$$W_{SLAB} = [62.4](0.5)(0.15) = 4.7^K$$

$$31.3^K$$

$$P_{NET} = -7.99 + 31.3^K = 23.31^K$$



$$e = M/P = \frac{78.04}{23.31} = 3.35'$$

$$B/6 = 1.33' < e$$

SOIL STRESS DISTRIBUTION WILL BE TRIANGULAR

$$P_{MAX} = \frac{2R}{3L(B/2 - e)}$$

$$P_{MAX} = \frac{2(23.31)}{3(8.0)(\frac{8.0}{2} - 3.35)}$$

$$= 2.99 \text{ ksf} > 2.5^{ksf}$$

not good

See sheet 34.

L = 8.0'
B = 8.0'
R = P_{NET} = 23.31 K
e = 3.35'

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

WLW 10/24/91

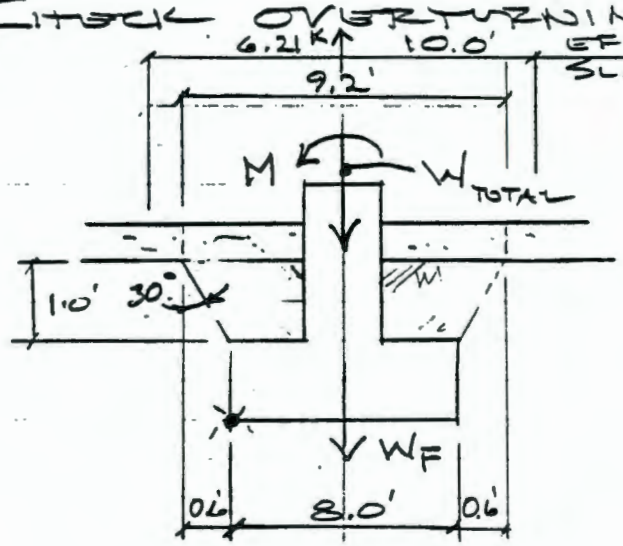
CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 34 OF 69		3	DATE	DATE
J.O 6237.001		4		

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

TYPE K FOOTING (CONT.)

CHECK OVERTURNING FACTOR OF SAFETY



$W_F = 19.7^K$

$W_{SOIL} = \left[\frac{(9.2)^2+(8.0)^2}{2} - (1.25)^2\right](1.0)(0.11)$

$W_{SOIL} = 8.0^K$

$W_{SLAB} = \left[(10.0)^2 - (1.25)^2\right](0.5)(0.15)$

$W_{SLAB} = 7.4^K$

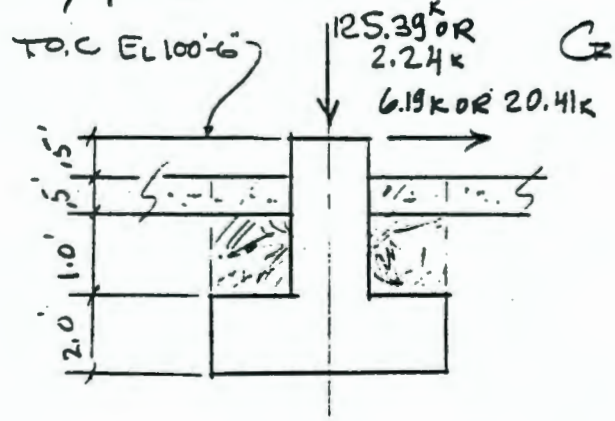
$W_{TOTAL} = 19.7 + 8.0 + 7.4 - 7.99 = 27.11^K$

RESISTING MOMENT $= 27.11 \times (4.0') = 108.44^{'K}$

FACTOR OF SAFETY $= \frac{108.44}{78.04} = 1.39 < 1.5$ not good.

USE 8.5' x 8.5' x 2.0' THICK FOOTING WITH NOMINAL 1.25' SQ PIER by inspection.

TYPE G FOOTING - COL C-7, D-7, D.5-7 & E-8



CRITICAL LOAD - COL E-8 $125.39^K \downarrow$ $6.19^K \xrightarrow{E-W}$

C-7 $2.24^K \downarrow$ $20.41^K \xrightarrow{E-W}$

TRIAL DESIGN

FOOTING 8.0' x 8.0' x 2.0' THICK

PIER 1.25' SQ x 2.0' HIGH

$W_F = 19.7^K$

See sheet 33

See TYPE K FOOTING CALC:- PRECEDING PAGE

$P_{TOTAL} = 125.39 + 19.7 = 145.09^K$

$M = 6.19 \times (4.0') = 24.76^K$

FOR C-7 $P = 2.24 + 31.3 = 33.54^K$

$M = 20.41 \times 4.0 = 81.64^K$

$e = 81.64/33.54 = 2.43'$

TYPE G FOOTING (CONT.)

$A = 64^{FT^2}$

$S = \frac{(8.0)^3}{6} = 85.3^{FT^3}$

$f_{soil} = \frac{33.54}{8 \times 8} \times \frac{4}{(3 - 6\frac{2.43}{8})} =$

$= 1.78 \text{ ksf} < 2.5 \text{ ksf}$ O.K

$f_{soil} = P/A \pm M/S = \frac{145.09}{64} \pm \frac{24.76}{85.3} = 2.27 \pm 0.29 =$

$= 2.56^{ksf}$ OR 1.98^{ksf}

$> 2.5^{ksf}$

USE 8.0' x 8.0' x 2.0' FOOTING WITH NOMINAL 1.25' SQ PIER

TYPE M FOOTINGS ~ COL C.5-8 & D.5-8

CRITICAL LOADING (SAME FOR BOTH COL.) $148.39^K \downarrow$ $0 \rightarrow$

TRIAL DESIGN

FOOTING 8.0' x 8.0' x 2.0' THICK
PIER 1.25' SQ x 2.0' HIGH

$W_F = 19.7^K$ ~ SEE TYPE K FOOTING CALCULATION

$P_{TOTAL} = 148.39 + 19.7 = 168.09 K$

$f_{soil} = P/A = \frac{168.09}{(8.0)^2} = 2.63^{ksf} > 2.5^{ksf}$

SAY OK AS FLOOR LOADING AROUND THESE COLUMNS WILL BE LESS THAN IN PRODUCTION AREAS

USE 8.0' x 8.0' x 2.0' THICK FOOTING WITH NOMINAL 1.25' SQ PIER

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

W LW 12/24/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 36 OF 69		3	DATE	DATE
J.O 6237.001		4		

TYPE J FOOTING ~ COL. C-8 & D-8

CRITICAL LOADING - COL D-8 $185.97^K \downarrow$ $0.36^K \xrightarrow{EW}$

TRIAL DESIGN

FOOTING 9.0' x 9.0' x 2.0' THICK $A = 81\ FT^2$

PIER 1.5' SQ x 2.0' HIGH $S = (9)^3/6 = 121.5\ FT^3$

$$W_F = \left[(9.0)^2(2.0) + (1.5)^2(2.0)\right]0.15 = 25.0^K$$

$$P_{TOTAL} = 185.97 + 25.0 = 210.97^K$$

$$M = 0.36^K(4.0') = 1.44^{K\,FT}$$

$$f_{SOIL} = P/A \pm M/S = \frac{210.97}{(9.0)^2} \pm \frac{1.44}{121.5} = 2.60 \pm 0.01$$

$$= 2.61^{KSF} \text{ OR } 2.59^{KSF} >$$

$> 2.50^{KSF}$ but O.K. since floor load is much smaller than 500 #/sf. (Mechanical room).

USE 9.0' x 9.0 x 2.0' THICK FOOTING WITH PIER 1.5' SQ (MAY VARY)

WCW 10/29/91

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

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CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	1	DATE 9/3/92	DATE 9.3.92
VOID		3		
SHEET 37 OF 69			DATE	DATE
J.O 6237.001				

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

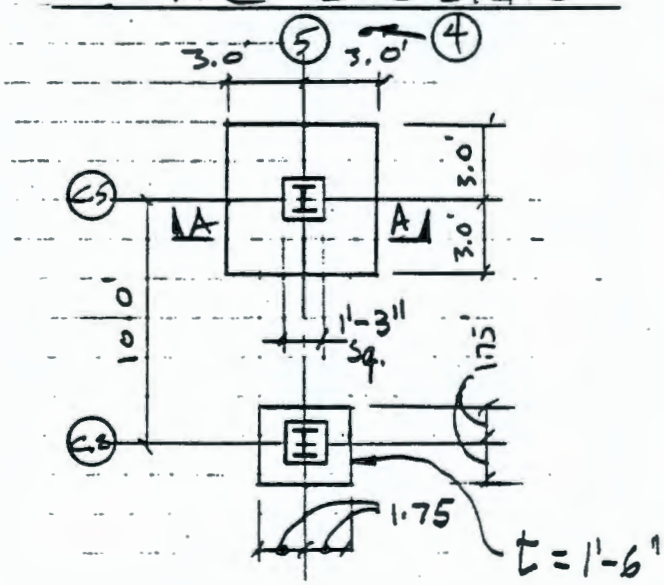
FOOTING TYPE AA & AB ~ COL C.5-4, C.5-5, C.8-4 & C.8-5

CRITICAL LOADING - COL C.5-5 & C.8.5

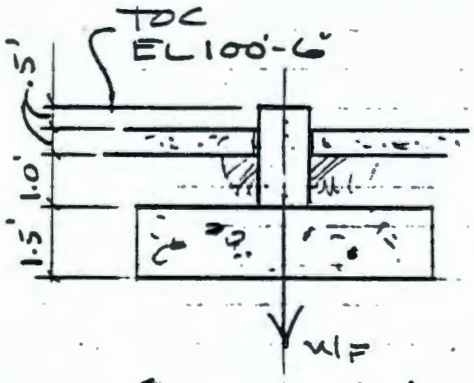
	COL C5-5	P_y = 97.43K	F_x = 2.10K	F_z = 1.2K
CRITICAL →	C.5-4	P_y = 75.82K	F_x = 1.38K	F_z = 2.04K
	C.8-5	P_y = 24.90K	Small	
	C.8-4	P_y = 17.82K	→ 5.47K	

Assume horiz. loads taken by floor slab.

TRIAL DESIGN



PLAN



SECT AA

COL C.5-5

$W_F = [(6)^2(1.5) + (1.25)^2(2)]0.15 = 8.6^K$

$P_{TOTAL} = 97.43 + 8.6 = 106.03 \Rightarrow f_{soil} = \frac{106.03}{(6)^2} = 2.95 \text{ ksf} <$

$< 3.0 \text{ ksf}$ o.k.

Not a process area.

COL C.8-5

$W_F = [(3.5)^2(1.5) + (1.25)^2(2)]0.15 = 3.3^K$

$P_{TOTAL} = 24.9 + 3.3 = 28.2^K \Rightarrow f_{soil} = \frac{28.2}{(3.5)^2} = 2.30^{KSF}$ ok

USE 1.5 FT THICK FOOTINGS AS SHOWN ABOVE

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

W LW 10/29/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	3	V.L.L.	H.J.F.
FINAL	✓	8	DATE 9/3/92	DATE 9.3.92
VOID		7		
SHEET 38 OF 69		8 4	DATE	DATE
J.O 6237.001				

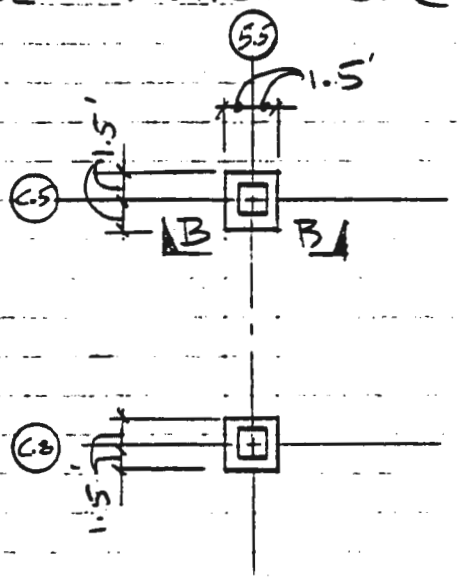
FOOTING TYPE AC ~ COL C.5-5.5 & C.8-5.5

COL LOADS ~ COL C.5-5.5 $F_y = 2.95^K$

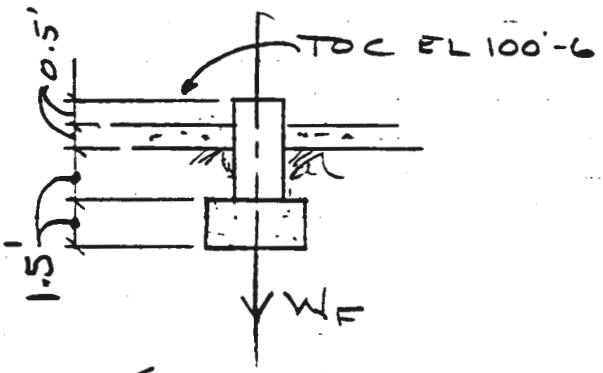
COL C.8-5.5 $F_y = 5.33^K$

LATERAL LOADS RESISTED BY BLOCK WALLS, NOT PIERS

USE MINIMUM 3.0 x 3.0' x 1.0' THICK FOOTING



PLAN



SECT BB

$$W_F = \left[(3.0)^2(1) + (1.25)^2(1)\right]0.15 = 1.6^K$$

$$f_{soil} = \frac{5.33 + 1.6}{(3.0)^2} = 0.77^{KSF} \text{ OK}$$

USE 3.0 x 3.0 x 1.0 THK FOOTING AS SHOWN ABOVE

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

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United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD

SUBJECT BUILDING FOUNDATION

W LW 10/24/91

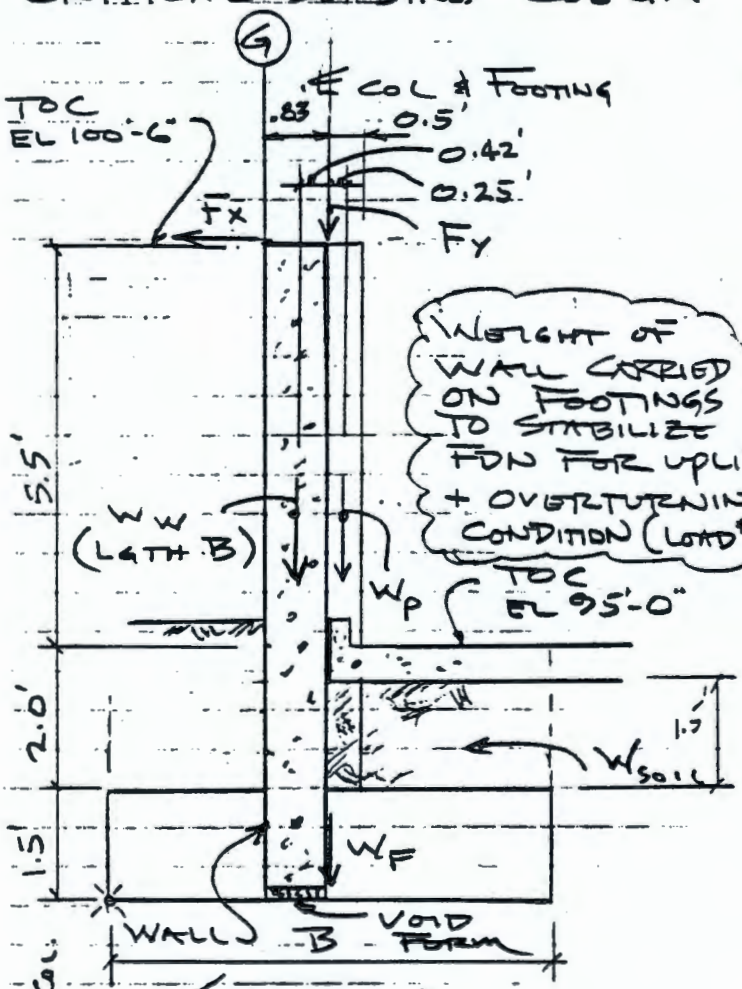
CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	2	V.L.L.	H.J.F
FINAL	✓		DATE 9/3/92	DATE 9.3.92
VOID		3		
SHEET 39 OF 69		4	TST DATE 6/8/93	LHR DATE 6/8/93
J.O 6237.001				

EXTERIOR COLUMN FOOTINGS - REF PAGES 5-14

FOOTING TYPE A - COLS ~~F-1, F-4~~, G-1, G-2, G-3 & G-4

CRITICAL LOADING - COL G2 - LOAD #1 $F_y = 38.99^k\downarrow$ $F_x = 4.25^k$ $F_z = 0.21^k$

LOAD #2 $F_y = 15.55^k\uparrow$ $F_x = 3.07^k$ $F_z = 7.35^k$



SECTION

LOADS IN Z DIRECTION WILL BE CARRIED BY WALL & TRANSFERED TO SOIL BY LATERAL PRESSURE AGAINST SIDE OF FOOTINGS

TRIAL DESIGN

FOOTING $L = 4.0'$ $B = 6.0'$ $t = 1.5'$

$W_F = (4.0 \times 6.0)(1.5)(0.15) = 5.4^k$

$W_W = (0.83 \times 25.0' \times 9.0)(0.15) = 28.0^k$

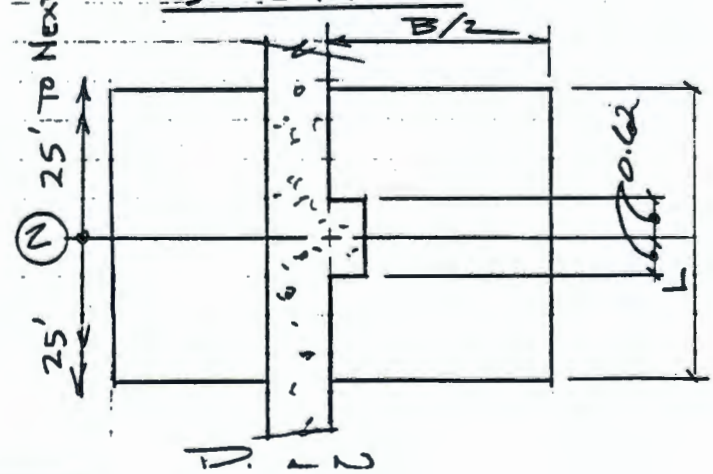
$W_P = (0.5 \times 7.5 \times 1.25)(0.15) = 0.6^k$

$W_{TOTAL} = 5.4 + 28.0 + 0.6 = 34.0^k$

$W_{SOIL} = [(4.0 \times 6.0) - (4.0 \times .83)](1.5)(.11)$

$W_{SOIL} = 3.4^k$

SLAB WT NOT INCLUDED



PLAN

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE - RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

WLW 10/24/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 40 OF 69		3	DATE	DATE
J.O 6237.001				

FOOTING TYPE A (CONT.)

LOAD #1

$P_{TOTAL} = \overset{F_y}{38.99} + \overset{W_{TOTAL}}{34.0} = 72.99^K$

$+\circlearrowleft M = -(4.25 \times 9.0') + (0.6 \times 0.25') - (28.0^K \times 0.42') = -49.86^{K\,FT}$

$e = M/P = \frac{49.86}{72.99} = 0.68'$ $B/6 = 1.0'$ ∴ LOAD RESULT FALLS IN MIDDLE 1/3 OF FOOTING

$f_{SOIL} = P/A \pm M/S$ $A = 24^{FT^2}$

$S = \frac{4(6)^2}{6} = 24^{FT^3}$

$f_{SOIL} = \frac{72.99}{24} \pm \frac{49.86}{24} = 3.04 \pm 2.08 = 5.12^{ksf}$ OR $0.96^{ksf} > 2.5^{ksf}$ NG

INCREASE B TO 9.0' & L TO 5.0' $S = \frac{5(9)^2}{6} = 67.5^{FT^3}$

$W_F = (5.0 \times 9.0)(1.5)(0.15) = 10.1^K$

$W_{TOTAL} = 10.1 + 28.0 + 0.6 = 38.7^K$

$P_{TOTAL} = 38.99 + 38.7 = 77.69^K$

$f_{SOIL} = \frac{77.69}{45} \pm \frac{49.86}{67.5} = 1.73 \pm 0.74 = 2.47^{ksf}$ OR $0.99^{ksf} < 2.5^{ksf}$ OK

CHECK OVERTURNING FACTOR OF SAFETY

$OTM = 4.25 \times 9.0 = 38.25^{K\,FT}$

$W_{SOIL} = [(5.0 \times 9.0) - (5.0 \times 0.83)](1.5)(0.11) = 6.7^K$

RESISTING MOMENT $= \underset{W_F}{(10.1^K \times 4.5')} + \underset{W_W}{(28.0 \times 4.08')} + \underset{W_P}{(0.6 \times 4.75')} + \underset{W_{SOIL}}{(6.7 \times 4.5)}$

$+ (\underset{F_y}{36.70} \times 4.0) = 339.7^{K\text{-}FT}$

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

& Constructors
A Bechtel Company

NAME OF COMPANY DOE - RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

WLW 10/24/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.R
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 41 OF 69		3	DATE	DATE
J.O 6237.001		4		

FOOTING TYPE A (CONT.)

FACTOR OF SAFETY $\frac{339.7}{38.25} = 8.88 > 1.5$ ok

LOAD #2

UPLIFT = 15.55 K

$W_{TOTAL} + W_{SOIL} = 38.7 + 6.7 = 45.4^K > 15.55^K$ ok

NET DOWNWARD LOAD = $P_{TOTAL} = 45.4 - 15.55 = 29.85$ K

$\circlearrowright + M = -(3.07 \times 9.0) + (0.6^K \times 0.25') - (28.0^K \times 0.42') = 39.24$ IK

$e = M/P = \frac{39.24}{29.85} = 1.31'$ $\qquad$ $B/6 = 1.33' > e$

$f_{SOIL} = \frac{29.85}{45.0} \pm \frac{39.24}{67.5} = 0.66 \pm 0.58 = 1.24^{ksf}$ or 0.08^{ksf}

ok

CHECK OVERTURNING FACTOR OF SAFETY

OTM = $3.07^K \times 9' = 27.63^{K\,FT}$

RESIST. MOM = $(10.1 \times 4.5) + (28.0 \times 4.08) + (0.6 \times 4.75) + (6.7 \times 4.5) - (13.73 \times 4.5) = 130.9^{K\,FT}$

FACTOR OF SAFETY = $\frac{130.9}{27.63} = 4.74 > 1.5$ ok

FOOTING TYPE A (CONT)

CHECK SEISMIC LOADING ON FOOTING

SEISMIC LOAD FROM FOUNDATION WALL
SINCE WALL IS SUPPORTED ON FOOTINGS

$F_p = ZIC_pW_p$ (REF 8, eq (12-10))

$C_p = 0.75(2) = 1.5$ (REF 8 Table 23-P)
$Z = 0.2$ (REF 8 Table 23-I)
$I = 1.25$ (REF 9)

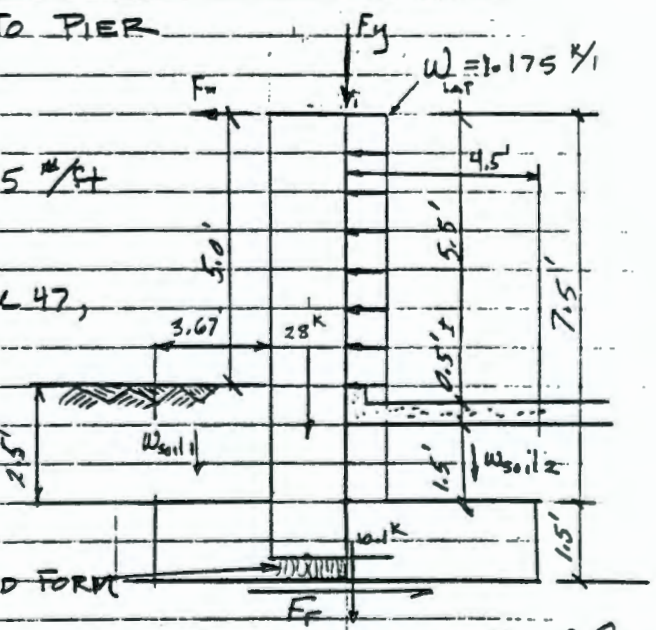
$F_p = 0.2(1.25)(1.5)W_p$
$= 0.375 W_p$ — GOVERNS OVER REF 9 REQUIREMENT USING HANFORD STANDARD SDC-4.1 (ZC = 0.25) $(0.25(1.25) = 0.3125) = F_p$

WALL WEIGHT = 0.83(150) = 125.0 PSF

SEISMIC LOAD FROM WALL TO PIER

$W_p = 125(0.375) = 47$ PSF

$W_{LAT} = 25 W_p = 25(47) = 1175$ #/ft



FROM REF 1 COMPUTER OUTPUT page 47, SEISMIC LOADS ON PIER FROM BUILDING. (KIPS)

SEISMIC LOAD CASES FROM BLDG.

1. Case 1. $F_x = 1.51$ $F_y = 7.77$ ↓ $F_z = 0.11$
2. Case 2. $F_x = 0.65$ $F_y = 25.66$ ↓ $F_z = -11.91$
3. Case 3. $F_x = 0.29$ $F_y = 15.33$ ↑ $F_z = 12.15$

OVERTURNING DUE TO WALLS LATERAL LOAD COMBINED WITH F_x of Case 3

$M_{OT} = 0.29(9.0) + 1.175(5)(6.5)$
$= 41.08$ K-'

TOTAL SHEAR $V = 0.29 + 1.175(5) = 6.17$ K

$W_{soil\ 1} = 5(3.67)(2)(0.11) = 4.0$ K
$W_{soil\ 2} = 5(2)(4.5)(0.11) = 5.0$ K

FOOTING TYPE A (CONT)

RESISTING MOMENT

$M_R = 28(4.08) + 10.1(4.5) + 0.6(4.75) + 4.0\left(\frac{3.67}{2}\right) + 5.0(6.75) - 15.93(4.5)$
$= 131.95^{K-1}$

$FS = \frac{M_R}{M_{OT}} = \frac{131.95}{40.8} = 3.23$ (OK)

(Soil Bearing Pressure)

$e = \frac{40.8}{31.77} = 1.28 < 9/6 = 1.5$

$A = 45\ SF \quad S = 5(9^2)/6 = 67.5\ FT^3$

$f_{soil} = \frac{31.77}{45} \pm \frac{40.8}{67.5} = 0.71 \pm 0.60$
$= 1.31$ OR 0.11 KSF (OK)

SLIDING RESISTANCE

$F_F = \mu W_{NET} \qquad \mu = 0.42$ (Friction Coef.) (Ref 2, Page 13)

$W_{NET} = 10.1 + 28 + 4.0 + 5.0 + 0.6 - 15.93 = 31.77^K$

$W_{REQ} = \frac{V(1.5)}{0.42} = \frac{6.2(1.5)}{0.42} = 22.1^K < W_{NET}$ (OK)

(Factor of Safety)

CHECK DL+LL CASE FOR SOIL PRESSURE DISTRIBUTION

Governing Load at Col G-2
Load Comb. 20 DL+LL+CRANE AT G
$F_x = 4.25^K \quad F_y = 38.99^K \downarrow$

Moments aro. J & Footing:

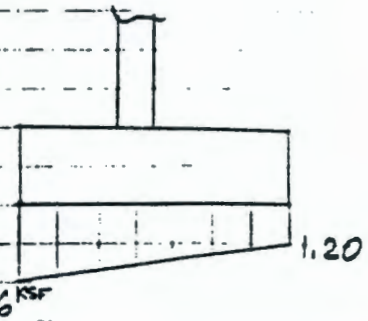
$\overset{\circlearrowleft +}{M_{\mathcal{L}}} = 5.0(2.25) + 0.6(0.25) - 28(0.42) - 4.0(2.67) - 4.25(9)$
$= -49.29^{IK}$

$W_{TOTAL} = 28 + 4.0 + 5.0 + 38.99 + 10.1 + 0.6 = 86.69^K$

$e = \frac{49.29}{86.69} = 0.57' \qquad 9/6 = 1.5'$

$f_{soil} = \frac{W_{TOTAL}}{A_F} \pm \frac{M}{S} = \frac{86.69}{45} \pm \frac{49.29}{67.5} = 1.93 \pm 0.73$

f_{soil} max $= 2.66$ KSF (OK)
f_{soil} min $= 1.20$ KSF



Outside of the building.

FORM 5007 REV. 7/79 **GENERAL COMPUTATION SHEET**

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE - RL UNIT/S WRAP MOD. 1

SUBJECT BUILDING FOUNDATION

TST 11/14/91 16c

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	2	TST	WLW
FINAL	✓	0	DATE 11/18/91	DATE 11/18/91
VOID		1		
SHEET 44 OF ~~66~~ 69		3 4	DATE	DATE
J.O 6237.001				

FOOTING TYPE A (CONT)

DL CASE

LOAD CASE 1 $F_x = 0.55^k$ $F_y = 5.72^k$

MOMENTS ABOUT ℄ FOOTING

$$\overset{\curvearrowright +}{M_{℄}} = 5.0(2.25) + 0.6(0.25) - 28(0.42) - 4.0(2.67) - 0.55(9)$$
$$= -16.3^{k-1}$$

$$W_{TOTAL} = 28 + 4.0 + 5.0 + 10.1 + 5.72 + 0.6$$
$$= 53.4^k$$

$$e = \frac{16.3}{53.4} = 0.31$$

$$f_{soil} = \frac{53.4}{45} \pm \frac{16.3}{67.5} = 1.19 \pm 0.24$$

$f_{soil\ max} = 1.43$ KSF

$f_{soil\ min} = 0.95$ KSF OK

TO TRY TO OBTAIN UNIFORM PRESSURE UNDER DL LOCATE FOOTING SYMMETRICALLY UNDER WALL

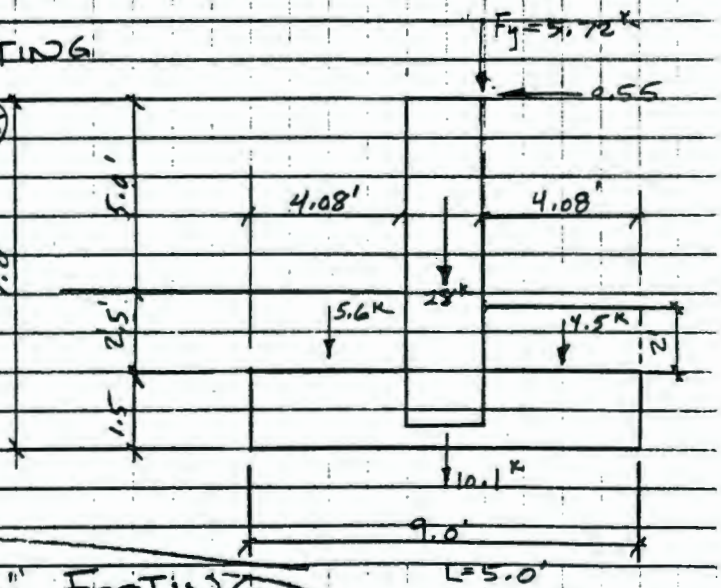
MOMENTS ABOUT ℄ FOOTING

$$\overset{\curvearrowright +}{M_{℄}} = 5.72(0.42) - 0.55(9) - 2.46(5.6 - 4.5)$$
$$= -5.25^{k-1}$$

$$f_{soil} = \frac{53.4}{45} \pm \frac{5.25}{67.5} = 1.19 \pm 0.07$$

$f_{soil\ max} = 1.26$ KSF

$f_{soil\ min} = 1.12$ KSF (OK)



Interior toe of footing to actually align with wall footing at ℄ F!

USE 5 X 9 X 1'-6" FOOTING CENTERED ON WALL

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

WCW 10/24/91

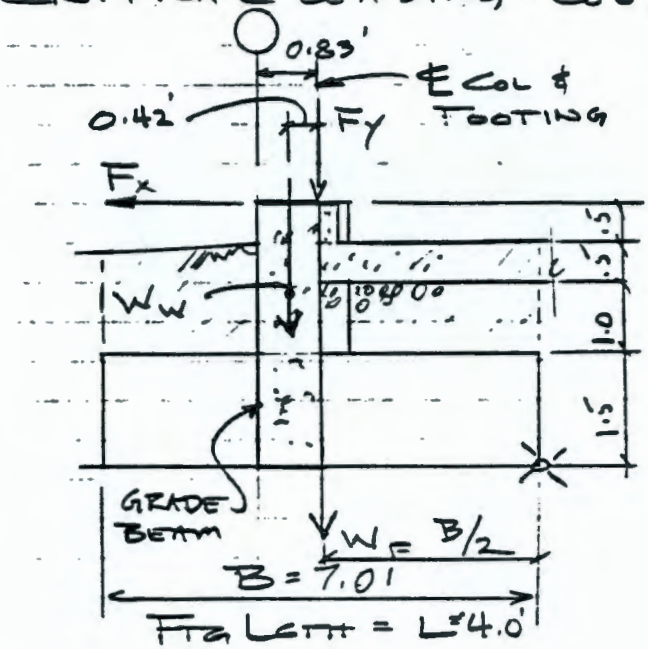
CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.R
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 45 OF 69		3	DATE	DATE
J.O 6237.001		4		

FOOTING TYPE N - COLS A-2, A-3, A-4, A-5, A-6, A-7 & A-8

CRITICAL LOADING ~ COL A-6 LOAD #1 $F_y = 25.55^K \downarrow$ $F_x = -6.17^K$

LOAD #2 $F_y = 10.56^K \uparrow$ $F_x = -2.21^K$

LOADS IN Z DIRECTION WILL BE CARRIED BY LENGTH OF WALL DOWN INTO FOOTINGS.



TRIAL DESIGN

FOOTING $B = 4'$ $L = 4'$ $t = 1.5'$

$W_F = (4.0)^2(1.5)(.15) = 3.6^K$

$W_W = (.83)(2.0)(4.0)(.15) = 1.0^K$

PIER WT NEGLIGIBLE

$W_{TOTAL} = 3.6 + 1.0 = 4.6^K$

LOAD # 1

$P_{TOTAL} = 25.55 + 4.6 = 30.15^K$

$\overset{+}{M} = -(6.17 \times 3.5) - (1.0 \times 0.42') = -21.18^{K\text{-}F}$

$e = M/P = 21.18/30.15 = 0.70'$ $\quad 4/6 = 0.67' = e$

$f_{soil} = P/A \pm M/S$ $\quad A = 16^{FT^2}$

$S = \frac{(4)^3}{6} = 10.7^{FT^3}$

$f_{soil} = \frac{30.15}{16} \pm \frac{21.18}{10.7} = 1.88 \pm 1.98 = 3.86^{ksf}$ OR -0.10^{ksf} NG

INCREASE B TO 5.0'

$W_F = (5.0 \times 4.0)(1.5)(.15) = 4.5 \Rightarrow W_{TOTAL} = 5.5^K$

$P_{TOTAL} = 25.55 + 5.5 = 31.05^K$

$A = 20^{FT^2}$ $\quad S = \frac{4.0(5.0)^2}{6} = 16.7^{FT^3}$

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
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NAME OF COMPANY DOE-RL UNIT/S WRAP Mod 1

SUBJECT BUILDING FOUNDATION

WCW 10/23/92

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	0	V.L.L. DATE 9/3/92	H.J.F. DATE 9.3.92
FINAL	✓	1		
VOID		2	TST DATE 2/1/93	VAP DATE 2/1/93
SHEET 46 OF 69				
J.O 6237.001				

SHEET 46a FOLLOWS

FOOTING TYPE N (CONT.)

$f_{soil} = \frac{31.05}{20} \pm \frac{21.18}{16.7} = 1.55 \pm 1.27 = 2.82$ ksf or 0.28 ksf

SAY OK

Since max pressure is outside of the building.

LOAD #2

ASSUME LOAD FROM WALL D.L. BETWEEN COLUMNS ACTS TO RESIST UPLIFT AND OVERTURNING WITH UPLIFT CONDITIONS

COLUMN SPACING = 25.0'

$W_W = 1.0^K + (0.83')(3.5')(21.0)(.15) = 10.2^K$

$P_{TOTAL} = \underset{W_F}{4.5^K} + \underset{W_W}{10.2^K} - \underset{F_y}{10.56} = \underline{4.14K} \downarrow$

$M = -(2.21^K \times 3.5') - (10.2 \times 0.42') = -12.02^{'K} \Rightarrow e = \frac{12.02}{4.14} = 2.9' > \frac{5.0}{3} = 1.67'$ n.g.

TRY B = 7'-0" $W_F = (7 \times 4) \times 1.5 \times 0.15 = 6.3K$

$P_{TOT} = 6.3 + 10.2 - 10.56 = 5.94K$ $e = \frac{12.02}{5.94} = 2.02'$

$f_{soil} = \frac{2 \times 5.94}{3 \times 4 \times (3.5 - 2.02)} = 0.67$ ksf O.K.

CHECK OVERTURNING FACTOR OF SAFETY USING LOAD #1 AS CRITICAL

$OTM = 6.17^K \times 3.5' = 21.6^{KFT}$

$RESIST\ MOM = (6.3 \times 3.5) + (10.2 \times 3.92) + (25.55 \times 3.5) = 151.46^{KFT}$

FACTOR OF SAFETY $= \frac{151.46}{21.6} = 7.01 > 1.5$ ok

CHECK LOAD #2 FACTOR OF SAFETY

$M_{OT} = -12.02^{'K}$ $* M_R = 5.94(3.5') = 20.79^{'K}$

FACTOR OF SAFETY $= \frac{20.79}{12.02} = 1.73 > 1.5$ ok

~~USE 7.0' × 4.0' × 1.5' THICK FOOTING~~

SEE SHEET 46a FOR CONTINUATION

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	3	TST	VAP
FINAL		2	DATE 2/1/93	DATE 2/1/93
VOID		4		
SHEET 46a OF 69			DATE	DATE
J.O 6237.001				

FOOTING N CONTINUED

SIZE FOOTING TO PROVIDE MINIMUM FACTOR OF SAFETY OF 1.5 FOR PULLOUT DUE TO UPLIFT FORCES.

$P\uparrow = 13.1^{k}$ (COL A-2)

DL REQUIRED = 13.1 (1.5) = 19.65^{k}

TRY 7' x 6 x 1.5 FOOTING

$W_F = 7(6)(1.5)(0.15) = 9.4^{k}$

$W_{soil} = 7(6)(0.11)(1.0) = 4.6^{k}$

$W_{slab} = 3.5(6)(0.5)(0.15) = 1.6^{k}$

$W_W = 0.83(25)(2)(0.15) = 6.23^{k}$ ← wall length taken as only the footing width on page 45.

$W_{TOTAL} = 9.4 + 4.6 + 1.6 + 6.23 = 21.83^{k}$ (OK)

USE 7' x 6' x 1.5'

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE - RL UNIT/S WRAP Hot 1

SUBJECT BUILDING FOUNDATION

WLW 10/25/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 47 OF 69		3	DATE	DATE
J.O 6237.001		4		

SHEET 47a FOLLOWS

FOOTING TYPE P ~ COLS A-1 & A-9

CRITICAL LOADING - LOAD #1 $F_x = -2.06^K$ $F_y = 25.42^K$ $F_z = 10.3^K$
COL A-1
A-9
LOAD #2 $F_x = 10.72^K$ $F_y = -21.92^K$ $F_z = 0.41^K$

COLS A-1 & A-9 ARE CORNER COLUMNS, SO BOTH F_x & F_z LOADS WILL TRANSFER ALONG LENGTH OF GRADE BEAMS. FOOTING DESIGNED FOR VERTICAL LOADS ONLY

TRIAL DESIGN

4.0' × 4.0' × 1.5' THICK

$W_F = (4.0)^2(1.5)(.15) = 3.6^K$

$W_W \approx (0.83')(5.0')(2.0')(.15) = 1.2^K$
LGTH HGT

$W_{TOTAL} = 3.6 + 1.2 = 4.8^K$

FOUNDATION SIMILAR TO TYPE N, ON PRECEDING PAGES

LOAD #1

$P_{TOTAL} = 25.42 + 4.8 = 30.22^K$

$f_{soil} = \frac{30.22}{16} = 1.89^{KSF} < 2.5^{KSF}$ OK

LOAD #2

WT OF WALL BETWEEN COLUMNS = W'_W

$W'_W = (0.83')(3.5')\left[\left(\frac{20}{2} - 2\right) + \left(\frac{25}{2} - 2\right)\right](0.15) = 8.1^K$
8 10.5

$W_{soil} \approx \left[(4.0)^2 - (.83 \times 5.0)\right](1.5')(.11) = 1.96^K$

$W_{TOTAL} = 4.8 + 8.1 + 1.96 = 14.9^K < 21.92^K$ uplift NG.

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

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CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	3	TST	
FINAL	✓	2	DATE 2/1/93	DATE 2/1/93
VOID		4		
SHEET 47a OF 69			DATE	DATE
J.O. 6237.001				

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

TYPE P FOOTING CONTINUED

SIZE FOOTING TO PROVIDE MINIMUM FACTOR OF SAFETY OF 1.5 FOR PULLOUT DUE TO UPLIFT FORCES

$P\uparrow = 21.92^K$

DL REQUIRED $= 21.92(1.5) = 32.88^K$

TRY $8' \times 8' \times 2'$ FOOTING

$W_F = 8^2(2)(0.15) = 19.2$

$W_{SOIL} = 8^2(1.0)(0.11) = 7.04$

$W_W = 8.1^K$

W_{slab} = (neglect)

$W_{TOTAL} = 19.2 + 7.04 + 8.1 = 34.3^K$ (OK)

USE $8' \times 8' \times 2'$ FOOTING

~~FOOTING TYPE P~~ (CONT)

~~INCREASE FOOTING SIZE TO 5.5'x5.5'x2.0'~~

~~$W_F = (5.5)^2(2.0)(.15) = 9.1^K$~~

~~$W_{SOIL} = [(5.5)^2 - (.83 \times 6.3)](1.5)(0.11) = 4.1^K$~~

~~$W_{TOTAL} = 9.1^K + 1.2 + 8.1 + 4.1 = 22.5^K > 21.92^K$ ok~~

W_F W_W $W_{W'}$ W_{SOIL}

~~USE 5.5' x 5.5' x 2.0' THICK FOOTING~~

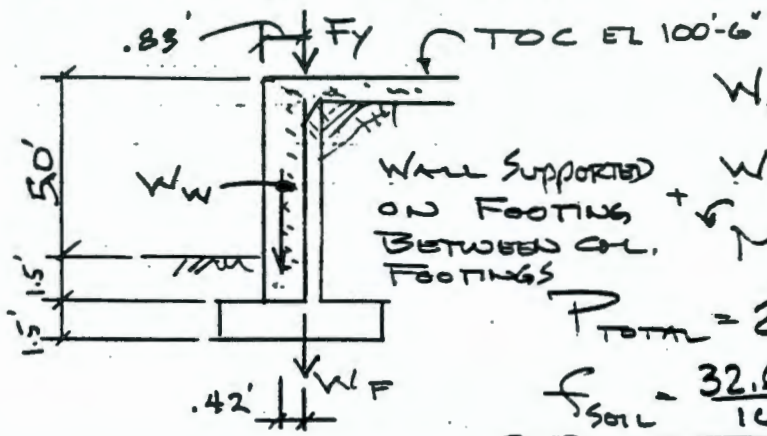
FOOTING TYPE Q ~ COLS F-5, F-6, F-7, F-8 & F-9

CRITICAL LOADING ~ COL F-8 $F_y = 25.86^K$

LATERAL LOADS TAKEN INTO ADJACENT SLABS. RETAINING WALL AT FACE OF DOCK AT COL F-5 & F-6 RESTRAINED AT TOP BY TIE TO DOCK SLAB

TRIAL DESIGN

FOOTING ~ 4.0' x 4.0' x 1.5' $A = 16^{FT^2}$ $S = 10.7^{FT^3}$



$W_F = (4.0)^2(1.5)(0.15) = 3.6^K$

WALL SUPPORTED ON FOOTING BETWEEN COL. FOOTINGS + $W_W = (0.83' \times 6.5 \times 4.0)(.15) = 3.2^K$

$M = 3.2 \times 0.42' = 1.34^{K\,FT}$

$P_{TOTAL} = 25.86 + 3.6 + 3.2 = 32.66^K$

$f_{SOIL} = \frac{32.66}{16.0} \pm \frac{1.36}{10.7} = 2.04 \pm 0.13 = 2.17^{KSF}$ OR 1.91^{KSF} ok

USE 4.0x4.0x1.5 FOOTING

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP ~~MOD~~ 1

SUBJECT BUILDING FOUNDATION

WLW 10/25/91

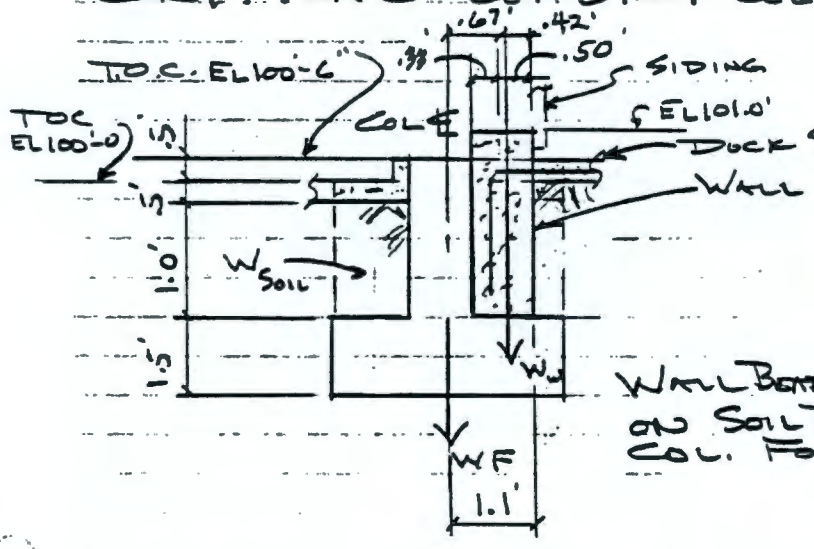
CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	0	V.L.L.	H.J.F.
FINAL	✓	1	DATE 9/3/92	DATE 9.3.92
VOID		3	TST	VAP
SHEET 49 OF 69		2	DATE 2/1/93	DATE 2/1/93
J.O 6237.001		4		

SHEET 49a FOLLOWS

FOOTING TYPE R ~ COL E.5-4 & E.5-7

CRITICAL LOADING - COL E5-7 LOAD #1 $F_y = 27.03^K \downarrow$ $\rightarrow 0$

LOAD #2 $F_y = 7.06^K \uparrow$ $F_z = 1.81^K$



LATERAL LOADS TO BE RESISTED BY DOCK SLAB TIED INTO GRADE BEAM WALL & COLUMN PIER

TRIAL DESIGN

FOOTING ~ 4.0' × 4.0' × 1.5' THICK
PIER ~ 1.25' SQ × 2.0' HIGH
WALL ~ .83' THICK × 2.5' HIGH
NEGLECT BLOCKOUT AT TOP FOR WEIGHT

$W_W = (.83 \times 2.5 \times 4.0)(0.15) = \underline{1.2^K}$

$W_F = (4.0)^2(1.5)(.15) + (1.25)^2(2.0)(.1$

$W_F = 4.1^K$

$W_{SOIL} = [(4.0)^2 - .83(4.0) - (1.25 \times .8)](1.5)(.11)$

$W_{SOIL} = \underline{1.9^K}$ (SLAB WT NOT INCLUDED)

$W_{TOTAL} = 1.2 + 4.1 + 1.9 = \underline{7.2^K}$

LOAD #1

$P_{TOTAL} = \underset{F_y}{27.03^K} + \underset{W_F}{4.1^K} + \underset{W_W}{1.2^K} = 32.33^K$

$f_{SOIL} = \dfrac{32.33}{16.0} = 2.02 \text{ ksf} < 2.5 \text{ ksf}$ OK

LOAD #2

$W_{TOTAL} = 7.2^K > 7.06^K \uparrow$ UPLIFT ~~OK~~ (NG)

~~USE 4.0' × 4.0' × 1.5' THICK FOOTING~~

SEE SHEET 49a FOR CONTINUATION

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-S4	3	TST	VAP
FINAL	✓	2	DATE 2/1/93	DATE 2/1/93
VOID		4		
SHEET 49a OF			DATE	DATE
J.O 6237.001				

TYPE R FOOTING CONTINUED

SIZE FOOTING TO PROVIDE MINIMUM FACTOR OF SAFETY OF 1.5 FOR PULLOUT DUE TO UPLIFT FORCES

$P\uparrow = 7.06^k$

DL REQ'D $= 7.06(1.5) = 10.59^k$

TRY 4'-9" x 4'-9" x 1'-6" FOOTING

$W_F = 4.75^2(1.5)(0.15) = 5.08^k$

$W_{SOIL} = 4.75^2(1.0)(0.11) = 2.48^k$

$W_W = 1.2^k$

$W_{TOTAL} = 5.08 + 2.48 + 1.2 = 8.76^k$ (NG)

TRY 5'-6 x 5'-6" x 1'-6"

$W_F = 5.5^2(1.5)(0.15) = 6.81^k$

$W_{SOIL} = 5.5^2(1.0)(0.11) = 3.33^k$

$W_W = 1.2$

$W_{TOTAL} = 6.81 + 3.33 + 1.2 = 11.34^k$ (OK)

USE 5'-6" x 5'-6" x 1'-6" FOOTING

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

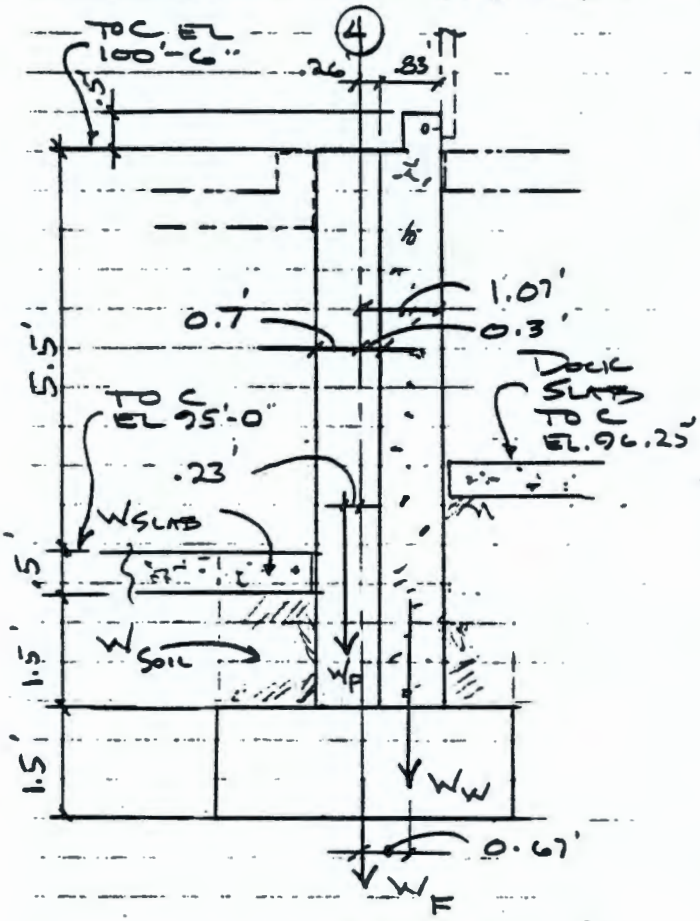
SUBJECT BUILDING FOUNDATION

WLW 10/28/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54		V.L.L.	H.J.F.
FINAL	✓		DATE 9/3/92	DATE 9.3.92
VOID				
SHEET	50 OF 69		DATE	DATE
J.O	6237.001			

FOOTING TYPE 5 - COL F.5-1 & F.5-4

CRITICAL LOADING - COL. F.5-1 LOAD #1 $F_y = 13.69^k \downarrow$
LOAD #2 $F_y = 5.09^k \uparrow$
DEAD LOAD $= 4.51^k$



Horizontal loads will be taken by walls.

TRIAL DESIGN

FOOTING 4.5' x 3.5' x 1.5' THICK
PIER ~ 1.25' WIDE BUILT INTO WALL

$W_F = (4.5)(3.5)(1.5)(0.15) = 3.6^k$

$W_W = (0.83)(7.5)(3.5)(.15) = 3.3$

$W_P = (1.25)(.96)(7.5)(.15) = 1.4$

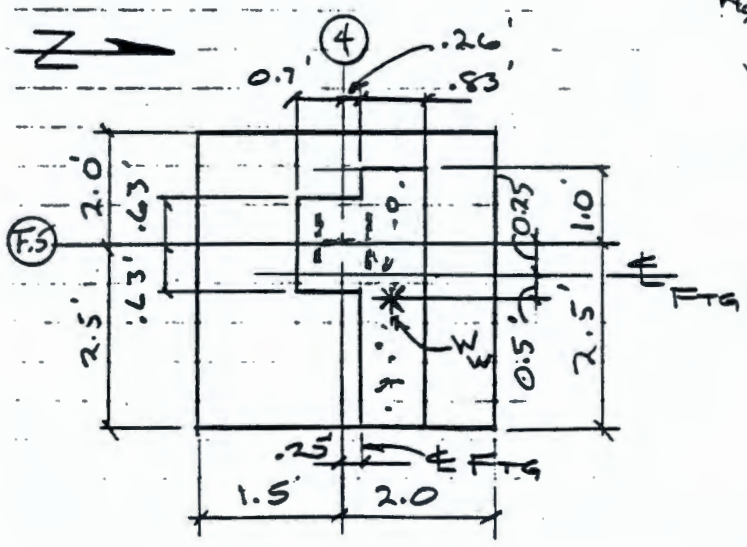
$W_{TOTAL} = \underline{8.3^k}$

$W_{SOIL} = [\overbrace{(4.5 \times 3.5) - (0.83 \times 3.5) - (1.25 \times 0.96)}^{11.64}](1.5)(.11)$

$W_{SOIL} = 1.9^k$

$W_{SLAB} = (11.64^{SF})(0.5)(0.15) = \underline{0.9^k}$

SECTION (F.5-4)



PLAN

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54		V.L.L.	H.J.E
FINAL			DATE 9/3/92	DATE 9.3.92
VOID				
SHEET 51 OF 69			DATE	DATE
J.O 6237.001				

WLW 10/2/92

NAME OF COMPANY DOE - RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

FOOTING TYPE S (CONT.)

COL F.5-1 LOAD # 1

MOMENT ABOUT N-S ℄ OF FOOTING

$$M_{N-S}^{+\circlearrowright} = (\underset{F_y}{13.69} \times 0.25') - (\underset{W_W}{3.3} \times 0.50') + (1.4 \times 0.25) = 3.42 - 1.7 + 0.4 = 2.12^{KFT}$$

MOMENT ABOUT E-W ℄ OF FOOTING

$$M_{E-W}^{+\circlearrowright} = (3.3^{K} \times 0.42) - (1.4^{K} \times 0.48) - (17.18 \times 0.25) = -3.5^{KFT}$$

APPROX CALCULATION OF MAXIMUM SOIL BEARING

$$f_{SOIL} = P/A \pm \frac{M_{N-S}}{S_{N-S}} \pm \frac{M_{E-W}}{S_{E-W}}$$

$$P_{TOTAL} = 13.69 + 8.3^{K} = 21.99^{K}$$

$$A = 3.5' \times 4.5' = 15.75^{FT^2}$$

$$S_{N-S} = \frac{3.5(4.5)^2}{6} = 11.8^{FT^3}$$

$$S_{E-W} = \frac{4.5(3.5)^2}{6} = 9.2^{FT^3}$$

$$f_{SOIL} = \frac{21.99}{15.75} \pm \frac{2.12}{11.8} \pm \frac{3.5}{9.2} = 1.40^{ksf} \pm 0.18 \pm 0.38$$

$$= \underset{max}{1.96}^{ksf} \text{ OR } \underset{min}{0.84}^{ksf}$$

OK

CHECK MOMENTS WITH DEAD LOAD ONLY TO DETERMINE TENDENCY FOR UNEVEN SETTLEMENT

$$M_{N-S}^{+\circlearrowright} = (\underset{F_{y\,DL}}{4.51'} \times 0.25') + (\underset{W_P}{1.4} \times 0.25') - (\underset{W_W}{3.3} \times 0.5) = -0.17^{KFT}$$

$$M_{E-W}^{+\circlearrowright} = (\underset{W_W}{3.3^{K}} \times 0.42') - (\underset{F_{y\,DL}}{4.51^{K}} \times .25') - (\underset{W_P}{1.4^{K}} \times 0.48) = -0.41^{KFT}$$

SAY OTM CLOSE ENOUGH TO ZERO - USE LAYOUT SHOWN ON PREVIOUS PAGE

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

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WLW 7/28/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	2	V.L.L.	H.J.F.
FINAL	✓	1	DATE 9/3/82	DATE 9.3.82
VOID		3	TST	LHB
SHEET 52 OF 69		4	DATE 6/8/93	DATE 6/8/93
J.O 6237.001				

FOOTING TYPE 5 (CONT.)

COL F.5-1 LOAD #2

UPLIFT LOAD = 5.09 K

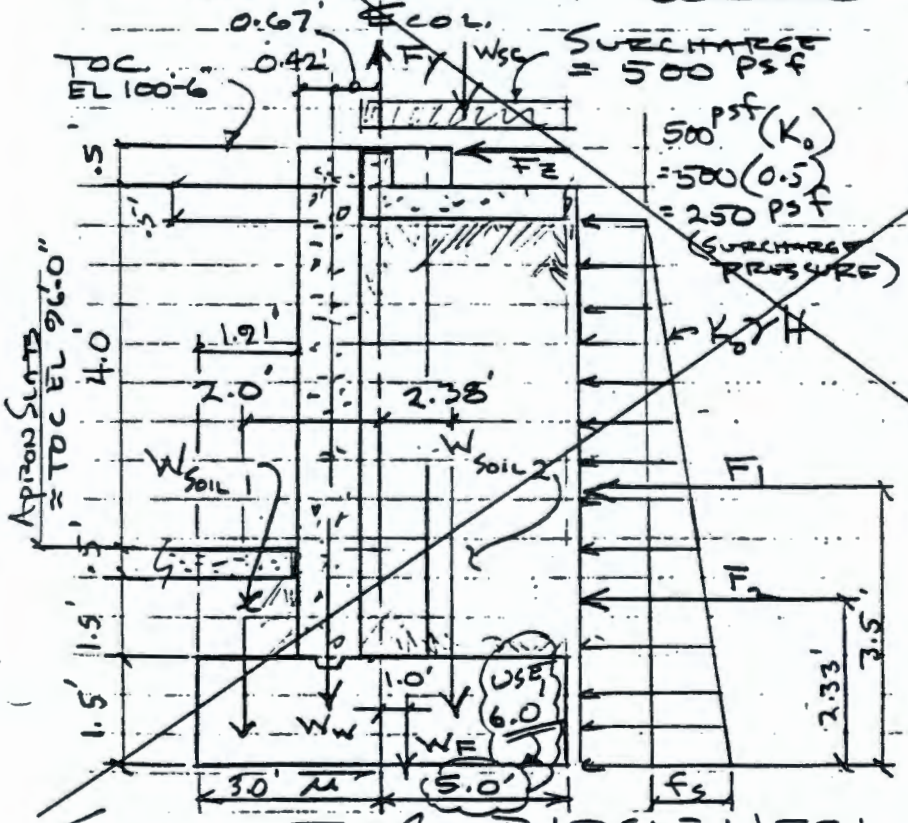
$W_{TOTAL} + W_{SOIL} + W_{SLAB} = 8.3^K + 1.9^K + 0.9^K = 11.1^K > 5.09^K$

OK

USE 4.5' x 3.5' x 1.5' THICK FOOTING OFFSET AS SHOWN ON PLAN SKETCH FOR F.5-4 - FOOTING CENTERED ON COLUMN FOR F.5-1

~~FOOTING TYPE T - COL. D-1, D.5-1, E-1 & E.5-1~~

CRITICAL LOADING - COL D.5-1 $F_x = 0$ $F_y = 0.64^K$ $F_z = 4.17^K$ N-S



SECTION FOR COL. D-1, D.5-1, E-1 & E.5-1

LENGTH OF FOOTING = L

LOADS IN X DIRECTION WILL TRANSFER INTO LENGTH OF GRADE BEAM

μ = SOIL FRICTION COEFFICIENT

$\phi = 30°$ FOR REF. 2 PAGE 6

$K_o = 1 - \sin\phi = 1 - \sin 30° = 0.50$ PER REF. 3 PAGE 272

$f_s = K_o \gamma H_{max} = 0.5(110)(7') = 385^{psf}$

RESISTANCE DUE TO PASSIVE & ACTIVE SOIL PRESSURE AGAINST TOE OF FOOTING HAS BEEN NEGLECTED

WALL ON EITHER SIDE OF FOOTING TO BE SUPPORTED BY A CONTINUOUS RETAINING WALL FOOTING.

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

WLW 10/28/9

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	3	V.L.L.	H.J.F.
FINAL	✓	4	DATE 9/3/92	DATE 9.3.92
VOID		3	TST	LHB
SHEET 53 OF 69		4	DATE 6/8/93	DATE 6/8/93
J.O 6237.001				

~~FOOTING TYPE T (CONT.)~~

BY INSPECTION, CRITICAL LOADING WILL BE THE COLD5-1 LOAD, AS FOOTING WILL BE SIZED ON THE BASIS OF LATERAL LOADING. ASSUME NO TIE OF COLUMN PIER TO FLOOR SLAB.

TRIAL DESIGN

FOOTING $\underset{B}{8.0'} \times \underset{L}{4.0'} \times 1.5'$ THICK

$W_F = (8.0 \times 4.0 \times 1.5)(0.15) = 7.2^K$

$W_W = (0.83' \times 6.5' \times 4.0')(0.15) = 3.2^K$

PIER WEIGHT SMALL RELATIVE TO OTHER LOADS

$W_{TOTAL} = 7.2 + 3.2 = 10.4^K$

$P_{NET} = -0.64^K + 10.4^K = 9.8^K \downarrow$ UPLIFT ok

$F_1 = (0.250^{ksf})(7.0')(4.0') = 7.0^K$

$F_2 = (0.385^{ksf})(7.0)(4.0)(0.5) = 5.39^K$

$W_{SOIL\,1} = (1.91)(1.5)(4.0)(.11) = 1.26^K$

$W_{SOIL\,2} = (5.25)(5.5)(4.0)(.11) + \underbrace{(0.5^{ksf})(5.25)(4.0)}_{W_{SC}\ (SURCHARGE)} = 23.2^K$

MOMENTS ABOUT ℄ FOOTING +↻

$M = +(\underset{W_{SOIL2}}{23.2^K} \times 1.38') - (\underset{W_W}{3.2} \times 1.67') - (\underset{W_{SOIL1}}{1.26} \times 3.0')$

$-(\underset{F_1}{7.0} \times 3.5') - (\underset{F_2}{5.39^K} \times 2.33') - (\underset{F_3}{4.17} \times 8.0') =$

$M = +32.0 - 5.3 - 3.8 - 24.5 - 12.6 - 33.4 = -\underline{47.6}^{K'F}$

$P = P_{NET} + W_{SOIL\,1} + W_{SOIL\,2} = 9.8 + 1.26 + 23.2 = \underline{34.3}^K$

FORM 5007 REV. 7/79 **GENERAL COMPUTATION SHEET**

(DISCIPLINE) Engineers & Constructors — A Bechtel Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	WLW 11/11/91	TST 11/18/91
FINAL		3		
VOID		4	TST 6/8/93	LHB 6/8/93
SHEET 54 OF 669				
J.O. 6237.001				

25a

FOOTING TYPE T (CONT.)

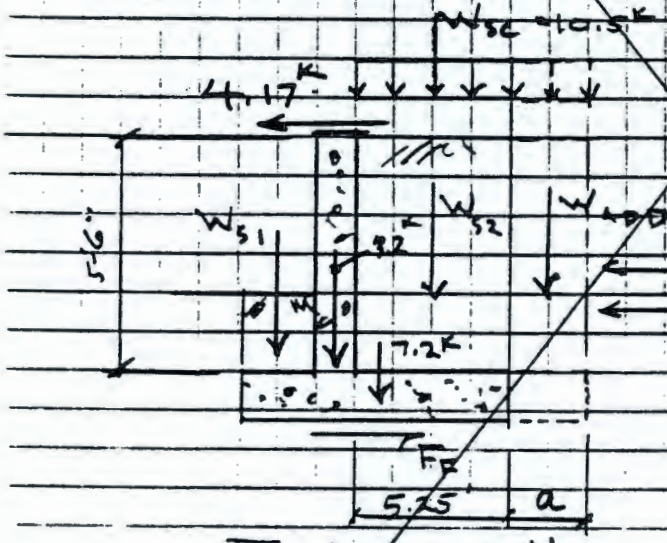
$e = M/P = \frac{47.6}{34.3} = 1.39 < B/6 = 1.33$

$f_{soil} = \frac{2\Sigma V}{3L(B/2 - e)} = \frac{2(34.3)}{3(4)(\frac{8.0}{2} - 1.39)}$

$f_{soil} = 2.19^{ksf}$ OK

CHECK SLIDING RESISTANCE

μ = SOIL FRICTION COEFFICIENT = 0.42 PER REF. 2 PAGE 12



$W_{SC} + W_{S2} = 23.2^K$

$W_{S1} = 12.6^K$

$F_F = 0.42(W_{NET})$

SLIDING FACTOR OF SAFETY REQUIRED = 1.5

$F_F = 1.5(12.6^K) = 24.8^K$

$W_{ROD} = \frac{24.8}{0.42} = 59.1^K$

$W_{TOTAL} = 3.2^K + 1.26^K + 23.2^K + 7.2^K = 34.9^K$

$W_{NET} = 34.9 - 0.61 = 34.25^K < 59.1^K$ ROD NG.

F_Y

INCREASE FOOTING WIDTH TO 6.0'

$W_{TOTAL} = 6/4 \times 34.9 = 52.4^K \Rightarrow W_{ROD} = 59.1 - 52.4 = 6.75^K$

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP Mod 1

SUBJECT BUILDING FOUNDATION

WCW 10/28/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	3	V.L.L.	H.J.F.
FINAL	✓	2	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 55 OF 69		3	TST	LHB
J.O 6237.001		4	DATE 6/8/93	DATE 6/8/93

~~FOOTING TYPE T (CONT.)~~

~~ADDNL FOOTING HEEL LENGTH = a~~

$a(5.5)(6)(0.110) + a(6)(0.500) = 6.75^K$

$a[(5.5)(6)(0.110) + 6(0.500)] = 6.75^K$

$a = 1.01' \Rightarrow$ USE $1.0'$

~~CHECK D.L. CONDITION~~

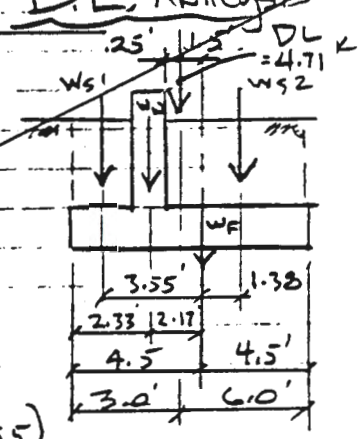
$M_{EFFTG} = (6/4 \times 23.2)(1.38') - 4.71(1.5) - (6/4 \times 3.2)(2.17) - (6/4 \times 1.26)(3.55)$

$M = 23.8^K\,FT$ $P_{TOTAL} = 57.0^K$

$e = \frac{23.8}{57.0} = 0.42$ $9/6 = 1.5$ $A = 54^{SF}$ $S = \frac{6(9)^2}{6} = 81^{FT^3}$

$f_{SOIL} = \frac{57.0}{54.0} \pm \frac{23.8}{81} = 1.06 \pm 0.29$
$= 1.35$ OR 0.77^{KSF}
$\Delta = 0.58^{KSF}$

D.L. ANALYSIS



~~USE 6.0' x 9.0' x 1.5' FOOTING CONFIGURATION AS SHOWN WIDTH MATCHES ADJOINING WALL FOOTING~~

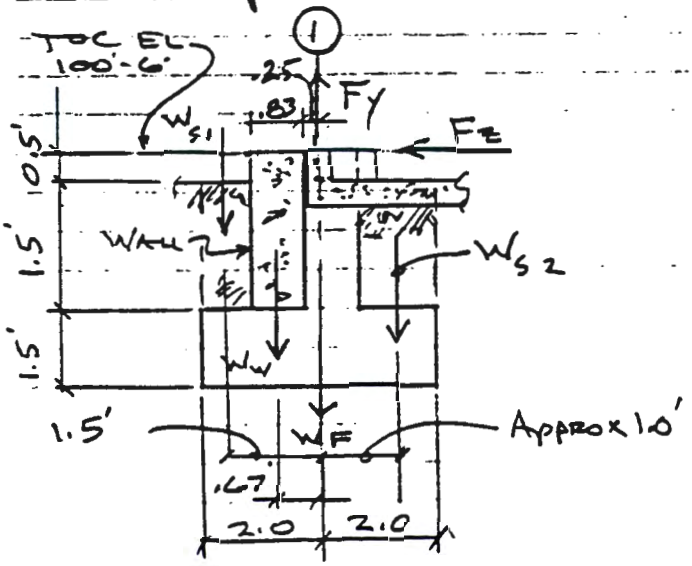
FOOTING TYPE X - COL. B-1, B-9, B.5-1 & E.5-9

CRITICAL LOADING - COL. E.5-9 LOAD #1 $F_Y = 13.73^K$ $F_Z = 0$

LOAD #2 $F_Y = -2.86^K$ $F_Z = -1.50^K$

BY INSPECTION, LOAD #2 WILL BE CRITICAL DUE TO OVERTURNING AND UPLIFT

X DIRECTION LOAD TRANSFERRED ALONG LENGTH OF WALL



TRIAL DESIGN

FOOTING 4.0 x 4.0 x 1.5' THICK
PIER 1.25' WIDE - BUILT INTO WALL

$W_F = [(4.0)^2(1.5) + 1.25'(.9')(2.0)]0.15 = 3.9^K$

$W_W = (.83)(2.0)(4.0)(.15) = 1.0^K$

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

WLW 10/28/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54		V.L.L.	H.J.T.
FINAL	✓		DATE 9/3/92	DATE 9.3.92
VOID				
SHEET 56 OF 69			DATE	DATE
J.O 6237.001				

$W_{S1} = (.9')(1.5)(4.0)(.11) = \underline{0.6^K}$

$W_{S2} = [(2.25')(4.0) - (1.25')(.9')](1.5)(0.11) = \underline{1.3^K}$

$P_{TOTAL} = -2.86 + 3.9 + 1.0 + 0.6 + 1.3 = 3.94^K$
(W_F, W_W, W_{S1}, W_{S2})

$M^{\circlearrowright}_{\text{ABOUT } \mathbb{C} \text{ FTG}} = (1.3)(1.0) - (1.0)(0.67') - (0.6)(1.5') - (1.5)(3.5') = -5.52^{KFT}$
(W_{S2}, W_W, W_{S1}, F_Z)

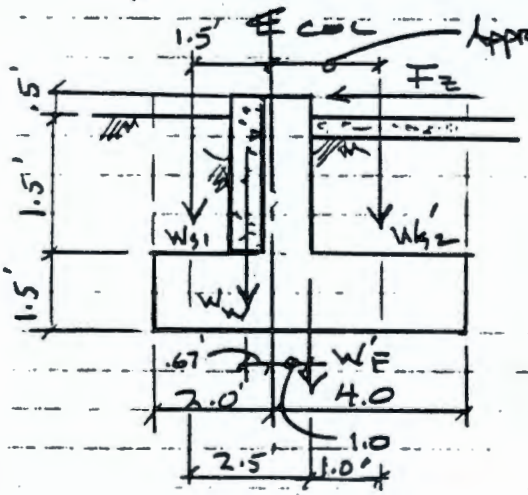
$e = M/P = \frac{5.52}{3.94} = 1.4'$ N.G.

INCREASE INSIDE TOE OF FOOTING TO 4.0

$W'_{S2} = [(4.25')(4.0) - (1.25)(.9)](1.5)(0.11) = 2.6^K$

$W'_F = (4.0)(6.0)(1.5)(.15) = 5.4^K$

PIER NOT INCLUDED (MINIMUM EFFECT)



$P_{TOTAL} = -2.86 + 5.4 + 1.0 + 0.6 + 2.6 = 6.74^K$
(F_Z, W_F, W_W, W_{S1}, W_{S2})

$M_{\text{ABOUT } \mathbb{C} \text{ FOOTING}} = (2.6)(2.0) - (1.0)(1.67) - 0.6(2.5) + (1.5)(3.5) = 4.68^{1K}$
(W_{S2}, W_W, W_{S1}, F_Z)

$e = M/P = \frac{4.68}{6.74} = 0.69'$ $B/6 = 1.0$

$f_{SOIL} = \frac{6.74}{4 \times 6} \pm \frac{4.68 \times 6}{4 \times 6^2} = 0.28 \pm 0.20 = 0.48 \text{ ksf max}$
0.08 ksf min O.K.

USE 4.0 × 6.0 × 1.5 FOOTING LOCATED AS SHOWN ABOVE

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Bechtel Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD.1

SUBJECT BUILDING FOUNDATION

TST 11/13/91 27a

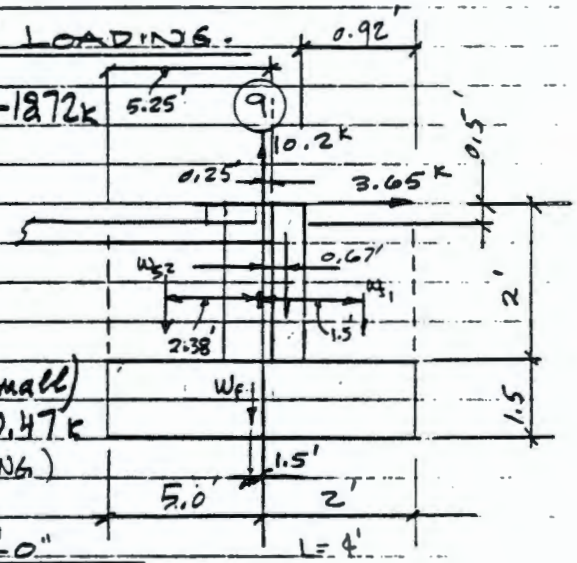
CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	3	V.L.L.	H.J.F
FINAL		4	DATE 9/3/92	DATE 9.3.92
VOID		3		
SHEET 57 OF 69		4	DATE	DATE
J.O 6237.001				

FOOTING TYPE A2 COL A.5-1 & A.5-9

CHECK FOR COL A.5-9 UPLIFT LOADING.

$F_y = 9.13^k \uparrow$ $F_z = -3.65^k$ OR $F_y = -18.72^k$

TRY TYPE X FOOTING PROPERTIES (4 x 6 x 1.5)



$W_F = 5.4^k$
$W_W = 1.0^k$
$W_{S1} = 0.6^k$
$W_{S2} = 2.6^k$

$P_{TOTAL} = -9.13 + 5.4 + 1.0 + 0.6 + 2.6 = -0.47^k$ (small) (NG)

INCREASE FOOTING TOE TO 5'-0"

$W_F = 7(4)(1.5)(0.15) = 6.3^k$
$W_W = 1.0^k$
$W_{S1} = 0.6^k$
$W_{S2} = 5.25(1.5)(4)(0.11) - 1.25(0.9)(1.5)(0.11) = 3.3^k$

$P_{TOTAL} = -9.13 + 6.3 + 1.0 + 0.6 + 3.3 = 2.07^k$

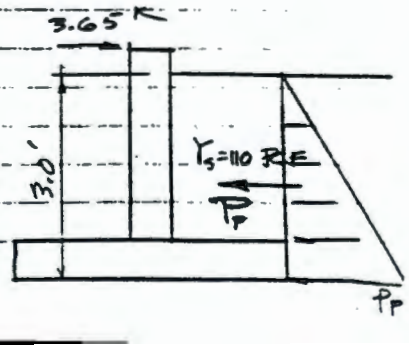
Moment about ℄ FOOTING

$M_{℄} = 0.6(3) + 1.0(2.17) + 3.65(3.5) - 3.3(0.88) - 9.13(1.5) = 0.15^{k\text{-}'}$

$e = \frac{M_{℄}}{P_{TOTAL}} = \frac{0.15}{2.07} = 0.07 < 7/6 = 1.16'$

$f_{soil} = \frac{2.07}{7 \times 4} \pm \frac{0.15 \times 6}{4 \times 7^2} = 0.07 \pm 0.00$ ksf O.K

SLIDING RESISTANCE BY PASSIVE PRESSURE



$P_p = K_p \gamma_s H = 2.5(0.110)(3) = 0.825^{KSF}$ (Ref 2, Page 13)

$P_P = 0.825(3)(1/2)(4) = 4.95^k > 3.65^k$ (OK)

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United Engineers & Constructors
A Bechtel Company

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-54	2	V.L.L.	H.J.F.
FINAL	✓	3	DATE 9/3/92	DATE 9.3.92
VOID		4		
SHEET 58 OF 69			DATE	DATE
J.O 6237.001				

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT BUILDING FOUNDATION

FOOTING TYPE A2 (CONT.) SHEET 58a FOLLOWS

UPLIFT ON A.5-9 WITH NO LATERAL LOAD

$F_y = 18.72^K \uparrow$

FULL WEIGHT OF GRADE BEAM TRIBUTARY TO COL

$W_w = 2(0.83)(20)(0.15) = 4.98^K$

$P_{TOTAL} = -18.72 + 6.3 + 4.98 + 0.6 + 3.3$
$= -3.54$ (NG)

INCREASE FOOTING WIDTH TO 6'

$P_{TOTAL} = -18.72 + 6.3(\frac{6}{4}) + 4.98 + 0.6(\frac{6}{4}) + 3.3(\frac{6}{4})$

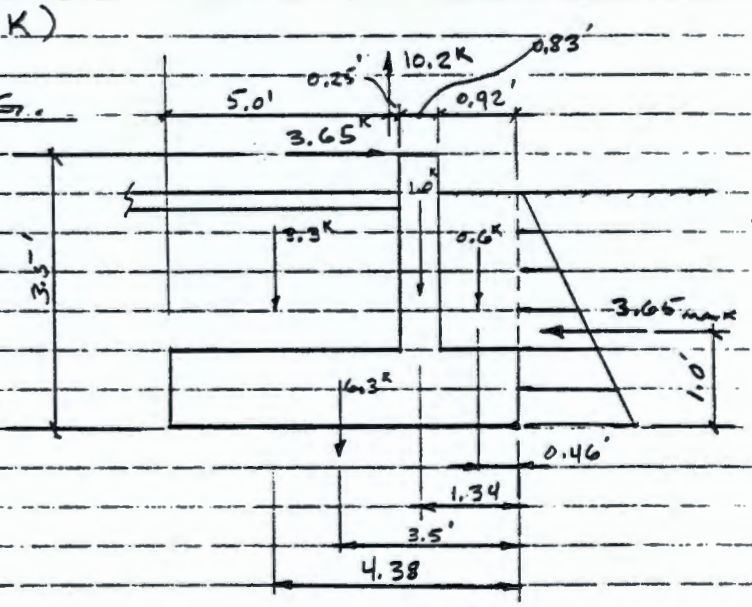
$= 1.56^K$ (OK)

CHECK OVERTURNING.

$M_{OT} = 3.65(3.5) = 12.8^{K-1}$

$M_R = 3.3(4.38) + 6.3(3.5) + 1(1.34)$
$+ 0.6(0.46) - 10.2(2.0)$
$+ 3.65(1.0)$
$= 21.8$

$FS = \frac{21.8}{12.8} = 1.70$ (OK)



USE 7.0' × 6.0' × 1.5' FOOTING LOCATED AS SHOWN ABOVE

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-S4	3	TST	VAP
FINAL	✓	2	DATE 2/1/93	DATE 2/1/93
VOID		4		
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J.O 6237.001				

FOOTING A2 CONTINUED

SIZE FOOTING TO PROVIDE MINIMUM FACTOR OF SAFETY OF 1.5 FOR PULLOUT DUE TO UPLIFT FORCES.

$P\uparrow = 18.72^K$

DL REQUIRED $= 18.72(1.5) = 28.08^K$

TRY FOOTING 7' x 6' x 2.0

$W_F = (7)(7)(2.0)(0.15) = 14.7^K$

$W_{SOIL} = 7(7)(1.0)(0.11) = 5.39^K$

$W_W = 4.98$

$W_{SLAB} = 5(7)(0.5)(0.15) = 2.63^K$

$W_{TOTAL} = 14.7 + 5.39 + 4.98 + 2.63 = 27.7^K$ (OK)

USE 7' x 6' x 2'-0" FOOTING

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(DISCIPLINE)

United Engineers & Constructors
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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

W LW 10/29/91

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PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	3	DATE 9/3/92	DATE 9.3.92
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SHEET 59 OF 69			DATE	DATE
J.O 6237.001				

FOOTING TYPE V C.5-9, D-9 & D.5-9
Type VI Col C-9

CRITICAL LOADING COL D-9 ~ $F_x = 4.03^k$ $F_y = 94.09^k$ $F_z = 0.02$

X DIRECTION LOADING TRANSFERRED INTO LENGTH OF WALL
Z LOADING NEGLIGIBLE

TRIAL DESIGN

FOOTING 6.0' x 6.0' x 1.5' THICK

$W_F = (6.0)^2(1.5)(0.15) = 8.1^k$

$W_{WALL} = (0.83)(6.0)(2.0)(.15) = 1.5^k$

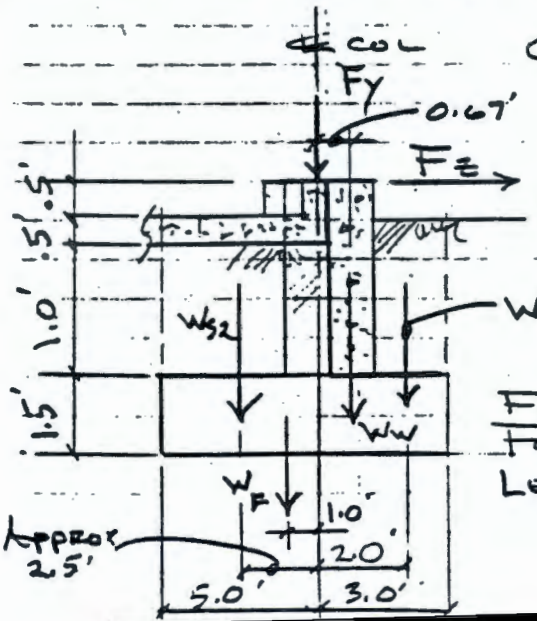
$P_{TOTAL} = \underset{F_y}{94.09} + \underset{W_F}{8.1} + \underset{W_W}{1.5} = 103.69^k$

$f_{SOIL} = P/A = \frac{103.69}{36.0} = 2.88^{ksf}$ INCREASE TO 6.5' SQ

USE FOOTING 6.5' x 6.5' x 1.5 THICK CENTERED ON COLUMN

FOOTING TYPE W ~ COL B.5-9 & E-9

CRITICAL LOADING ~ COL B.5-9 ~ LOAD #1 $F_x = 0.05^k$ $F_y = 64.77^k \downarrow$ $F_z = 0.119^k$



COL E-9

LOAD 2 $F_x = 0.12^k$ $F_y = 70.34^k \downarrow$ $F_z = -5.94^k$
LOAD 3 $F_x = 0.01^k$ $F_y = 50.44^k \downarrow$ $F_z = -12.58^k$
X DIRECTION LOADS TRANSFERRED INTO LENGTH OF WALL

+F_z FORCES WILL BE RESISTED BY SLAB ACTING THRU COMPRESSED EXPANSION JOINT MATERIAL
-F_z LOAD WILL BE CRITICAL FOR OVERTURNING
∴ LOADS 2 & 3 WILL CONTROL

FINAL FOOTING LENGTH = 6.0'

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WLW 10/29/91

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PRELIM.	WM1-54	2	V.L.L.	W.J.F.
FINAL	✓	8	DATE 9/3/92	DATE 9.3.92
VOID		1		
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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

FOOTING TYPE W (CONT.)

TRIAL DESIGN

FOOTING 5.0' × 8.0' × 1.5' THICK

$W_F = (5.0)(8.0)(1.5)(.15) = 9^K$

$W_W = (0.83)(5.0)(2.0)(.15) = 1.2^K$

$W_{S_1} = (1.9')(1.5')(5.0)(0.11) = 1.6^K$

$W_{S_2} = [(5.25')(5.0) - (1.25')(0.9')](1.5)(0.11) = 4.1^K$

$P_{TOTAL} = \underset{F_y}{\overset{50.44 \text{ OR}}{70.34}} + \underset{W_F}{9.0} + \underset{W_W}{1.2} + \underset{W_{S_1}}{1.6} + \underset{W_{S_2}}{4.1} = 66.34^K / 86.24^K$

$+\circlearrowleft M = (\overset{12.58 \text{ OR}}{5.94})(3.5) + (1.6)(3.0) + (1.2)(1.67) - (4.1)(1.5)$

ABOUT ℄ FTG F_z W_{S_1} W_W W_{S_2}

$M = 44.68^{IK} / 21.44^{IK}$

$e = M/P = \frac{44.68}{66.34} = 0.67'$ OR $e = \frac{21.44}{86.24} = 0.25'$ $B/6 = 8/6 = 1.33' > e$

$f_{soil} = P/A \pm M/S$

$A = (5.0)(8.0) = 40^{FT^2}$

$S = \frac{(5.0)(8.0)^2}{6} = 53.3^{FT^3}$

$f_{soil} = \frac{66.34}{40} \pm \frac{44.68}{53.3} = 1.66 \pm 0.84 = 2.5 \text{ ksf}$ OR 0.82 ksf

$f_{soil} = \frac{86.24}{40} \pm \frac{21.44}{53.3} = 2.16 \pm 0.40 = 2.56 \text{ ksf}$ OR 1.76 ksf

USE 6.0 × 8.0 × 1.5' THICK FOOTING OFFSET AS SHOWN ON PREVIOUS PAGE

Increase width of footing.

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SUBJECT BUILDING FOUNDATION

WLW 10/29/91

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
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FOOTING TYPE Y ~ COLS LINES F.4

CRITICAL LOAD ~ COL F.4-9 ~ $F_y = 2.84^K \downarrow$

TRIAL DESIGN

FOOTING 3.0' × 3.0' × 1.0' THICK (MINIMUM PRACTICAL FOOTING SIZE)
PIER 1.0' SQ × 2.0' HIGH

$W_F = (3.0)^2(1.0)(.15) + (1.0)(2.0)(.15) = 1.95^K$

$P_{TOTAL} = 2.84 + 1.95 = 4.79^K$

$f_{SOIL} = \frac{4.79}{9.0} = 0.53$ ksf ok

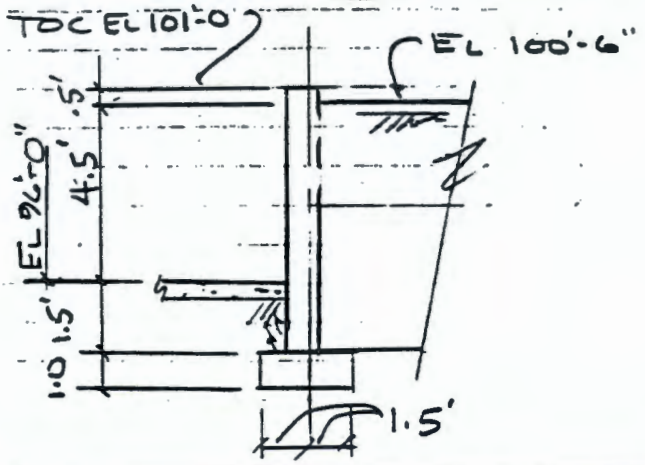
USE 3.0' × 3.0' × 1.0' THICK FOOTING WITH 1.0 SQ PIER - BOTTOM OF FOOTING @ elev. 97'-0"
TOP OF PIER AT EL 101'-0"

FOOTING TYPE Z ~ COL F.4-7

LOAD = 2.4^K
SIMILAR TO TYPE Y

FOOTING MUST BE 2.5 BELOW EL 96.0'

USE 3.0' × 3.0' × 1.0' THICK FOOTING ~ SAME AS TYPE Y



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United Engineers & Constructors
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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD.1

SUBJECT BUILDING FOUNDATION

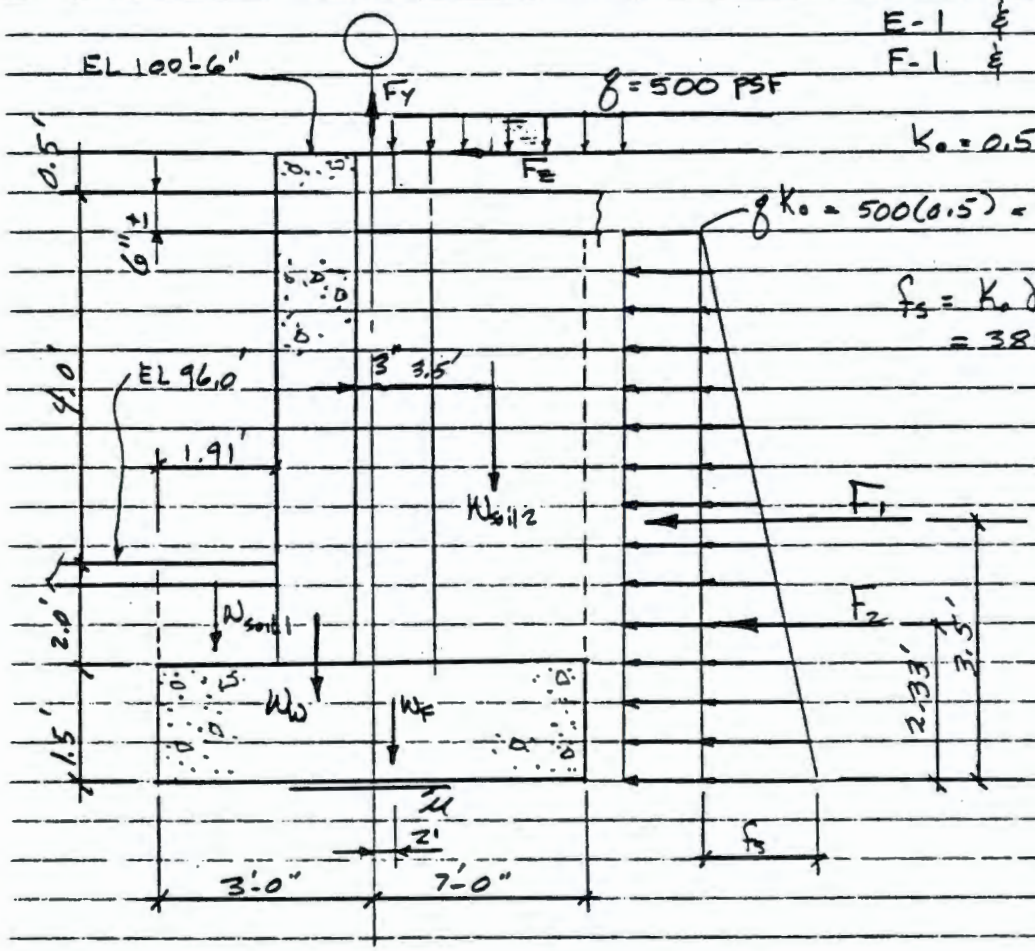
TST 11/13/91 30a

CALC. SET NO.		REV.	COMP. BY	CHK'D. BY
PRELIM.	WM1-54	2	V.L.L.	H.J.F.
FINAL	✓	3	DATE 9/3/92	DATE 9.3.92
VOID		4	TST	LHB
SHEET 62 OF 63			DATE 6/8/93	DATE 6/8/93
J.O 6237.001				

FOOTING TYPE A1

Col. C-1 & C.5-1
D-1 & D.5-1
E-1 & E.5-1
F-1 & F-4 (SIM)

$K_o = 0.5$ (Ref 3, Page 272)



PASSIVE PRESSURE AT TOE OF FOOTING IS Neglected.

WALL ON EITHER SIDE OF FOOTING TO BE SUPPORTED BY A CONTINUOUS RETAINING WALL FOOTING.

Col C-1 HAS Governing LOADING

TRY FOOTING 10' x 6' x 1.5' THICK

$W_F = (10.0)(6.0)(1.5)(0.15) = 13.5^K$

$W_W = (0.83)(6.5)(6.0)(0.15) = 4.9^K$

PIER WEIGHT (Negligible)

$W_{TOTAL} = 13.5 + 4.9 = 18.4^K$

$P_{NET} = -4.51 + 18.4 = 13.89^K \downarrow$

SHEET 63a Follows

$F_1 = (0.250)(7)(6) = 10.5^K$

$F_2 = (0.385)(7)(6)(0.5) = 8.0^K$

$W_{soil\,1} = (1.91)(1.5)(6.0)(0.11) = 1.89^K$

$W_{soil\,2} = (7.25)(5.5)(6.0)(0.11) + (0.5)(7.25)(6.0) = 48^K$ (surcharge)

Moment about ℄ FOOTING

$M_{℄} = \overset{W_w}{4.9(2.67)} + \overset{W_{s1}}{1.89(4.04)} + \overset{F_z}{4.17(8)} + \overset{F_1}{10.5(3.5)} + \overset{F_2}{8(2.33)} - \underset{F_4}{4.5(2)} - \underset{W_{s2}}{48(1.5)} = 28.45^{K\text{-}F}$

$P = P_{NET} + W_{soil\,1} + W_{soil\,2} = 13.89 + 1.89 + 48.0 = 63.78$

$e = \frac{M_{℄}}{P} = \frac{28.45}{63.78} = 0.45$ $\quad B/6 = 1.67'$

$A_F = 6(10) = 60\ SF$

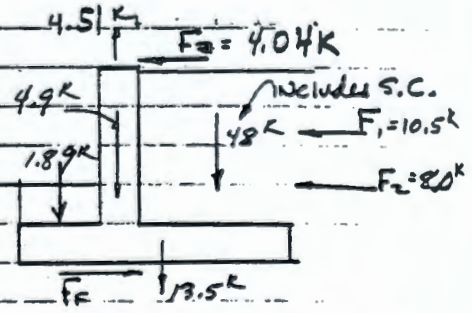
$S_F = 6(10^2)/6 = 100\ FT^3$

$f_{soil} = \frac{P}{A} \pm \frac{M_{℄}}{S_F} = \frac{63.78}{60} \pm \frac{28.45}{100} = 1.06 \pm 0.28$

$= 1.34$ or 0.78 KSF

(OK)

CHECK SLIDING RESISTANCE



$\mu = 0.42$ (Coef. of Friction) (Ref 2, Page 13)

$F_F = 0.42\ W_{NET}$

~~$F_F = 1.5(16.6) = 24.9$~~

~~$W_{req'd} = \frac{24.9}{0.42} = 59.1^K$~~

~~$W_{TOTAL} = 4.9 + 1.89 + 48.0 + 13.5 = 68.3$~~

~~$W_{NET} = 68.3 - 4.51 = 63.78 > 59.1^K$ (OK)~~

SEE SHEET 63a

~~(Use 6'-0" x 10'-0" x 1'-6" Footing)~~

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

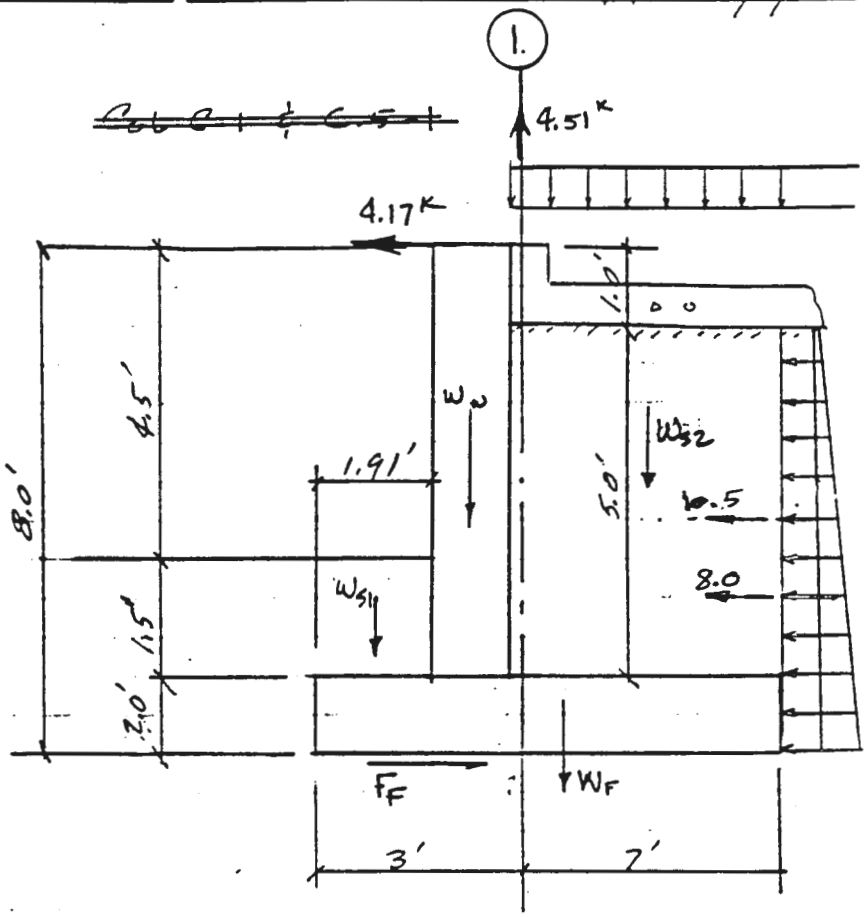
SUBJECT BUILDING FOUNDATION

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-S4	~~3~~ 0	TST DATE 3/4/93	VAP DATE 3/4/93
FINAL	✓			
VOID				
SHEET 63a OF 69		4	TST DATE 6/8/93	LHG DATE 1/18/93
J.O 6237.001				

(FOOTING A1 CONTINUED)

~~COLC + ¢ C.5 +~~

TRY 2'-0" THICK FOOTING



$F_{F\ needed} = (10.5 + 8.0 + 4.17)1.5 = 34.00^K$

$\text{WEIGHT NEEDED} = \frac{F_F}{0.42} = W_{TOT.}$

$W_{TOT} = \frac{34.}{0.42} = 80.96^K$

$W_{S2} = 5.5(6)(7.25)(0.11) + 0.5(7.25)(6) = 48.0^K$

$W_{S1} = 1.91(1.5)(6)(0.11) = 1.89^K$

$W_W = 6(0.83)(6)(0.15) = 4.5^K$

$W_F = 2(10)(6)(0.15) = 18.0^K$

$W_{TOT} = 48.0 + 1.89 + 4.5 + 18.0 - 4.51 = 67.9^K < 80.96^K$ (NG)

TRY 2' x 11.5' footing (EXTEND HEEL UNDER FLOOR SLAB)

$W_{S2} = 5(6)(8.75)(0.11) + 6(8.75)(0.5)(0.15) + 0.5(6)(8.75) = 59.1^K$ (Soil, Slab)

$W_F = 11.5(6)(2)(0.15) = 20.7^K$

$W_{TOT} = 59.1 + 1.89 + 4.5 + 20.7 - 4.51 = 81.7^K$ (OK)

USE 6'-0" x 11'-6" x 2'-0" FOOTING

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SUBJECT BUILDING FOUNDATION

WLW 11/11/91

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PRELIM.	WMI-54	2	WLW	TST
FINAL	✓	0	DATE 11/18/91	DATE 11/18/91
VOID		1		
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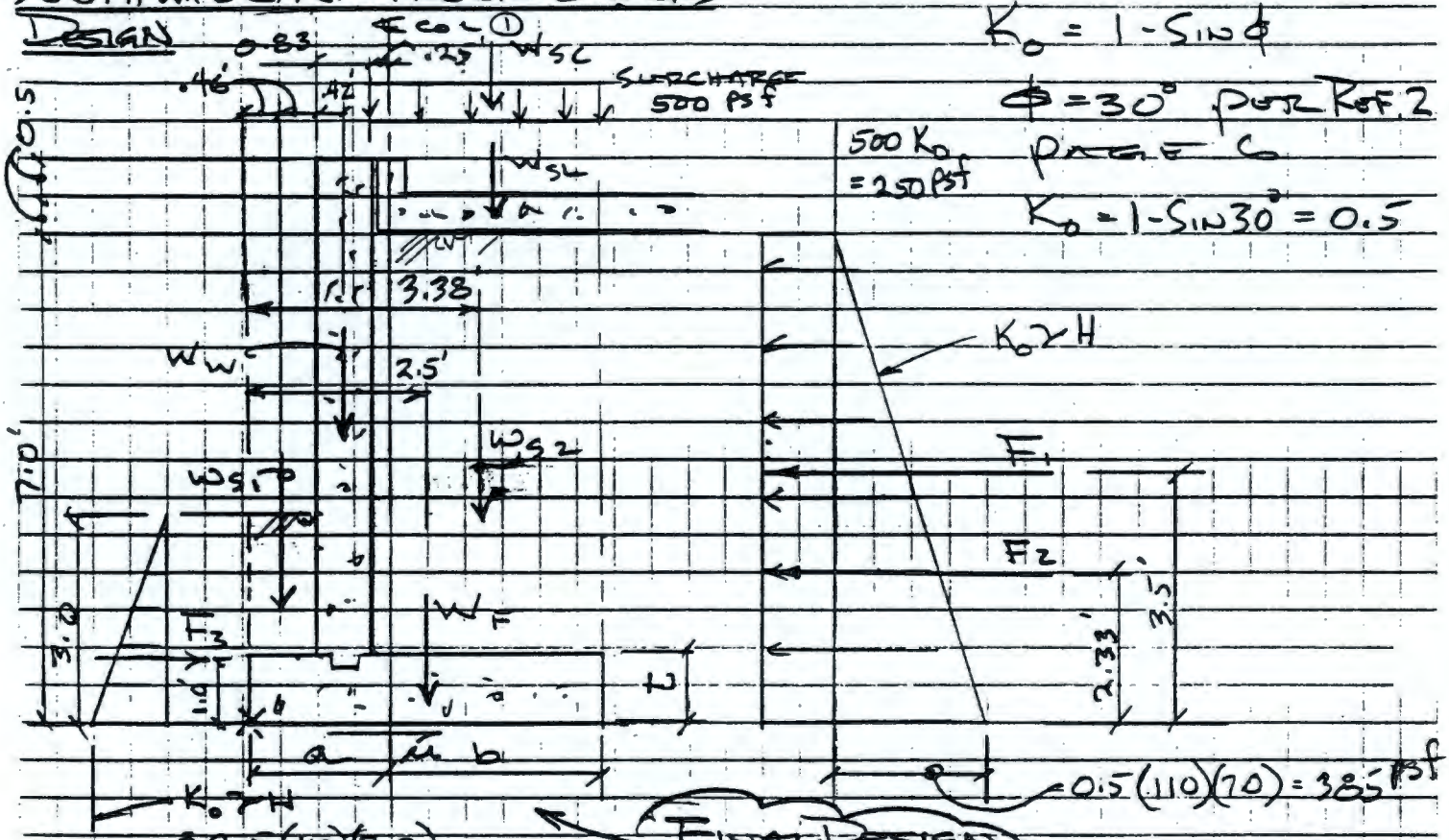
SOUTH WALL AT TRUCK DOCKS

DESIGN



$K_0 = 1 - \sin\phi$

$\phi = 30°$ PER REF. 2 PAGE 6

$500 K_0 = 250$ psf

$K_0 = 1 - \sin 30° = 0.5$

$F_1 = (0.250)(7.0)(1.0) = 1.75^K$ /FT OF WALL

$F_2 = (0.385)(7.0)(1.0)(0.5) = 1.35^K$ /FT OF WALL

$F_3 = (0.165)(3.0)(1.0)(0.5) = 0.25^K$ /FT OF WALL

TRIAL DESIGN

$a = 2.0'$ $b = 3.0'$ $t = 1.0'$

$W_W = 0.83(7.0)(0.15) = 0.87^K$ /FT OF WALL

$W_F = (5.0)(1.0)(0.15) = 0.75$

$W_{S1} = (0.92)(2.0)(0.11) = 0.20$

$W_{S2} + W_{SC} + W_{SL} = (3.25)[(6.0)(.11) + (0.5)(.15) + 0.50] = 4.0^K$ /FT OF WALL

WLW 11/11/91

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FINAL	✓	0	DATE 11/18/91	DATE 11/18/91
VOID		1		
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NAME OF COMPANY DOE - RL UNIT/S WRAP MOD 1

SUBJECT BUILDING FOUNDATION

OVERTURNING

$OTM = 1.75(3.5) + 1.35(2.33) - 0.25(1.0) = 9.0^{K\cdot FT}$
(F_1, F_2, F_3)

$Res.Mom = 0.87(1.34) + 0.75(2.5) + 0.20(0.46) + 4.0(3.38)$
$= 16.7^{K\cdot FT}$

FACTOR OF SAFETY $= \frac{16.7}{9.0} = 1.86 > 1.5$ ok

SLIDING

$\mu = 0.42$ PER REF 2 PAGE 13

$F_{TOTAL} = F1 + F2 - F_3 = 1.75 + 1.35 - 0.25 = 2.85^K$

$F_F = \mu W_{TOTAL} = 0.42(0.87 + 0.75 + 0.20 + 4.0)$
$= 2.44$

F_F REQD $= 1.5 \times 2.85 = 4.3 > 2.44^K$ NG.

INCREASE FOOTING SIZE

$a = 3.0'$ $b = 6.0'$ $t = 1.5'$

$W_W = 0.83(6.5)(0.15) = 0.81^K$ / FT OF WALL

$W_F = (9.0)(1.5)(0.15) = 2.00$

$W_{S1} = (1.92)(1.5)(0.11) = 0.32$

$W_{S2} = (6.25)(5.5)(0.11) = 3.78$

$W_{SC} = (6.25)(0.50) = 3.13$

$W_{SL} = (6.25)(0.5)(0.15) = 0.47$

$W_{TOTAL} = 10.51^K$

$F_F = 0.42(10.51) = 4.41^K > 4.3^K$ REQD ok

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WLW 11/11/91

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PRELIM.	WM1-S4	2	WLW	TST
FINAL	✓	0	DATE 11/18/91	DATE 11/18/91
VOID		1		
SHEET 66 OF 69		3	DATE	DATE
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SOIL PRESSURE

$$M_{\mathbb{C}\ FTG} = -0.81_{WW}(1.75) - 0.32_{WS1}(4.5-0.96) - 1.75_{F1}(3.5) - 1.35_{F2}(2.33)$$
$$+ 0.25_{F3}(1.0) + 3.78_{WS2}(1.38) + 3.13_{WSC}(1.38) + 0.47_{WSW}(1.38)$$

$$M = -1.39^{K\,FT}/FT$$

$$A_{FTG} = 1.0(9) = 9^{FT^2}/FT$$

$$S_{FTG} = \frac{1.0(9)^2}{6} = 13.5^{FT^3}/FT$$

$$W_{TOTAL} = 10.51^{K}/FT$$

$$S_{SOIL} = P/A \pm M/S = \frac{10.51}{9.0} \pm \frac{1.39}{13.5} = 1.17 \pm 0.10$$
$$= 1.27^{KSF} \text{ OR } 1.07^{KSF}$$

OK

USE 9.0' WIDE x 1.5' THICK FOOTING, LOCATED AS SHOWN ON PREVIOUS SKETCH

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FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		1		
SHEET 67 OF 69		3 4	DATE	DATE
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NAME OF COMPANY DOE-RL UNIT/S WRAP Mod.1

SUBJECT Building foundation.

Foundation type XX.

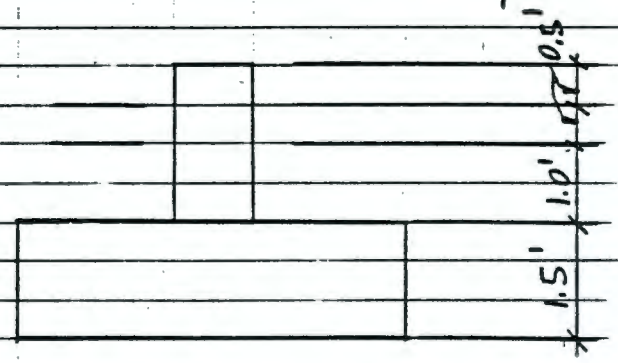
Columns B.3-7 & B.3-8

Critical loadings col. B.8-8:

(1) $F_y = 36.96$ K $F_z = 0.23$ K (neglect)

(2) $F_y = 27.72$ K $F_z = 8.06$ K

(3) $F_y = 9.59$ K $F_z = 10.62$ K



Try 5' x 5' x 1.5' footing

Pier 1.25' sq x 2.0' high

$W_f = (5.0^2 \times 1.5 + 1.25^2 \times 2.0) \times 0.15 =$

$= 6.09$ K

$P_{TOT} =$ (1) 43.05 K (36.96 + 6.09)

(2) 33.81 K (27.72 + 6.09)

(3) 15.68 K (9.59 + 6.09)

$M =$ (1) 0

(2) 28.21 'K (8.06 x 3.5)

(3) 37.17 'K (10.62 x 3.5)

Soil pressure:

$f_1 = \frac{43.05}{5.0 \times 5.0} = 1.72$ ksf < 2.5 ksf o.k.

$f_2 = \frac{33.81}{5.0 \times 5.0} \pm \frac{28.21 \times 6}{5.0 \times 5.0^2} = 1.35 \pm 1.35 = 2.7$ ksf or 0 ksf > 2.5 ksf

n.g.

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(DISCIPLINE)

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CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-SH	2	V.L.L.	H.J.F.
FINAL	✓	0	DATE 9/3/92	DATE 9.3.92
VOID		+		
SHEET 68 OF 69		3	DATE	DATE
J.O 6237.001		4		

NAME OF COMPANY DOE-RL UNIT/S WRAP Mod. 1

SUBJECT Building foundation.

f_3 $e = \frac{37.17}{15.68} = 2.37' > \frac{e}{3} = 1.67'$ n.g.

Increase size of footing. Try 6'x6'x1.5' footing.

$W_f = (6.0^2 \times 1.5 + 1.25^2 \times 2.0) \times 0.15 = 8.57K$

$P_{TOT.} =$ (1) $36.96 + 8.57 = 45.53K$

(2) $27.72 + 8.57 = 36.29K$

(3) $9.59 + 8.57 = 18.16K$

$M =$ (1) 0

(2) 28.21^{1K}

(3) 37.17^{1K}

Soil pressure

$f_1 = \frac{45.53}{6.0 \times 6.0} = 1.26 ksf < 2.5 ksf$ o.k.

$f_2 = \frac{36.29}{6.0 \times 6.0} \pm \frac{28.21 \times 6}{6.0 \times 6.0^2} = 1.01 \pm 0.78 = 1.79 ksf$ or $0.23 ksf < 2.5 ksf$ o.k.

f_3 $e = 37.17/18.16 = 2.05' \approx e/3 = 6.0/3 = 2.0'$

$f_3 = \frac{18.16}{6.0 \times 6.0} \times \frac{4}{3 - 6\frac{2.05}{6}} = 2.12 ksf < 2.5 ksf$ o.k.

Use 6.0' x 6.0' x 1.5 footing.

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

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SUBJECT Building foundation

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-SH	3	V.L.L.	H.J.F.
FINAL	✓	4	DATE 5/3/92	DATE 9.3.92
VOID		3		
SHEET 69 OF 69		4	DATE	DATE
J.O. 6237.001				

Foundation type YY.

Column B.3-9.

Try footing same as type X (See sheet 56)

$W_{S_1} = 0.6K$ $W_{S_2} = 2.6K$ $F_f = 5.4K$ $W_w = 1.0K$

$F_y = 16.34K$ $F_z = 7.03K$

$M = 2.6 \times 1.0 - 1.0 \times 1.67 - 0.6 \times 2.5 - 7.03 \times 3.5 = -25.18^{'K}$

$P = 16.34 + 0.6 + 2.6 + 5.4 + 1.0 = 25.94K$

$f_{soil} = \frac{25.94}{6 \times 4} \pm \frac{25.18 \times 6}{4 \times 6^2} = 1.08 \pm 1.05 = 2.13ksf$ or $0.03ksf$

$< 2.5ksf$ O.K.

Use same footing as footing type X.

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WM1-S5

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TASK NO. 6237.001

SUBJECT GROUND FLOOR SLAB

United Engineers & Constructors
A Raytheon Company
Stearns-Roger Division

CALCULATION DISCLOSURE SHEET

ITEM #	CALC. SHEET #	ITEM DESCRIPTION	CALC. SET REV. # (Item Resolved)	REMARKS
1.	7	DUAL ROLLERDECK WHEEL LOADS NEED TO BE VERIFIED FOR PURCHASED EQUIPMENT	0	THIS EQUIPMENT LOADING SHOULD NOT be SIGNIFICANTLY DIFFERENT FROM THE ASSUMED LOADING EVEN IF OTHER MANUFACTURER'S VEHICLES ARE PURCHASED.
2	8	7000 lb CAPACITY FORK TRUCK WHEEL LOADS NEED TO BE VERIFIED FOR PURCHASED EQUIPMENT	0	
3	9	9000 lb CAPACITY FORK TRUCK WHEEL LOADS NEED TO BE VERIFIED FOR PURCHASED EQUIPMENT	0	

TOTAL NUMBER OF CALCULATION SET SHEETS 18a & 18b 20 CALC. SET REV. ~~0~~ 1

CALCULATION DONE BY T. S. Trumbell DATE 10/18/91 / 11/7/91

CALCULATION CHECKED BY J M Geist / WMM 11/7/91 DATE 10-18-91

CONCURRED BY T. S. Trumbell DATE 11/7/91
LEAD DISCIPLINE ENGINEER

A04901081

TASK NO. 6237.001

SUBJECT GROUND FLOOR SLAB

United Engineers & Constructors
A Raytheon Company
Stearns-Roger Division

CALCULATION CONTROL SHEET

PROBLEM STATEMENT

DESIGN GROUND FLOOR SLAB-ON-GRADE FOR LOADS IMPOSED BY HEAVY EQUIPMENT AND CONCRETE BLOCK MASONRY WALLS.

DESIGN BASIS

1. FORK TRUCK WHEEL LOADS FROM CATERPILLAR AND RAYMOND FORK TRUCK SALES & DATA MANUALS
2. UNIFORM BUILDING CODE, 1988 ed., FOR SEISMIC LOADS ON WALLS
3. ARCHITECTURAL AND MECHANICAL DRAWINGS (SEE REFERENCES)

TOTAL NUMBER OF CALCULATION SET SHEETS 20 (18a & 18b) CALC. SET REV. 0-1

CALCULATION DONE BY T. S. Trimbell DATE 11/7/91

CALCULATION CHECKED BY W. M. McMechen DATE 11/7/91

CONCURRED BY T. S. Trimbell DATE 11/7/91
LEAD DISCIPLINE ENGINEER

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-S5	1	TST	WMM
FINAL	✓		DATE 11/7/91	DATE 11/7/91
VOID				
SHEET 3 OF 20			DATE	DATE
J.O 6237.001				

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT GROUND FLOOR SLAB

CALCULATION SUMMARY

1. FORK TRUCK WHEEL LOADS GOVERN THE FLOOR THICKNESS DESIGN OVER THE SELF GUIDED VEHICLE.

   THE GENERAL TRAFFIC AREA SLAB THICKNESS REQUIRED IS 6" WITH ONE LAYER OF #4 at 12" E.W.

2. THE FLOOR SLAB IN THE "TRUCK LOADING" BAY IS CONTROLLED BY THE WHEEL LOAD OF THE TRANSPORT VEHICLE. (8" THICK WITH #4 @ 12" EW T & B.)

3. THICKENED FLOOR SLABS WERE EVALUATED FOR SUPPORTING MASONRY WALLS.

   THICKENED AREAS 1'-0" THICK AND VARIOUS WIDTHS UP TO 4'-0" WIDE WERE FOUND TO BE ADEQUATE

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

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United Engineers & Constructors
A Raytheon Company

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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT GROUND FLOOR SLAB

REFERENCES

1. DRAWINGS

		DISIPLINE NO.
H-2-87595	REV B	M-3
H-2-87596	REV B	M-4
H-2-87597	REV B	M-5
H-2-88062	REV B	A-2
H-2-88069	REV A	A-9
H-2-88070	REV A	—
H-2-88071	REV A	A-11

2. CATERPILLAR MANUAL CEHA0403 8/87 FOR "SGC" SELF GUIDED VEHICALS.
3. RAYMOND FORK TRUCK SALES MANUAL
4. STRUCTURAL STEEL DESIGN by JACK C. McCORMAC, 1967
5. UNIFORM BUILDING CODE, 1988 edition.
6. CALCULATION SET NO. WM1-52 "BUILDING LOADS"
7. ACI 318-89, BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE.
8. PORTLAND CEMENT ASSOCIATION CONCRETE INFORMATION "THICKNESS DESIGN FOR CONCRETE PAVEMENTS"
9. REPORT OF GEOTECHNICAL INVESTIGATION PROPOSED HANFORD WASTE VITRIFICATION PLANT HANFORD, WASHINGTON, DAMES & MOORE, NOV 15, 1989

TST 10/8/91 5

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

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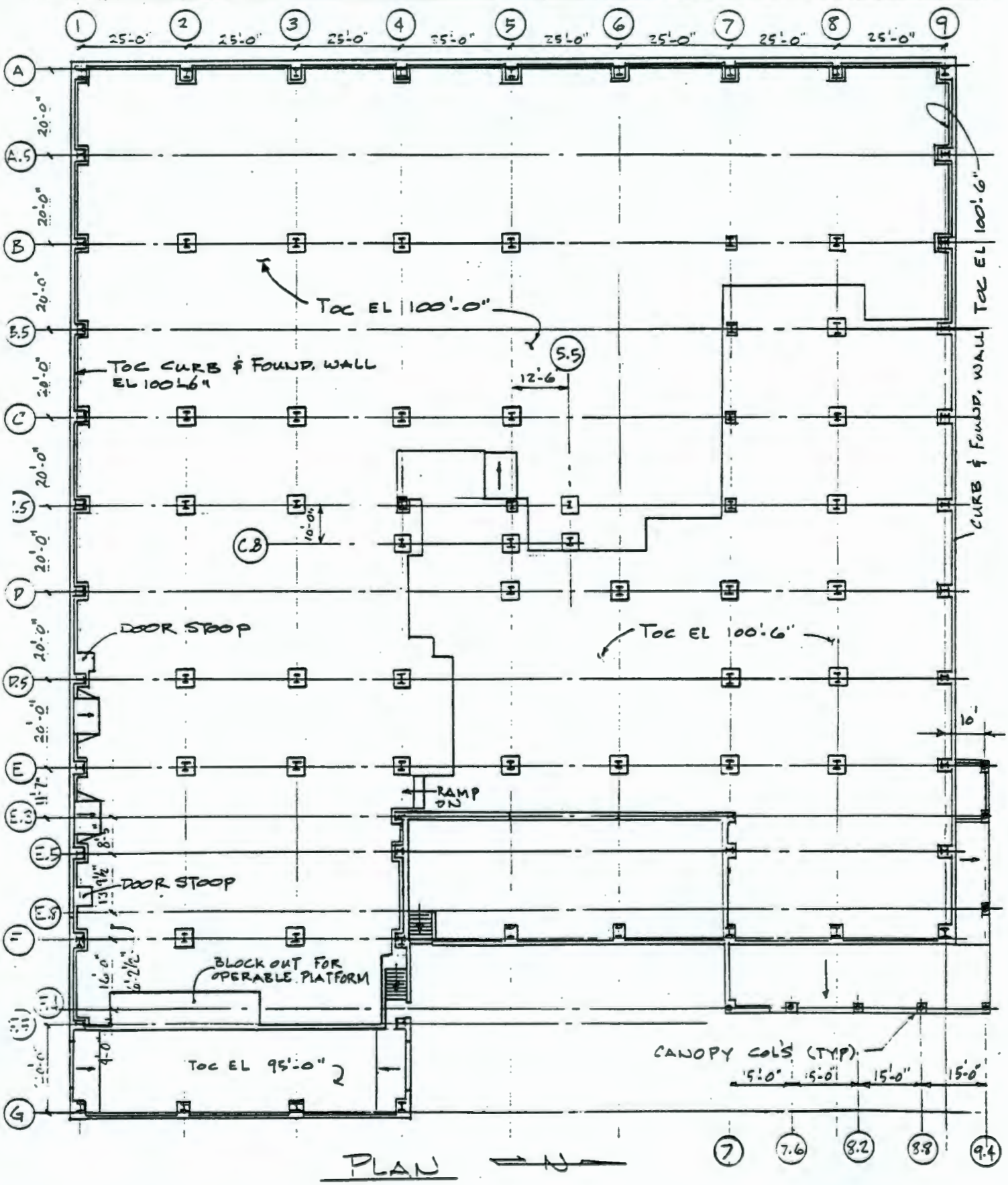
PRELIM.	WM1-55	1	TST	WMM
FINAL	✓		DATE 11/7/91	DATE 11/7/91
VOID				
SHEET 5 OF 20			DATE	DATE
J.O 6237.001				

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD.1

SUBJECT GROUND FLOOR SLAB



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FORM 5007 REV. 7/79 **GENERAL COMPUTATION SHEET**

DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-55	1	TST	WMM
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SHEET 6 OF 20			DATE	DATE
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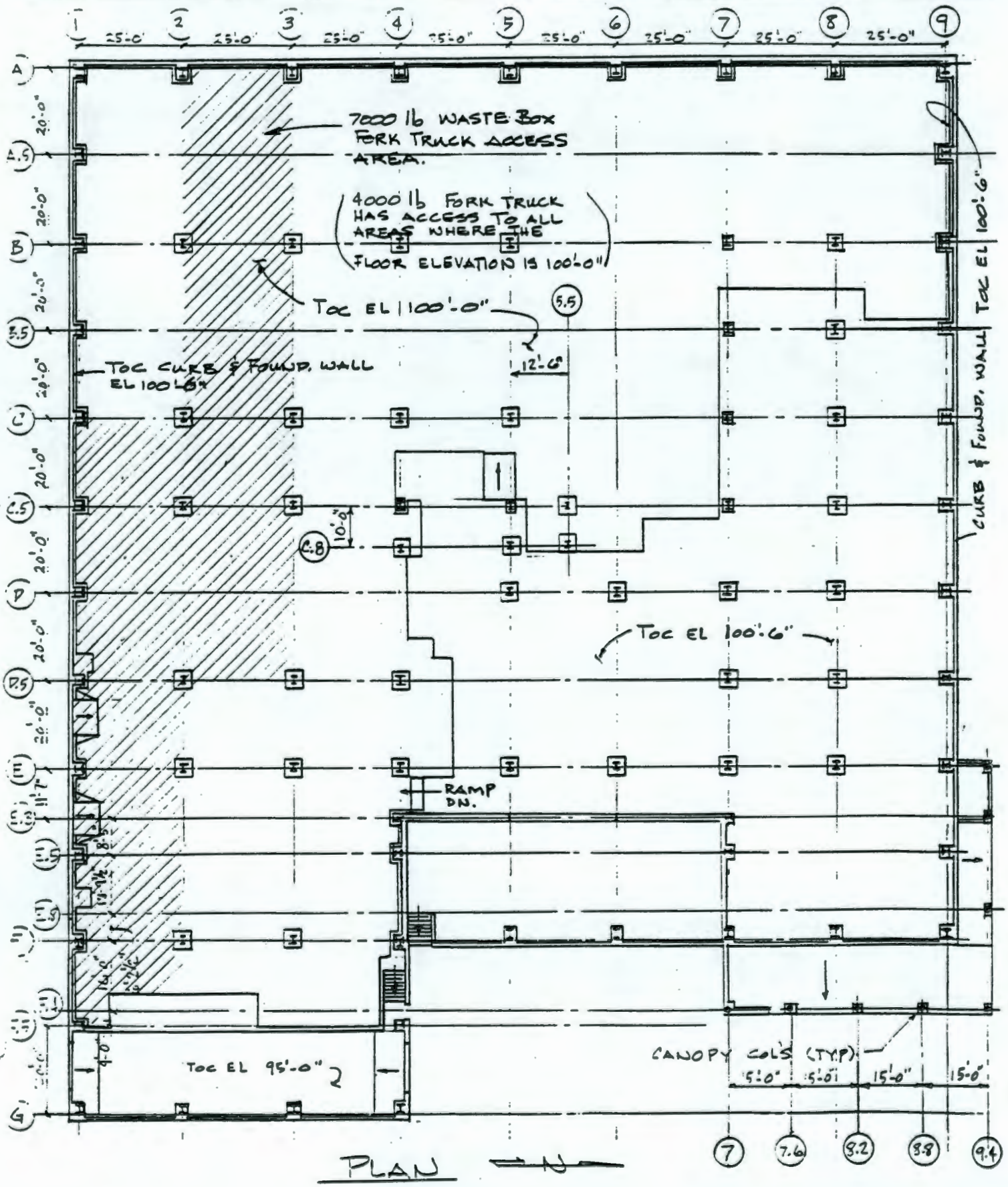
NAME OF COMPANY DOE-RL UNIT/S WRAP MOD.1

SUBJECT GROUND FLOOR SLAB



PLAN → N

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

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A Raytheon Company

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SHEET 7 OF 20			DATE	DATE
J.O 6237.001				

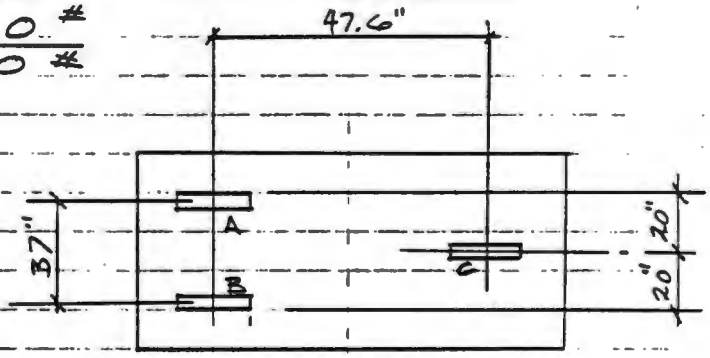
NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

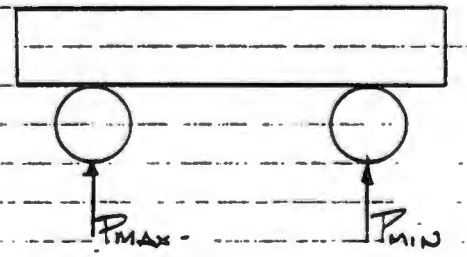
SUBJECT GROUND FLOOR SLAB

MOVING FLOOR LOADS

DUAL ROLLERDECK GV-11-101 (AGV) (3-WHEEL VEHICLE)
(REF. 1 DWGS M-3 TO M-5 AND REF. 2)

LOAD 2000 #
VEHICAL 4000 #
6000 #





Assumptions:

1/3 OF AGV SUPPORTED BY EACH WHEEL $= \frac{4000}{3} = 1333$ #

FULL LOAD CARRIED BY 2 WHEELS (A & B) $= \frac{1000}{2333}$ # MAX WHEEL LOAD

WITH 30% IMPACT $P_{MAX} = 2333(1.3) = 3033$ #

$P_{MIN} = 1333(1.3) = 1733$ #

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT GROUND FLOOR SLAB

7000 lb CAPACITY FORK TRUCK

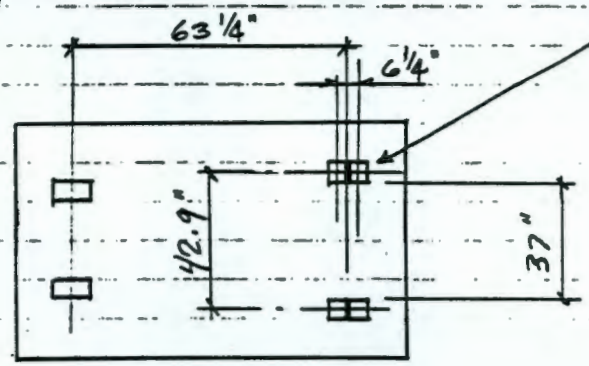
(REF 3, SECTION 5-C3, Page 8 To 13)
(ASSUME HEAVIESTS VEHICLE)
FORK TRUCK SHOULD HAVE A CAPACITY OF 7000#
WITH 30" LOAD CENTER.
AVAILABLE INFORMATION (REF Page 13) INDICATES
7000# CAPACITY AT 24" LOAD CENTER WITH 6000#
CAPACITY AT 30" LOAD CENTER

ASSUME FORK TRUCK WEIGHT WILL WEIGH AN ADDITIONAL
2000 lbs TO GIVE CAPACITY OF 7000# WITH A 30" LOAD
CENTER

TRUCK WEIGHT = (7300 + 2000) = 9300#
BATTERY WGHT = 2800#
12100#
LOAD = 7000#
19100#

MAX WHEEL LOAD = 0.35 (19100) = 6685#

WITH 30% INCREASE FOR IMPACT P_{max} = 6685(1.3) = 8690 lbs
(ASSUME BOTH WHEEL EQUAL)



FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

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NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT GROUND FLOOR SLAB

TST 10/8/91 9

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J.O 6237.001				

4000# CAPACITY FORK TRUCK

(REF 3, SECTION 5-B1, Page 8 To 12)

ASSUME MODEL 60-C40TN, TT (A)

FORK TRUCK CAPACITY WITH 24" LOAD CENTER

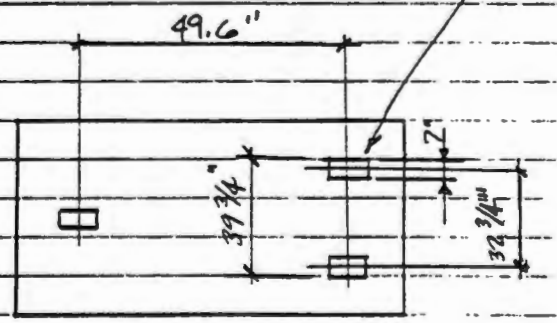
MAX WHEEL LOAD (ASSUME MAX WEIGHT VEHICLE)

TRUCK WEIGHT = 6340#
BATTERY WEIGHT = 3000#
9340#

LOAD 4000#
13340#

MAX. WHEEL LOAD = 0.458(13340) = 6110 #

WITH 30% IMPACT P_{max} = 6110(1.3) = 7943#



FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-55	1	TST	JMG
FINAL	✓		DATE 10/18/91	DATE 10-18-91
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SHEET 10 OF 20			DATE	DATE
J.O 6232.001				

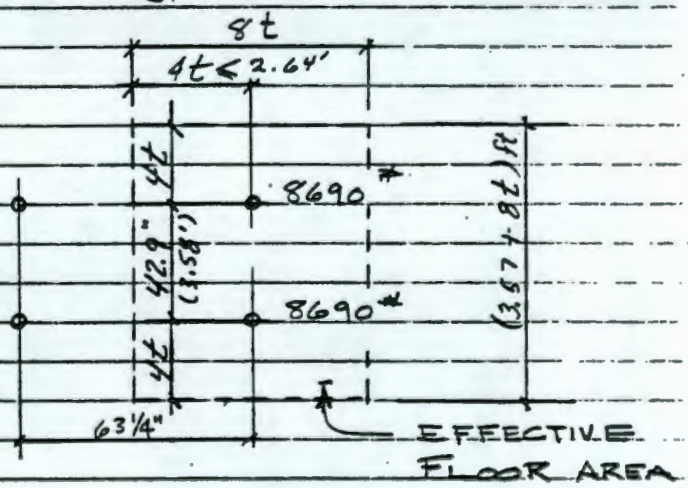
NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT GROUND FLOOR SLAB

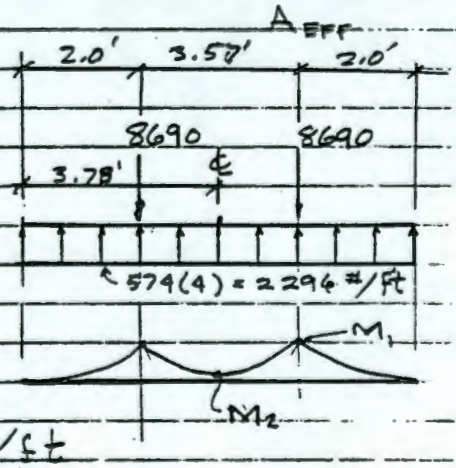
FLOOR DESIGN FOR MOVING LOADS

FLOOR AREAS ACCESSED BY 2000# FORK TRUCKS

USE $f'_c = 4000$ psi
$f_y = 60000$ psi



TRY 6" THICK SLAB



$$A_{EFF} = 8(0.5)\ (3.57 + 8(0.5))$$
$$= 30.3 \text{ SF}$$

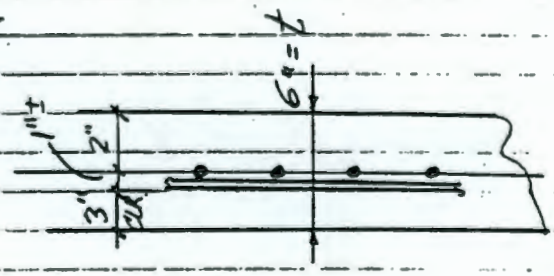
$$q = \frac{8690(2)}{30.3} = 574.0 \text{ PSF}$$

$$4t = 4(0.5) = 2.0'$$

$$M_1 = \frac{574.0(2.0)^2}{2} = 1148 \text{ ft-lbs/ft}$$

$$M_u = 1.148\ (1.7) = 1.950 \text{ k-'/ft}$$

$$M_2 = \left[8690(1.78) + \frac{2296(3.78)^2}{2}\right] 1/4$$
$$= 234 \text{ ft-lbs/ft}$$



$$d = 2" \quad F = \frac{12(2)^2}{12000} = 0.004$$

$$K_u = \frac{1.95}{0.004} = 487.50 \implies a_u = 4.10$$

$$A_s = \frac{1.95}{4.1(2)} = 0.24 \text{ in}^2/\text{ft} \quad \#4 @ 10" \text{ c-c}$$

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT GROUND FLOOR SLAB

TST 10/9/91

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PRELIM.	WM1-55	1	TST	AMG
FINAL	✓	0	DATE 10/18/91	DATE 10-18-91
VOID				
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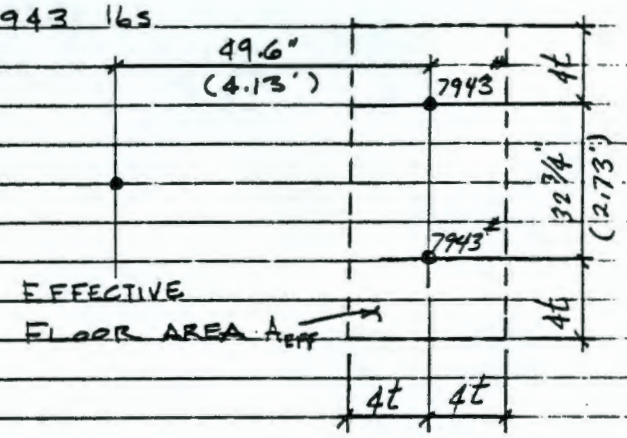
J.O 6237.001				

FLOOR AREAS ACCESSED BY 4000 lb FORK TRUCK

RM 101, 104, 107, 112, 113

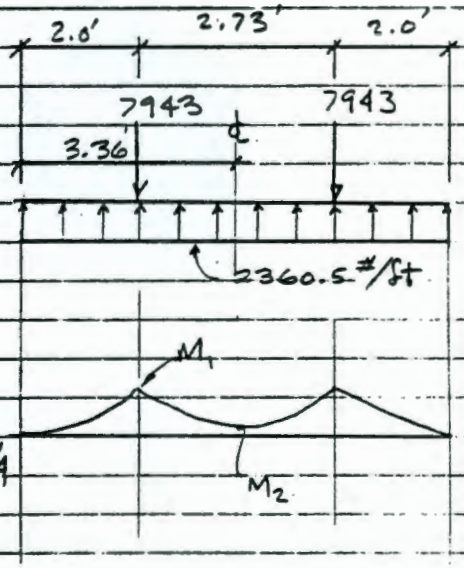
MAX WHEEL LOAD 7943 lbs



TRY 6" THICK SLAB

$A_{EFF} = 8(0.5)(2.73 + 8(0.5))$
$= 26.92 \text{ ft}^2$

$q = \frac{2(7943)}{26.92} = 590 \text{ PSF}$



$M_1 = 2360.5(2)^2(1/2)(1/4)$

$= 1180. \text{ ft-lbs/ft}$

$M_2 = [2360.5(3.36)^2(1/2) - 7943(1.36)]\,1/4$

$= 630 \text{ ft-lbs/ft}$

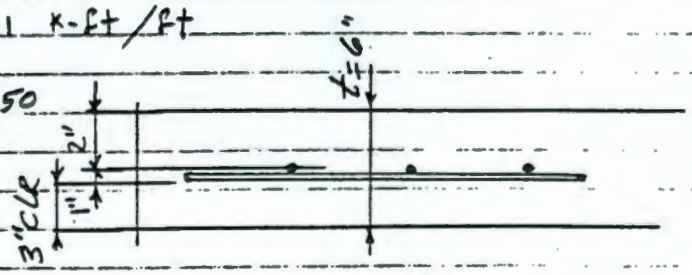
$M_u = 1.18(1.7) = 2.01 \text{ k-ft/ft}$

$d = 2"$ $\quad E = 0.004$ $\quad K_u = \frac{2.01}{0.004} = 502.50$

$a_u = 4.09$

$A_s = \frac{2.01}{(4.09)(2)} = 0.25 \text{ in}^2/\text{ft}$

#4 @ 9 1/2"



FORM 5007 REV. 7/79 **GENERAL COMPUTATION SHEET**

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD 1

SUBJECT GROUND FLOOR SLAB

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PRELIM.	WM1-55	1	TST	AMG
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SHEET 12 OF 20			DATE	DATE
J.O 6237.001				

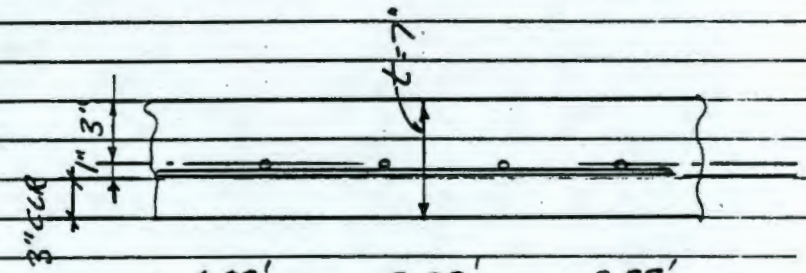
TST 10/9/91 12

TRY THICKER SLABS TO REDUCE REINF. REQUIREMENTS TO #4@12

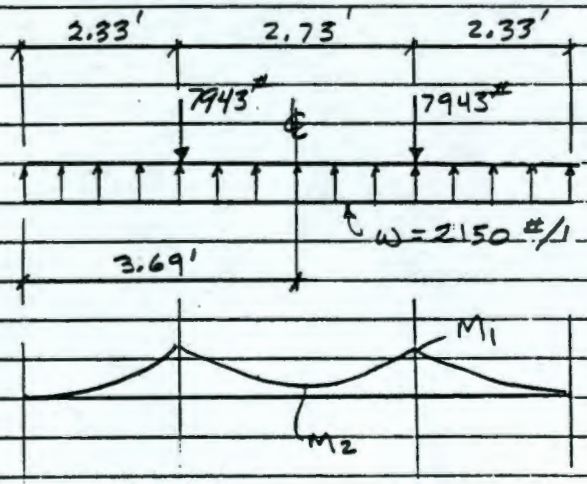
TRY 7" THICK SLAB

$A_{EFF} = 8(0.5833)(2.73 + 8(0.5833))$
$= 34.51$ SF

$q = \frac{2(7943)}{34.51} = 460.3$ PSF



$M_1 = 2150(2.33)^2(1/2)\left(\frac{1}{8(0.58)}\right)$
$= 1258$ ft-lbs/ft



$M_2 = \left[2150(3.69)^2(1/2) - 7943(1.36)\right]\frac{1}{8(0.58)}$
$= 826$ ft-lbs/ft

$M_u = 1.258(1.7) = 2.14$ K-'/'

$F = \frac{12(3)^2}{12000} = 0.009$ $\quad K_u = \frac{2.14}{0.009} = 237.78$

$a_u = 4.31$ $\quad A_s = \frac{2.14}{(4.31)(3)} = 0.17$ USE: # 4 @ 12

MINIMUM FLOOR SLAB IN AREAS WITH FORK TRUCK ACCESS

7" THICK SLAB WITH #4 @ 12 EA. WAY

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT GROUND FLOOR SLAB

TST 11/4/91 13

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-55	1	TST	WMM
FINAL	✓		DATE 11/7/91	DATE 11/7/91
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SHEET 13 OF 20			DATE	DATE
J.O 6237.001				

FLOOR AREA ACCESSED BY H20 TRUCK LOADS (RM 100)

(DESIGN PER REF 8, Figure 6)

AXLE LOAD: 32000 lbs

SUBGRADE MODULUS $K_1 = 150$ (REF 9, Page 11)

$K_s = K_1 \left(\frac{B+1}{2B}\right)^2$ ASSUME $B \cong 20'$ (WIDTH OF DRIVE)

$= 150 \left(\frac{20+1}{2(20)}\right)^2 = 41$ (USE $K_s = 50$, min for chart)

TRY 8" THICK SLAB ($t = 8"$)

$f_c = 455$ psi $M_{cr} = 455\,S = \frac{455(12)(8^2)}{6} = 58{,}240 \frac{in\text{-}lbs}{ft}$

$= 4.85^{k\text{-}1}$

$M_u = 1.7(4.85) = 8.25$ k-1/ft

TRY 10" THICK SLAB ($t = 10"$)

$f_c = 333$ psi $M = \frac{333(12)(10^2)}{6} = 66600 \frac{in\text{-}lbs}{ft}$

$= 5.55^{k\text{-}1}/ft$

$M_u = 1.7(5.55) = 9.44$ k-1/ft

REINFORCING FOR 8" SLAB $d = 4\frac{1}{2}"$

$F = \frac{12(4.5)^2}{12000} = 0.0203$ $K_u = \frac{8.25}{0.0203} = 406.40$

$a_u = 4.17$ $A_s = \frac{8.25}{4.17(4.5)} = 0.44\ in^2/ft$ #6@12

REINFORCING FOR 10" SLAB $d = 6\frac{1}{2}"$

$F = \frac{12(6.5)^2}{12000} = 0.0423$ $K_u = \frac{9.44}{0.0423} = 223.17$

$a_u = 4.32$ $A_s = \frac{9.44}{4.32(6.5)} = 0.33\ in^2/ft$ #5@10

USE 10" SLAB WITH #5@10" EW, T & B

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Stone & Webster Company

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-55	1	TST	WMM
FINAL	✓		DATE 11/7/91	DATE 11/7/91
VOID				
SHEET 14 OF 20			DATE	DATE
J.O 6237.001				

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT GROUND FLOOR SLAB

CHECK SLAB SHEAR

BEAM SHEAR

$$V = 3.245(3)\left(\frac{1}{8(0.667)}\right) = 1.82^{k/ft}$$

$$V_u = 1.7(1.82) = 3.09^{k/ft}$$

$$V_c = 0.85(2)bd\sqrt{f'_c} = \frac{0.85(2)(12)(4.625)\sqrt{4000}}{1000} = 5.97^{k/1}$$

(OK)

TWO-WAY SHEAR

$$b_o = [9.2 + 4.625 + 20 + 4.625]2$$

$$= 76.9 \text{ in}$$

$$\phi V_c = 0.85\left(2 + \frac{4}{\beta_c}\right)\sqrt{f'_c}\; b_o d \qquad \text{(REF 7, eq(11-36))}$$

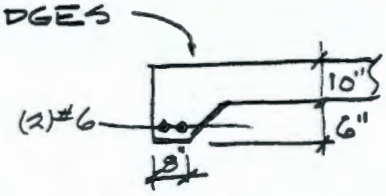
$$\beta_c = 20/9.2 = 2.174$$

$$= 0.85(2 + 4/2.174)\sqrt{4000}(76.9)(4.625)\left(\frac{1}{1000}\right)$$

$$= 73.4^k \text{ (OK)}$$

SLAB IN TRUCK UNLOADING AREA 10" THICK WITH #5@10 E-W TOP & BOT. TOP & BOT LAYERS PLACED PERPENDICULAR TO TRUCK DRIVE

THICKEN SLAB EDGES



FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT GROUND FLOOR SLAB

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-55	1	TST	WMM
FINAL	✓		DATE 11/7/91	DATE 11/7/91
VOID				
SHEET 15 OF 20			DATE	DATE
J.O 6237.001				

OFFICE, LOCKER & LUNCH ROOMS

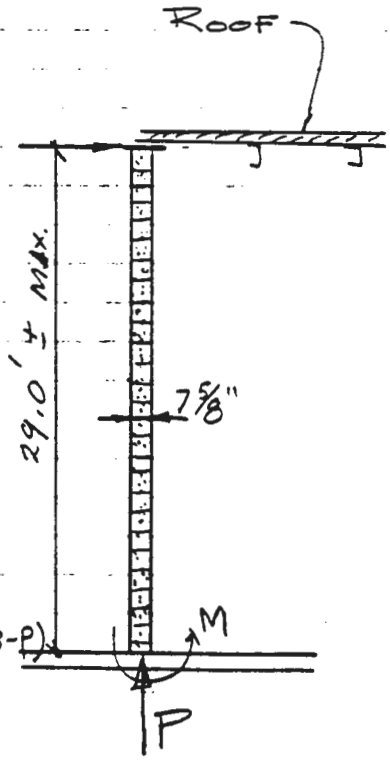
4" FLOOR SLAB (MINIMUM) CAN BE USED;

PER John PAYNE 10/10/91 USE 6" MIN FLOOR SLAB.

FLOOR SLABS SUPPORTING CONCRETE MASONRY WALLS

ASSUME CONCRETE BLOCK MASONRY WALLS WILL BE SUPPORTED BY THE FLOOR SLAB WITHOUT FOOTINGS. FLOOR SLAB WILL BE THICKENED AS REQUIRED TO SUPPORT WALLS.

WALLS SPANNING FLOOR TO ROOF



INTERNAL PRESSURE DUE TO WIND

$P_w = 3.5$ PSF (REF 6, Pg. 32)

MIN. WALL PRESSURE

$P_{min} = 5.0$ PSF (REF 5, Pg 137)

SEISMIC LOAD ON WALLS

$F_p = Z I C_p W_p$ (REF 5, eq (12-10))

$Z = 0.2$ FOR ZONE 2B

$I = 1.25$

$C_p = 2(0.75) = 1.5$ (REF 5, Table 23-P)

$W_p = \frac{7.625}{12}(150.0) = 95$ PSF

$F_p = 0.2(1.25)(1.5)(95)$

$= 35.6$ PSF → GOVERNS OVER SDC-4.1 WHERE ZC = 0.25

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-55	1	TST	WMM
FINAL	✓		DATE 11/7/91	DATE 11/7/91
VOID				
SHEET 16 OF 20			DATE	DATE
J.O 6237.001				

TST 10/11/91

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT GROUND FLOOR SLAB

ASSUME BLK WALLS ARE FIXED AT BOTTOM & SUPPORTED AT ROOF

MOMENT AT BOTTOM OF WALL

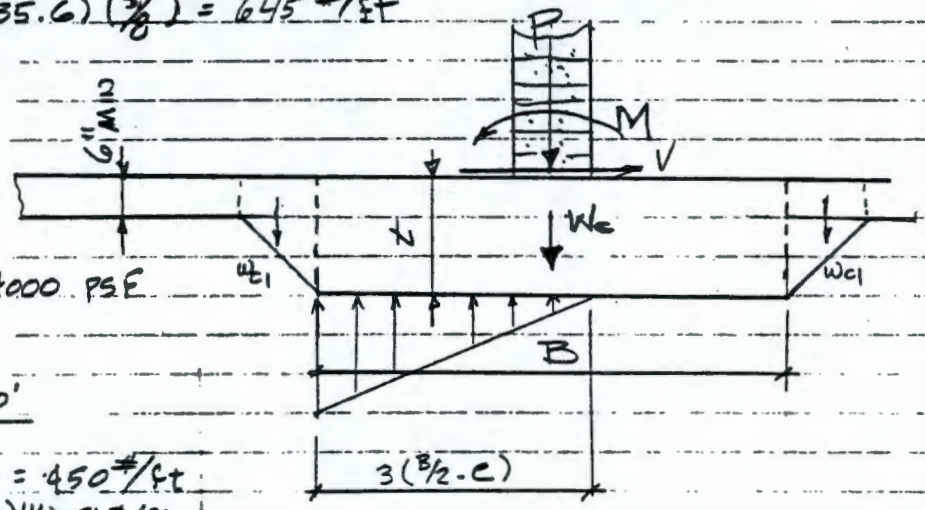
$$M = \frac{wl^2}{8} = \frac{35.6(29)^2}{8} = 3743 \text{ ft-lbs/ft}$$

VERTICAL LOAD AT TOP OF SLAB

$$P = 95(29) = 2755 \text{ lbs/ft}$$

SHEAR AT TOP OF SLAB

$$V = 29(35.6)(5/8) = 645 \text{ \#/ft}$$



allowable Soil Bearing Press. $= q_{all} = 3000(1.33) = 4000$ PSF

TRY T = 1'-0" B = 3.0'

$W_c = 1(3)(150) = 450$ #/ft

$W_{c1} = (0.5 + 1.0)(1/2)(150)(1/2) = 56$ #/ft

$$e = \frac{M}{P + W_c + 2W_{c1}} = \frac{3743}{2755 + 450 + 112} = 1.128' > (B/6 = 0.5')$$

$$q_{MAX} = \frac{2\Sigma V}{3L(B/2 - e)} = \frac{2(2755 + 450 + 112)}{3(1)(3/2 - 1.128)} = 5944 \text{ PSF (NG)}$$

TRY T = 1'-6" B = 4.0'

$W_c = 1.5(4)(150) = 900$ #/ft

$W_{c1} = (0.5 + 1.5)(1/2)(1.0)(150) = 150$ #/ft

$$e = \frac{M}{P + W_c + 2W_{c1}} = \frac{3743}{2755 + 900 + 2(150)} = 0.946'$$

$3(B/2 - e) = 3(4/2 - 0.946) = 3.162'$

$$q_{MAX} = \frac{2\Sigma V}{3L(B/2 - e)} = \frac{2(2755 + 900 + 2(150))}{3(1)(4/2 - 0.946)} = 2502 \text{ PSF (OK)}$$

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PRELIM.	WM1-55	1	TST	WMM
FINAL	✓		DATE 11/7/91	DATE 11/7/91
VOID				
SHEET 17 OF 20			DATE	DATE
J.O 6237.001				

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT GROUND FLOOR SLAB

TRY T = 1.0' B = 4.0' ← USE

$W_c = 1(4)(150) = 600$ #/ft

$2W_{c_1} = 112$ #/ft

$$e = \frac{M}{P + W_c + 2W_{c_1}} = \frac{3743}{2755 + 600 + 112} = 1.080'$$

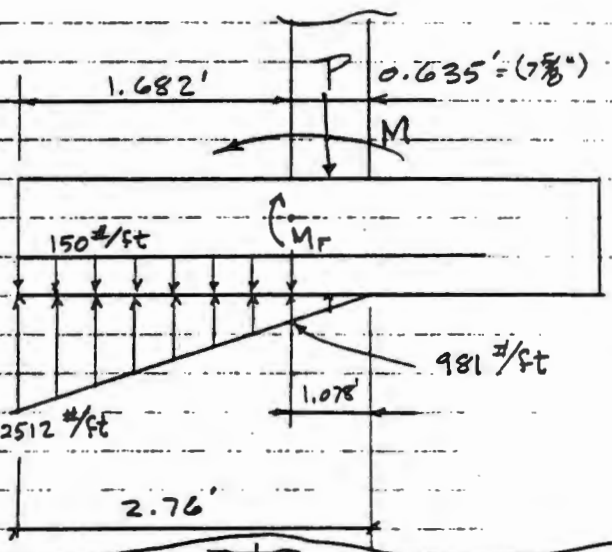
$$q_{max} = \frac{2\Sigma V}{3L(B/2 - e)} = \frac{2(2755 + 600 + 112)}{3(1)(4/2 - 1.080)} = 2512 \text{ (OK)}$$

$$3(B/2 - e) = 3(4/2 - 1.08') = 2.76'$$

SLAB MOMENT AT WALL

$$M_F = 981(1.68)^2(1/2) + 1531(1.68)^2(1/2)(2/3) - 150(1.68)^2(1/2) = 2613 \text{ ft-lbs/ft}$$

$M_u = 1.7(1.936) = 4.44$ K-'/ft

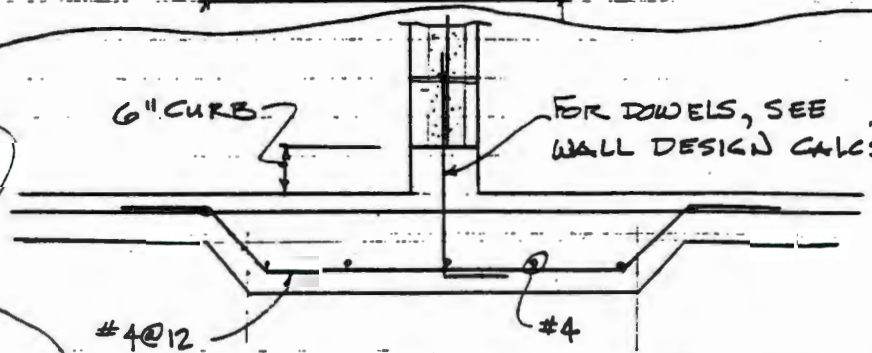


$d = 8\frac{1}{2}$" $F = \frac{12(8.5)^2}{12000} = 0.072$

$K_u = \frac{4.44}{0.072} = 61.5$

$a_u = 4.45$

$A_s = \frac{4.44}{4.45(8.5)} = 0.118$ in²/ft



THICKENED SLAB FOR CONC BLK. MASONRY WALLS WITH TOP OF WALL SUPPORTED AT BLDG ROOF

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United Engineers & Constructors
A Raytheon Company

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WMI-55	1	TST	WMM
FINAL	✓		DATE 11/7/91	DATE 11/7/91
VOID				
SHEET 18 OF 20			DATE	DATE
J.O 6237.001				

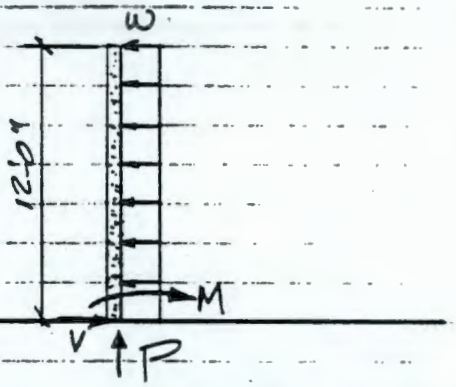
TST 10/15/91 8

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT GROUND FLOOR SLAB

THICKENED SLAB FOR CONC. BLK MASONRY WALLS CANTILEVERED OFF FLOOR UP TO 12'-0" HIGH

$W = 35.6$ PSF See PREVIOUS WALL LOAD CALC FOR 29'-0" HIGH SUPPORTED WALL.



$M = 35.6(12)^2(1/2) = 2563$ ft-lb/ft

$P = 95(12) = 1140$ #/ft

$V = 35.6(12) = 427$ #/ft

$q_{all} = 3000(1.33) = 4000$ PSF

TRY $t = 1'-0"$ $B = 2'-0"$ (REF SKETCH ON SHEET 16)

$W_c = 1(2)(150) = 300$ #/1

$W_{c1} = 56$ #/1

$$e = \frac{M}{P + W_c + 2W_{c1}} = \frac{2563}{1140 + 300 + 112} = 1.65' > B/2 \text{ (NG)}$$

TRY $t = 1'-0"$ $B = 3'-0"$

$W_c = 450$ #/1

$W_{c1} = 56$ #/1

$3(B/2 - e) = 3(1.5 - 1.51) < 0.0$ (NG)

$$e = \frac{2563}{1140 + 450 + 112} = 1.51'$$

TRY $t = 1'-0"$ $B = 4'-0"$

$W_c = 600$ #/1

$W_{c1} = 56$ #/1

$3(B/2 - e) = 3(2 - 1.38) = 1.86'$ (OK)

$$e = \frac{2563}{1140 + 600 + 112} = 1.38'$$

$$q_{MAX} = \frac{2(1140 + 600 + 112)}{3(1)(4/2 - 1.38)} = 1992 \text{ PSF (OK)}$$

FORM 5007 REV. 4/91

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GENERAL COMPUTATION SHEET

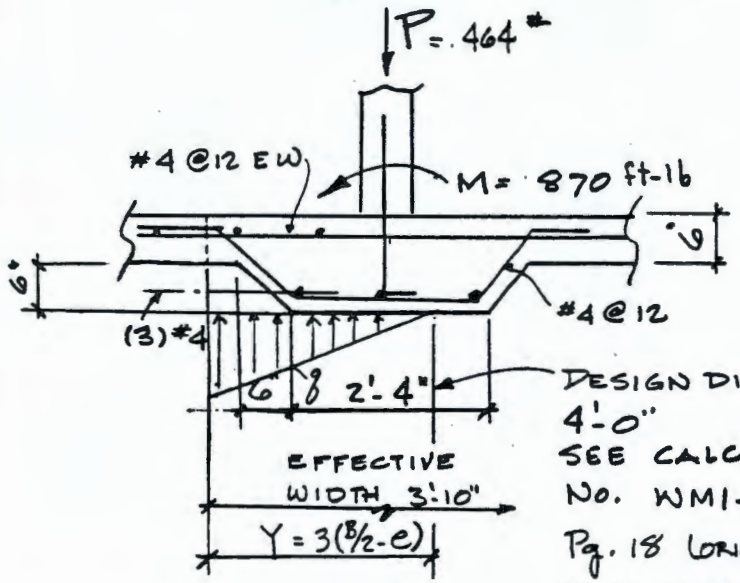
CALCULATION SET NO.			REV	COMP. BY	CHK'D BY
WMI-55			1	TST	VAP
PRELIM	FINAL ✓	VOID		DATE 11/23/94	DATE 11/23/94
SHEET 18a OF 20				DATE	DATE
J.O. 6237.001					

PROJECT DOE-RL WRAP 1

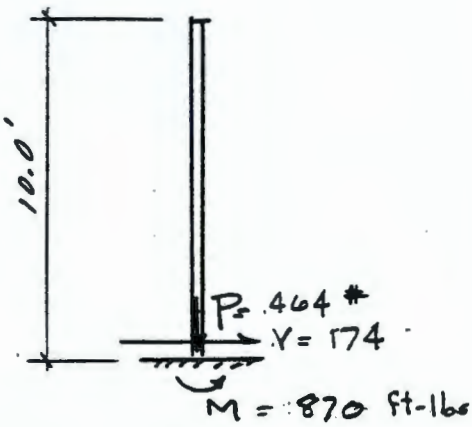
SUBJECT GROUND FLOOR SLAB

CHECK MASONRY WALL FOOTINGS AT CANTILEVED WALLS

10'-0" High CANTILEVERED WALL



DESIGN DIM. 4'-0"
SEE CALC SET No. WMI-55, Pg. 18 (ORIGINAL DESIGN WALL HEIGHT 12')



TRY 2'-4" WIDE FOOTING

FOOTING CONCRETE WEIGHT

$$W_c = [2.33(1) + (1+0.5)(\tfrac{1}{2})(0.5)(2) + 0.5(0.25)(2)]150 = 500\ \#/ft$$

$$e = \frac{M}{P+W_c} = \frac{870}{464+500} = 0.902$$

ASSUME 3" OF 6" SLAB IS EFFECTIVE IN RESISTING OVERTURNING. $B = 3.83'$ $e = 1.336'$

$$q = \frac{2(464+500)}{3(1)(\frac{3.83}{2} - 0.902)} = 634 \text{ PSF (OK)}$$

FORM 5007 REV. 4/91

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GENERAL COMPUTATION SHEET

CALCULATION SET NO.	REV	COMP. BY	CHK'D BY
WMI-55	1	TST	VAP
PRELIM. / FINAL ✓ / VOID		DATE 11/23/94	DATE 11/23/94
SHEET 18b OF 20		DATE	DATE
J.O. 6237.001			

PROJECT DOE-RL WRAP 1

SUBJECT GROUND FLOOR SLAB

FACTOR OF SAFETY AGAINST OVERTURNING

$M_{OT} = 870$ ft-lb/ft

$M_R = (500 + 464)(3.83)(1/2) = 1846$ ft-lbs

$F_S = \frac{1846}{870} = 2.12$ (OK)

F_S USING 85% OF DL TO RESIST OVERTURNING

$FS = \frac{1846(0.85)}{870} = 1.80 > 1.5$ (OK)

TRY $t = 1'\text{-}0''$ $B = 3'\text{-}6''$

$W_c = 1(3.5)(150) = 525\ \#/'$

$W_{c_1} = 56\ \#/'$

$$e = \frac{2563}{1140 + 525 + 112} = 1.44'$$

$3(B/2 - e) = 3(1.75 - 1.44) = 0.92'$ small

$$q_{MAX} = \frac{2(1140 + 525 + 112)}{3(1)(3.5/2 - 1.44)} = 3850\ PSF < 4000\ PSF\ (OK)$$

USE $t = 1'\text{-}0''$ $\frac{1}{2}B = 4'\text{-}0''$ FOR UNIFORMITY WITH THICKENED SLAB AT 29'-0" HIGH WALLS
USE #4 @ 12 AT BOTTOM OF THICKENED AREA
USE BENT BARS

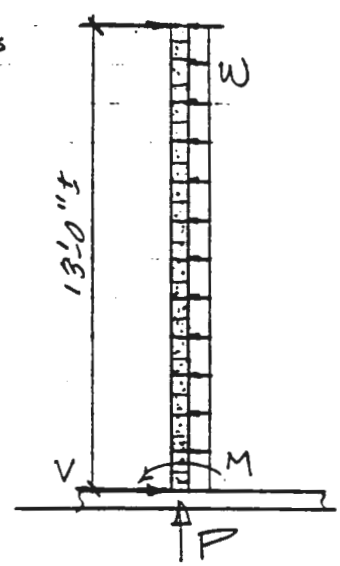
THICKENED SLAB FOR WALLS APPROXIMATELY 13'-0" TALL SUPPORTED AT THE TOP (WALLS UNDER HVAC ROOM FLOOR)

$W = 35.6\ PSF$

$M = W\ell^2/8 = 35.6(13)^2/8 = 752.0\ FT/lbs$

$P = 13(95) = 1235\ \#/ft$

$$V = \frac{5WL}{8} = \frac{5(35.6)(13)}{8} = 289\ \#/ft$$



TRY $t = 1'\text{-}0''$ $B = 2'\text{-}0''$

$W_c = 2(150) = 300\ \#/'$

$W_{c_1} = 56\ \#/'$

$$e = \frac{M}{\Sigma V} = \frac{752.0}{1235 + 300 + 112} = 0.457$$

$$q_{MAX} = \frac{2(1235 + 300 + 112)}{3(1)(2/2 - 0.457)} = 2022\ PSF\ (OK)$$

FORM 5007 REV. 7/79 GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY DOE-RL UNIT/S WRAP MOD. 1

SUBJECT GROUND FLOOR SLAB

-ST 10/15/91 20

CALC. SET NO.		REV	COMP. BY	CHK'D. BY
PRELIM.	WM1-55	1 &	TST	WMM
FINAL	✓		DATE 11/7/91	DATE 11/7/91
VOID				
SHEET 20 OF 20			DATE	DATE
J.O 6237.001				

TRY $t = 1'-0"$ $B = 1'-6"$

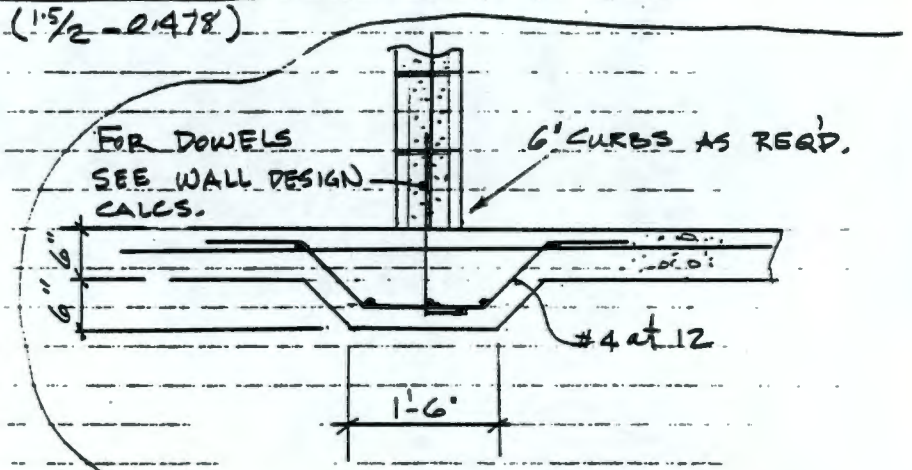
$W_c = 1.5(150) = 225$ #/1

$W_G = 112$ #/1

$e = \dfrac{752}{1235 + 225 + 112} = 0.478'$

$(3)(B/2 - e) = 3(1.5/2 - 0.478) = 0.82'$

$q_{max} = \dfrac{2(1235 + 225 + 112)}{3(1)(1.5/2 - 0.478)} = 3853$ PSF (OK)



THICKENED SLAB FOR CONC. BLK. WALL UNDER 13'-0" HIGH SUPPORTED AT THE TOP

APPENDIX 7A

BUILDING EMERGENCY PLAN FOR WRAP

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This plan covers the following buildings and structures: 2336-W, 2620-W, 2740-W.

Approved:

Building Emergency Director	5/13/98 Date
Manager, Waste Receiving and Processing Facility	5/13/98 Date
Emergency Preparedness	5-13-98 Date
Hanford Fire Department	5/13/98 Date

This document will be reviewed annually and updated as required by the Building Emergency Director and modified pursuant to Washington Administrative Code (WAC) 173-303-830 and in accordance with the Hanford Facility RCRA Permit. This document will be approved by the manager of Emergency Preparedness (or delegate) and the Hanford Fire Department.

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ATTACHMENT A 34

1.0 GENERAL INFORMATION

The Waste Receiving and Processing Facility (WRAP) is located on the Hanford Site, a 560-square mile U.S. Department of Energy (DOE) operational site in southeastern Washington State. WRAP is located in the western portion of the 200 West Area. The Hanford Site Emergency Preparedness Program is based upon the incident command system which allows a graded approach for response to emergency events. This plan contains a description of unit-specific emergency planning and response. It is used in conjunction with DOE/RL-94-02, *Hanford Emergency Response Plan*. Response to events is performed using unit specific and/or Site level emergency procedures. The WRAP subordinate documents implement DOE/RL-94-02.

1.1 **FACILITY NAME:** U.S. Department of Energy Hanford Site
Waste Receiving and Processing Facility

1.2 **FACILITY LOCATION:** Benton County, Washington; within the 200 West Area.

The following structures covered by this plan are:

2336-W	Waste Receiving and Processing Facility
2620-W	Maintenance Support Building
2740-W	Administrative Support Building

1.3 **OWNER:** U.S. Department of Energy
Richland Operations Office
825 Jadwin Avenue
Richland, Washington 99352

FACILITY MANAGER: Waste Management Federal Services of Hanford, Inc.
P.O. Box 700
Richland, Washington 99352

1.4 DESCRIPTION OF THE FACILITY AND OPERATIONS

The WRAP accepts contact-handled waste packaged in 208- or 322-liter steel drums and steel or wooden boxes no larger than 2.7 meters long by 1.6 meters wide. Contact-handled waste is waste where the external surface dose rate does not exceed 200 millirems per hour. Remote-handled waste could be received on a case-by-case basis with special precautions. Remote-handled waste is waste where the external surface dose rate exceeds 200 millirems per hour. The maximum weight of containers received at WRAP is 454 kilograms for drums and 3,180 kilograms for boxes. However, heavier boxes could be received on a case-by-case basis.

The WRAP has a waste shipping and receiving area, a nondestructive examination (NDE) and nondestructive assay (NDA) area, and a processing area. The processing area contains process enclosures (referred to as gloveboxes) for opening, sorting, sampling, and treating the contents of the waste containers. The WRAP also includes a process support area, a sample management area, and an administrative area.

Waste containers are received in the shipping and receiving area. After processing, the low-level portion of the waste is transferred to an onsite treatment, storage, and/or disposal unit (TSD) or to an offsite TSD facility. The transuranic waste will be shipped to a TSD unit approved by appropriate agencies to accept transuranic waste.

The WRAP provides NDE/NDA of the contact-handled waste. The NDE is used to identify the physical contents of waste containers to support waste characterization and processing, confirmation, or certification. The assay results are used to determine radioactive content and distribution.

The WRAP process area gloveboxes are designed for opening, sorting, and sampling to characterize or confirm the contents of containers of transuranic, low-level, and mixed waste. Treatment of waste includes deactivation, solidification or absorption of liquids, neutralization of corrosives, amalgamation, microencapsulation, macroencapsulation, volume reduction of waste (e.g., supercompaction), reaction of reactive waste, and repackaging of waste.

Process support areas are provided with space for heating, ventilation, and air conditioning equipment, mechanical equipment, and electrical equipment used to support operations.

A sample management area is provided to manage the various samples that are taken from within the process area gloveboxes.

The administrative area contains a computer control room. A computer is used to monitor the process control system, NDE equipment, NDA equipment, and other process equipment.

Exterior storage space is provided for the receipt of empty containers and other materials.

Although a separate equipment decontamination area is not provided within WRAP, manual decontamination of equipment and waste containers is performed throughout the various areas when necessary.

1.5 BUILDING EVACUATION ROUTING (BUILDING LAYOUT)

Figures 1 and 2 provide identification of emergency evacuation routes from WRAP to the designated staging areas. When evacuating the WRAP processing area, personnel wearing Personal Protective Equipment (PPE) clothing shall segregate themselves from persons wearing normal clothing.

The Primary Staging Area for WRAP is located at the northwest corner of the parking lot; the Secondary Staging Area is located on the southeast side of WRAP.

2.0 PURPOSE

This building emergency plan describes both the hazards and the basic responses to upset and/or emergency conditions. "Emergency" as used in this document includes events meeting the Washington Administrative Code (WAC) 173-303 definition of emergency, as well as U.S. Department of Energy (DOE) Order 232.1 categories of Unusual Occurrence and Emergency. These events include spills or releases as a result of processing, fires and explosions, transportation activities, movement of materials, packaging, storage of hazardous materials and natural and security contingencies. When used in conjunction with the DOE/RL-94-02, *Hanford Emergency Response Plan*, this plan meets the requirements for contingency planning as required by WAC 173-303.

3.0 BUILDING EMERGENCY ORGANIZATION

The WRAP maintains a weekly on-call list for technical expert notification. Upon notification, the on-call person will notify the primary or alternate Building Emergency Director (BED) to respond to the scene in person as necessary. The on-call technical expert will maintain contact with the on-scene Incident Commander (IC) until arrival of WRAP personnel.

Building emergency organizations are discussed in the following sections.

3.1 BUILDING EMERGENCY DIRECTOR

Emergency response will be directed by the BED until the IC arrives. The incident command structure and staff with supporting on-call personnel fulfill the responsibilities of the Emergency Coordinator as discussed in WAC 173-303-360.

During events, WRAP personnel perform response duties under the direction of the BED. The Incident Command Post (ICP) is managed by either the senior Hanford Fire Department member present on the scene or senior Hanford Patrol member present on the scene (security events only). These individuals are designated as the IC and as such have the authority to request and obtain any resources necessary for protecting people and the environment. The BED becomes a member of the ICP and functions under the direction of the IC. In this role the BED continues to manage and direct WRAP operations.

A listing of the primary and alternate BEDs by title, work location and work telephone numbers is contained in a separate, internally controlled document. The BED is on the premises or is available through an 'on-call' list 24 hours a day. Emergency Preparedness maintains a listing of BED names and work and home telephone numbers at the Patrol Operations Center (POC) in accordance with *Hanford Facility RCRA Permit*, Dangerous Waste Portion, General Condition II.A.4.

3.2 OTHER MEMBERS

As a minimum, the BED appoints and ensures training is provided to individuals who perform as Personnel Accountability Aides and Staging Area Managers. The accountability aides are responsible for facilitating the implementation of protective actions (evacuation or take cover) and for facilitating the accountability of personnel after the protective actions have been implemented. Staging Area Managers are responsible for coordinating and/or conducting activities at the staging area.

In addition, the BED might identify additional support personnel (health physics, maintenance, engineering, hazardous material coordinators, etc.) to be part of the building emergency organization when the incident command system (ICS) is activated.

The building emergency organization listing for the WRAP is maintained in a separate location in a format determined appropriate by WRAP management. Copies are distributed to appropriate locations and to Emergency Preparedness.

4.0 IMPLEMENTATION OF THE PLAN

To meet the requirements of WAC, this plan will be considered to be implemented when the BED has determined that a release, fire, or explosion that could threaten human health or the environment (WAC 173-303 Emergency) has occurred at the WRAP. The incident classification process is described in DOE/RL-94-02, Section 4.2.

Under DOE guidance, this plan will be considered implemented whenever the BED determines that one of the incidents listed in Section 6.0 has or will occur and that the severity is or will be such that there is a potential to threaten human health or the environment (DOE Unusual Occurrence or Emergency). The BED implements this plan through DOE/RL-94-02, *Hanford Emergency Response Plan*, and WRAP and/or site-specific procedures (see Attachment A). DOE declared emergencies are assigned to three classifications, which are listed in order of increasing severity: alert emergency, site area emergency, and general emergency. The WRAP implements these DOE emergencies through identified criteria in DOE-0223, RLEP 1.1, Appendix 1-2.L; this plan; and other documents listed in Attachment A.

The BED must assess each incident to determine the response necessary to protect personnel, the WRAP, and the environment. If assistance from Hanford Patrol, Fire, or ambulance units is required, the Hanford Emergency Response Number 911 (373-3800 if using a cellular phone) must be used to contact the Patrol Operations Center and request the desired assistance. To request other resources or assistance from outside the WRAP, the Patrol Operations Center business number is used (373-3800). The Emergency Duty Officer (EDO) is requested when making the initial 911 call.

5.0 FACILITY HAZARDS

5.1 HAZARDOUS MATERIALS

Hazardous materials are stored at designated areas within WRAP for use in various activities such as sampling preservation, waste treatment, and equipment maintenance. The use, storage, and inventory of hazardous materials is controlled. Hazardous material inventories and material safety data sheets are maintained by Environmental Compliance in 2336-W, administrative bay area; 2620-W, tool crib; and 2740-W, room 133.

5.2 INDUSTRIAL HAZARDS

Standard operations involve the use of forklifts, overhead and jib cranes, drum movements, and material processing. Hazards associated with industrial accidents include the potential for injuries or death resulting from moving equipment, falls, failure of pressurized systems, or radiological and/or chemical exposure from spilled waste or chemicals.

5.3 DANGEROUS, RADIOACTIVE AND/OR MIXED WASTE

The WRAP is designated as a TSD unit and is capable of managing dangerous, mixed, and radioactive (LLW and TRU) wastes received from site waste generators, offsite waste generators, or generated from WRAP operations. WRAP generated waste includes maintenance waste, repackaged waste, chemical waste from sampling and treatment activities, and step-off pad waste. These wastes are managed in waste areas throughout WRAP (e.g., shipping, receiving, stacker retriever, NDE/NDA, process gloveboxes).

5.4 RADIOACTIVE MATERIALS

Radioactive materials/wastes are stored and processed in several areas of WRAP. The shipping and receiving area provides the main storage location. Limited storage capabilities are provided in the NDE/NDA area and the process area. Radioactive sources are also maintained in the WRAP to perform testing and calibration of equipment.

5.5 CRITICALITY

WRAP, excluding the process glovebox area, is classified as a limited control unit. This is defined as a unit that may contain more than one third of a minimum critical mass (MCM) of fissionable material; however, the form and distribution of the material preclude the occurrence of a criticality accident. The criticality specification for WRAP limits the amount of fissionable material to 200 grams per drum and 350 grams per box. The inventories for each container are reviewed at the time of waste receipt to ensure that the quantity of fissile material does not exceed the specified limit. A specific plan must be developed and approved for handling each drum or box exceeding these limits. The process glovebox area is classified as up to three isolated facilities. An isolated unit contains less than 1/3 of an MCM. Strict inventory control in this area precludes a criticality event.

6.0 POTENTIAL EMERGENCY CONDITIONS

Potential emergency conditions may fall into one of three basic categories: operations (process upsets, fires and explosions, loss of utilities, spills, and releases), natural phenomena (e.g., earthquakes), and security contingencies (bomb threat, hostage situation, etc.). The following are conditions that may lead to an emergency situation (WAC 173-303-350 and 360 or DOE 232.1) at WRAP and require the implementation of this plan.

6.1 FACILITY OPERATIONS EMERGENCIES

6.1.1 Loss of Utilities

The loss of utilities (e.g., electricity) could result in loss of air balance contamination control in the process areas, compressed air systems, and limited control of WRAP operations. An uninterruptible power system (UPS) supplies backup power to computer and alarm systems. However, the loss of utilities would not necessarily result in an emergency classified as a WAC or DOE defined emergency.

6.1.2 Major Process Disruption/Loss of Plant Control

Process disruption/loss of plant control would not result in an emergency classified as a WAC or DOE defined emergency.

6.1.3 Pressure Release

Pressure hazards, which could cause objects to be propelled through the air, could result from damage to the facility service air system (125 PSIG maximum).

Compressed gas cylinders (e.g., P-10 gas, propane, air cylinders, and fire extinguishers) are bulk stored in a building located at the southeast corner of the 2620-W material staging area. In addition, compressed gas cylinders are routinely used in the process area, maintenance shops, and various locations around WRAP. Examples of the gasses placed at WRAP include argon, nitrogen, acetylene, and P-10 gas. Gas cylinders may pose a potential projectile, inhalation, or fire hazard in the immediate area where these are stored and/or used.

6.1.4 Fire and/or Explosion

A fire or explosion in WRAP could result in the release of hazardous and/or radioactive constituents to the air or ground due to failure of storage container integrity and damage to process gloveboxes. Fire associated with flammable materials could cause damage to electronic devices, containment controls, and HEPA Filters. Fire could also result in the loss of life.

6.1.5 Hazardous Material Spill

Hazardous materials are stored in the WRAP. Spills or releases of hazardous materials could result in the following conditions:

- Spill of Hazardous Material. Hazards associated with a spill include potential exposure to dangerous constituents as well as potential environmental damage. Releases likely would be confined within the WRAP.

- Toxic Fumes Hazards. Hazardous materials stored at the WRAP is a potential airborne contamination hazard. Volatile materials such as concentrated caustics and solvents might generate toxic fumes.

- Fires or Explosions Involving Hazardous Material. A fire or chemical reaction in the WRAP could result in the release of dangerous constituents to the air or soil.

- Reactive Chemical/Corrosive Material Hazards. Misrepresented shipments and/or transfers of incompatible hazardous materials stored at the WRAP could potentially cause chemical reactions resulting in fire, explosion, and dangerous waste releases. Acidic and basic solutions are corrosive and could cause chemical burns.

- Thermal Reactions/Hazards. Thermal reactions could cause burns, chemical burns, and toxic fumes, and cause pressure hazards in sealed containers.

- Flammable Material/Liquids Hazards. Hazards associated with flammable materials and liquids include fire, explosion, and release of dangerous waste.

- Asbestos Release. The WRAP structure does not contain asbestos, but dangerous waste containing asbestos could be stored inside containers stored within the structure. Release of friable asbestos waste could result in an inhalation hazard.

- Explosive Materials/Munitions Hazards - N/A.

6.1.6 Dangerous and Mixed Waste Spill

A dangerous, mixed, and/or radioactive waste spill could result in potential personnel contamination through skin contact or via airborne contamination. Environmental impact could include contaminated water or soil.

- Spill of Dangerous and Mixed Waste. Hazards associated with a spill include potential exposure to dangerous, mixed, and/or radioactive constituents as well as potential environmental damage. Releases likely would be confined to a local area because container contents routinely are not in a liquid or powder form.

- Toxic Fumes Hazards. Dangerous, mixed, and radioactive waste stored at the WRAP is a potential airborne radioactive contamination hazard. Volatile materials such as concentrated caustics and solvents might generate toxic fumes. Plutonium, an alpha emitter, is known to generate hydrogen (H_2) gas when hydrogenous materials are present in the waste; however, catalytic recombiners, or vents, are used to maintain H_2 gas concentrations below 1 percent in waste containers and are replaced whenever the waste is repackaged. The recombiners used onsite are projected to maintain the oxygen (O_2) concentration below 0.5 percent, and the H_2 concentration below 1 percent.

  NOTE: Container damage resulting in material upset without the $H_2 + O_2$ recombiner could lead to a hydrogen explosion and subsequent release to onsite populations and the environment.

Waste acceptance criteria require that the offsite generators and onsite generating units document waste with gas-generating potential and that the requirement for gas recombiners be specified on the waste tracking forms.

- Fires or Explosions Involving Dangerous and Mixed Waste. A fire or chemical reaction in the WRAP could result in the release of dangerous and/or radioactive constituents to the air or soil.

- Reactive Chemical/Corrosive Hazards. Misrepresented shipments and/or transfers of incompatible dangerous or mixed waste managed at the WRAP could potentially cause chemical reactions resulting in fire, explosion, and dangerous, mixed, and/or radioactive waste releases. Acidic and basic solutions are corrosive and could cause chemical burns.

- Thermal Reactions/Hazards - Thermal reactions could cause burns, chemical burns, and toxic fumes, and cause pressure hazards in sealed containers.

- Flammable Material/Liquids Hazards. Fire involving flammable materials/liquids could cause damage to containers resulting in potential dangerous, mixed, and or radioactive waste releases. Liquid waste stored at the WRAP could include containers with lab packs (e.g., vials of liquids packed with absorbent solids) or containers containing solvent-soaked rags that are packed with absorbent material. Except for lab packs, containers with free liquid cannot have greater than 10 percent unabsorbed liquid. If a fire occurs involving these items, a 'worst case' (e.g., assume entire container is liquid) will be assumed until the containers can be opened and inspected.

- Asbestos Release. Asbestos materials are potential components of waste stored at the WRAP. Damage to these containers could result in an unplanned release of friable asbestos to the environment, creating an inhalation health hazard.

- Explosive Materials/Munitions Hazards - N/A.

6.1.7 Transportation and/or Packaging Incidents

Radioactive, hazardous, and mixed wastes are shipped from and received at WRAP in various Department of Transportation approved shipping containers. Shipping containers that are damaged during transportation or packaging could result in chemical and/or radiological releases to the environment and exposure to WRAP personnel. The WRAP could receive offsite shipments of mixed waste as defined by WAC 173-303.

6.1.8 Radiological Material Release

Hazards associated with stack releases include personnel and environmental exposure to radioactive contamination, and downwind contamination by surface deposition.

Hazards associated with liquid releases from process upsets or spills can expose personnel and the environment to hazardous materials, radioactive materials and mixed wastes.

Significant contamination spread/release due to failure of primary and secondary containment systems could result in inhalation hazards involving exposure to radioactive, toxic, corrosive, or flammable materials, depending upon the nature of the release. In addition, this event could result in the chemical and/or radiological contamination of soil, water, or air.

6.1.9 Criticality

A criticality safety evaluation of WRAP indicates that the occurrence of a criticality would not be a credible event. Criticality safety is accomplished by controlling the form, amount, and distribution of fissile material bearing wastes that are being evaluated and processed.

6.2 NATURAL PHENOMENA

Natural phenomena are discussed in the following sections.

6.2.1 Seismic Event

Depending on the magnitude of the event, severe structural damage could occur resulting in serious injuries or fatalities and the release of hazardous materials. Damaged electrical circuits and wiring could result in the initiation of multiple fires and personnel injuries.

6.2.2 Volcanic Eruption/Ashfall

Ashfall could cause shorts in electrical equipment and plug ventilation system filters.

6.2.3 High Winds/Tornados

High winds or tornados may cause structural damage to systems containing hazardous materials, resulting in a release to the environment.

6.2.4 Flood

The result of three worst-case flood scenarios identified as part of the facility final safety analysis report concluded that WRAP is situated above all possible flood levels.

6.2.5 Range Fire

The hazards associated with a range fire include those associated with a building fire plus potential site access restrictions and travel hazards such as poor visibility.

6.2.6 Aircraft Crash

In addition to the potential for serious injuries or fatalities, an aircraft crash could result in the direct release of hazardous materials or cause a fire that could lead to such a release.

6.3 SECURITY CONTINGENCIES

Security contingencies are discussed in the following sections.

6.3.1 Bomb Threat

A bomb threat may be received by anyone who answers the telephone or receives mail. The major effect on the WRAP will be the evacuation of personnel. If a bomb explodes, the effects are the same as those discussed in Section 6.1.4, Fire and/or Explosion.

6.3.2 Hostage Situation

A hostage situation can pose an emergency situation if there is the potential to adversely impact the WRAP. This can be as a result of losing WRAP control (operators removed from their stations) or when the situation results in the coercion of personnel to perform an act of sabotage.

6.3.3 Suspicious Object

The major effect on the WRAP is ceased operations and the evacuation of personnel.

7.0 INCIDENT RESPONSE

The initial response to any emergency will be to immediately protect the health and safety of persons in the affected area. Identification of released material is essential to determine appropriate protective actions. Containment, treatment, and disposal assessment will be the secondary responses.

The following sections describe the process for implementing basic protective actions and outline response actions for the events listed in subsection 6.0. DOE/RL-94-02, Section 1.3, provides concept of operations for emergency response on the Hanford Site.

7.1 PROTECTIVE ACTIONS RESPONSES

Protective action responses are discussed in the following sections.

7.1.1 Evacuation

If an evacuation is ordered or the evacuation siren sounds in the area of WRAP, personnel shall proceed to the appropriate staging area (see Figure 1).

The BED or staging area manager directs the evacuation; however, to ensure that evacuations are conducted promptly and safety, all personnel must be familiar with the correct evacuation procedure. During an evacuation, all personnel must report to the nearest staging area (upwind) for a head count.

If it becomes necessary to evacuate the primary staging areas, the staging area manager or the BED will instruct personnel to proceed to the alternate staging area or an alternate destination, depending on the nature of the emergency.

If an area evacuation is called for, all personnel shall be familiar with the evacuation procedure that follows. The order to evacuate normally will be passed via the Site Crash Alarm Telephone system.

Area evacuations are either rapid or controlled, as pointed out in the following steps. When possible, the following steps need to be conducted concurrently.

AREA EVACUATION PROCEDURE
Direct the activation of the WRAP evacuation siren (STEADY BUZZER).
Use whatever means are available (PA system, bullhorns, runners, etc.) to pass the evacuation information to personnel.
Halt any operations or work and place the building in a safe condition if safe to do so. Use emergency shutdown procedures for rapid evacuation.

Evacuate personnel to the staging area; group personnel as follows: potentially contaminated protective clothing, keys immediately available for vehicles, those needing rides.
Conduct personnel accountability. Report personnel accountability results to the RL-Emergency Operations Center (RL-EOC) (373-3876, 373-1786, 376-8612, 376-4712).
Inform IC of any potentially affected personnel (i.e., injured, contaminated, exposed, etc.) once the IC arrives at the ICP.
Barricade main roadways into WRAP, if necessary, to limit traffic to emergency vehicles only.
Relay pertinent evacuation information (routes, destination etc.) to drivers.
Dispatch vehicles as soon as the vehicles are loaded.
Report status to the RL-EOC, request additional transportation, if required, and report if any people remain who are performing late shutdown duties.

7.1.2 Take Cover

When the Take Cover Alarm is activated, personnel shall take cover in the nearest building or trailer. A message followed by the Take Cover siren will be transmitted over the area emergency sirens. The following actions must be taken or considered:

- Shut doors and windows and wait for further instructions
- Secure ventilation system
- Follow normal exit procedures from radiological areas
- Lock up classified documents and prepare for a possible evacuation
- Report your location to the Accountability Aid or the BED
- Accountability Aides will provide accountability status to the Staging Area Manager for facility personnel during an event.

7.2 RESPONSE TO FACILITY OPERATIONS EMERGENCIES

Depending on the severity of the event, the BED reviews site-wide procedures, the WRAP specific emergency response guide, specific sections of this plan, and/or plant operating procedures (POPs) and classifies the event and initiates area protective actions (activate sirens, notifications, etc.) and site emergency response organization activation. Attachment A provides a list of procedures and emergency response guides.

7.2.1 Loss of Utilities

Loss of electricity, compressed air, or process ventilation could result in an emergency condition due to the possibility of a contamination spread from the process gloveboxes. Loss of all or part of these utilities could make it necessary to evacuate the affected areas. The electrical power system includes battery operated emergency lighting throughout the WRAP, which will maintain lighting for a minimum of 90 minutes. The electrical power system also includes an uninterruptible power supply (UPS) which will provide battery power for a minimum of 55 minutes to the electrical, compressed air and process ventilation monitoring systems, which annunciate in the Control Room. The Control Room Operator notifies the Duty Operations Supervisor who, along with the BED, will decide if evacuation is necessary. Evacuation can be directed using the PAX system and the evacuation alarm, both of which are powered by the UPS.

7.2.2 Major Process Disruption/Loss of Plant Control

The results of a major process disruption in WRAP are inclusive of the specific hazards discussed in the other sections (i.e. spills, fire/explosion, etc.).

7.2.3 Pressure Release

A pressure release can occur due to damage or failure of a pressurized system. A release can cause damage to WRAP equipment or injury and death to personnel. In the event of a release of a pressurized system, exit the area immediately and notify management. No personnel shall perform manipulation of equipment to mitigate an event unless qualified to do so.

7.2.4 Fire and/or Explosion

In the event of a fire, the discoverer activates a fire alarm, calls 911 (373-3800 if using a cellular phone), and evacuates. Automatic initiation of a fire alarm (through the smoke detectors and sprinkler systems) also is possible.

- On actuation of the fire alarm, personnel shut down equipment and secure waste ONLY if time permits. The alarm automatically signals the Hanford Fire Department.
- Personnel leave the area/building by the nearest safe exit and proceed to the designated staging area for accountability.
- The BED proceeds directly to the primary or secondary ICP, as appropriate, and sets up the ICP. The BED will obtain all necessary information pertaining to the incident and will meet with, or send a representative to meet with, the Hanford Fire Department.

- Depending on the severity of the event, the BED reviews site-wide procedures, the WRAP specific emergency response guide, specific sections of this plan, and/or POPs and classifies the event and initiates area protective actions (activate sirens, notifications, etc.) and site emergency response organization activation. Attachment A provides a list of procedures and emergency response guides.

- The BED informs the site emergency organization as to the extent of the emergency (including estimates of hazardous material quantities released to the environment).

- The BED informs the IC of any potentially affected personnel (i.e., injured, contaminated, exposed, etc.) when the IC arrives at the ICP.

- If operations are stopped in response to a fire, the BED ensures that systems are monitored for leaks, pressure buildup, gas generation, and ruptures.

- Hanford Fire Department firefighters extinguish the fire.

- The BED ensures that all emergency equipment is cleaned and fit for its intended use following completion of cleanup procedures.

7.2.5 Hazardous Material, Mixed and/or Radioactive Waste Spill

Spills can result from many sources including process leaks, container spills or leaks, damaged packages or shipments, or personnel error. Spills of mixed waste are complicated by the need to deal with the extra hazard posed by the presence of radioactive materials. The response to a spill and/or release is as follows:

- Notify WRAP personnel (including BED) of discovery of spill or release.

- Initiate notifications to the Hanford Fire Department (HazMat Team) by calling 911 (373-3800 if using a cellular phone), and provide all known information, or verify that the BED has called 911 or determined that emergency response assistance is not required.

- Ensure that any personnel that have been exposed to a spilled chemical and/or have suffered an injury receive proper first aid, immediate medical attention and that the PHMC health advocate is contacted by the EDO. In case of contact with a chemical, promptly remove contaminated clothing and shoes. **Immediately** contact supervision and the Patrol Operations Center at 911 (373-3800 if using cellular phone) to report injuries or exposure and obtain Hanford Fire Department medical response.

- Take action to contain and/or to stop the spill or container leak if all of the following are true:

  - The identity of the substance(s) involved is known.

  - Appropriate protective equipment and control/cleanup supplies, e.g., absorbents, readily are available.

  - Discoverer safely can perform the action(s) without assistance, or assistance readily is available from other trained personnel.

If any of the previous conditions are not met or if there is any doubt, evacuate the area and remain outside, upwind of the spill. The discoverer will remain available for consultation with the BED, Hanford Fire Department, or other emergency response personnel and restricts access to the area until the arrival of the BED.

The BED performs or arranges for the following:

- Establishes a command post at a safe location, and coordinates further spill mitigation activities

- Obtains all available information pertaining to the incident and determines if the incident requires implementation of the contingency plan

- Reviews site-wide procedures, the WRAP specific emergency response guide, specific sections of this plan, and/or POPs and classifies the event and initiates area protective actions (facility and area sirens, notifications, etc.) and activates the site emergency response organization. Attachment A provides a list of procedures and emergency response guides

- Informs the IC of any potentially affected personnel (i.e., injured, contaminated, exposed, etc.) when the IC arrives at the ICP

- Arranges for care of any injured persons

- Maintains access control at the incident site by keeping unauthorized personnel and vehicles away from the area. Security personnel can be used to assist in site control if control of the boundary is difficult (e.g., repeated incursions). In determining controlled access areas, considers environmental factors such as wind velocity and direction

- Arranges for proper remediation of the incident after evaluation

- Remains available for fire, patrol, and other authorities on the scene, and provides all required information

- Enlists the assistance of alternate BED(s), if response activities are projected to be long term

- Ensures the use of proper protective equipment, remedial techniques, transfer procedures [including ignition source control (e.g., nonsparking tools, grounding containers, isolation of ignition sources, use of explosion-proof electrical equipment, etc.) for flammable or reactive spills], and decontamination procedures by all involved personnel, if remediation is performed by WRAP personnel

- Remains at the ICP to oversee activities and to provide information, if remediation is performed by the Hanford Fire Department Hazardous Materials Response Team or other response teams

- Ensures proper containerization, packaging, and labeling of recovered spill materials and overpacked containers

  NOTE: All containers of spill debris, recovered product, etc., are managed in the same manner as waste containers. Overpacks in use are marked with information pertaining to their contents and noted as to whether the container inside the overpack is leaking or is in good condition.

- If operations are stopped in response to the release, ensures that systems are maintained in a safe condition

- Ensures decontamination (or restocking) and restoration of emergency equipment used in the spill remediation before resuming operations

- Provides required reports after the incident, in accordance with the DOE/RL-94-02, *Hanford Emergency Response Plan.*

7.2.5.1 Damaged or Unacceptable Shipments

In accordance with WAC 173-303-370, when a damaged shipment or transfer of hazardous material or dangerous waste arrives at WRAP and the shipment/transfer is unacceptable for receipt, the damaged shipment/transfer shall not be moved.

If a damaged shipment or transfer results in a spill, the following actions are performed.

- Notify the BED, the Hanford Fire Department, and the appropriate personnel to advise of the situation. The BED responds and assists in the evaluation of, and response to, the incident. The BED informs the IC of conditions upon arrival.

- The BED informs the IC of any potentially affected personnel (i.e., injured, contaminated, exposed, etc.) when the IC arrives at the ICP.

- Notify the offsite generator or onsite generating unit of the damaged shipment/transfer, and request any information necessary to assist in responding to the spill.

- Proceed with remedial action, including overpacking damaged containers, cleanup of spilled material, or other necessary actions to contain the spill. Refer to Section 7.2.5 for remedial actions.

7.2.5.2 Transportation Incidents

In accordance with WAC 173-303-145, the discoverer or BED will take the following actions for leaks or spills resulting from a hazardous materials transportation incident if the actions can be performed without jeopardizing personnel safety, as appropriate:

- Determines the nature of incident
  - Personnel injuries
  - Hazardous material spill with fire
  - Hazardous material spill without fire

- Assists injured personnel

- Initiates notifications to the appropriate personnel by any means available (telephone, radio, passing motorist, etc.) to request assistance from the Hanford Fire Department (Emergency Coordinator/Incident Commander for these type of events), Hanford Patrol, and medical personnel

- Remains in a safe location and attempts to isolate the area to prevent inadvertent personnel access

- The BED informs the IC of any potentially affected personnel (i.e., injured, contaminated, exposed, etc.) when the IC arrives at the ICP.

7.2.6 Radiological Material Release

Radioactive and mixed wastes are stored and processed throughout WRAP. Spills or releases could result in significant levels of contamination. Consideration must be given to radiological risks during events involving ventilation loss, electrical loss, and all spills, including the use of clean liquids on contaminated systems or areas.

7.2.6.1 Radioactive Gaseous Effluent Discharge - Stack Alarm

All potentially contaminated gaseous effluent discharges are continuously sampled to determine radioactivity.

If a continuously monitored stream from the 2336-W exhaust stack exceeds release limits, alarms are activated and sounded locally at the stack monitoring cabinet, the control room, and remotely at an annunciator panel in Room 120 of the WRAP administrative area. The stack alarms are characterized by an audible bell and a flashing red beacon.

7.2.6.2 Significant Contamination Spread

Significant contamination spreads are typically indicated by a continuous air monitor (CAM) alarm, or identified during routine operations and/or radiological surveillance. There are two types of CAM alarms in WRAP: local CAMs, which are characterized by an audible contamination bell and a flashing red beacon, and remote CAMs, which have an audible bell and a flashing amber beacon.

Local CAMs draw air from the immediate air space in which they are stationed, and are located in the shipping receiving area, NDE/NDA area, HVAC Room, and throughout the Process Area. Remote CAM alarms indicate airborne contamination in an adjacent space.

Personnel must be acutely aware of the CAM alarms located in their work areas and know the appropriate emergency responses listed below.

- Stop work activities and immediately exit the area
- Notify the immediate manager and the BED
- Contact Radiological Control (RC) and stand by for survey and contamination status. If the room is found to be contaminated, RC will post the room as an airborne radioactivity area.

The following steps shall be conducted when responding to a remote CAM:

- Notify the immediate manager and the BED
- Contact RC and remain available to provide pertinent information.

7.2.7 Criticality

A WRAP criticality safety evaluation indicates that the occurrence of a criticality is not a credible event. Criticality safety is accomplished by controlling the form, amount, and distribution of fissile material bearing wastes that are being evaluated and processed.

7.3 PREVENTION OF RECURRENCE OR SPREAD OF FIRES, EXPLOSIONS, OR RELEASES

The BED, as part of the incident command system, takes the steps necessary to ensure that a secondary release, fire, or explosion does not occur. The following actions are taken as necessary:

- Isolates the area of the initial incident by shutting off power, shutting off or closing ventilation systems, etc., to minimize the spread of a release and/or the potential for a fire or explosion
- Inspects containment for leaks, cracks, or other damage
- Inspects for toxic vapor generation
- Removes released material and waste as soon as possible
- Contains and isolates residual waste material using dikes and absorbents
- Reactivates operations in affected areas only after cleanup of residual waste materials is achieved.

7.4 RESPONSE TO NATURAL PHENOMENA

Depending on the severity of the event, the BED reviews site-wide procedures, the WRAP specific emergency response guide, specific sections of this plan, and/or POPs and classifies the event and initiates area protective actions (activates sirens, notifications, etc.) and site emergency response organization activation. Attachment A provides a list of procedures and emergency response guides.

Response to natural phenomena are discussed in the following sections.

7.4.1 Seismic Event

The emergency response organization's primary role in a seismic event is coordinating initial response to injuries, fires, and fire hazards and acting to contain or control radioactive, dangerous, or mixed waste releases.

Individuals must remain calm and stay away from windows, electrical lines, and hazardous material storage locations. Once the shaking has subsided, individuals must evacuate carefully and assist those needing help. The location of any trapped individuals is reported to the BED or to 911 (373-3800 if using a cellular phone).

The following steps shall be conducted by the BED when responding to a seismic event, as necessary:

- Conduct accountability
- Coordinate searches for personnel and potential hazardous conditions (fires, spills, etc.)
- Secure utilities and operations
- Arrange rescue efforts, and notify 911 (373-3800 if using a cellular phone) for assistance

- Assemble damage assessment teams
- Determine if hazardous materials were released
- Determine current local meteorological conditions
- Warn other units and implement protective actions if release of hazardous materials poses a danger
- Provide personnel and resource assistance to other units if required and possible.

7.4.2 Volcanic Eruption/Ashfall

When notified of an impending ashfall, the BED will implement measures to minimize the impact of the ashfall, such as:

- Installing filter media over building ventilation intakes
- Installing filter media or protective coverings on outdoor equipment that may be adversely affected by the ash (diesel generators, equipment rooms etc.)
- Shutting down some or all operations and processes
- Sealing secondary use exterior doors
- Releasing all non-essential personnel to go home.

If as a result of the ashfall other emergency conditions arise (e.g., fires due to electrical shorts or lightning), response is as described in the applicable section of this plan.

7.4.3 High Winds/Tornados

Upon notification of impending high winds, the BED takes steps necessary to secure all outdoor waste, hazardous material containers, and storage locations. All doors and windows are closed, and personnel are warned to use extreme caution when entering or exiting the building.

7.4.4 Flood

Not Applicable (refer to section 6.2.4, "Flood," of this plan).

7.4.5 Range Fire

Responses to range fires are handled by preventive measures (i.e., keeping hazardous material and waste accumulation areas free of combustible materials such as weeds and brush). If a range fire breaches the WRAP boundary, the response is as described in section 7.2.4, "Fire and/or Explosion."

7.4.6 Aircraft Crash

The response to an aircraft crash is the same as that for responding to a fire and/or explosion.

7.5 SECURITY CONTINGENCIES

Depending on the severity of the event, the BED reviews site-wide procedures, the WRAP specific emergency response guide, specific sections of this plan, and/or POPs and classifies the event and initiates area protective actions (activates sirens, notifications, etc.) and site emergency response organization activation. Attachment A provides a list of procedures and emergency response guides.

Security contingencies are discussed in the following sections.

7.5.1 Bomb Threat

7.5.1.1 Telephone Threat

Individuals receiving telephoned threats try to gain as much information as possible from the caller (using the Bomb Threat Checklist if available). Upon conclusion of the call, notify the BED and Security via 911 (373-3800 if using a cellular phone).

The BED evacuates the building to the secondary staging area, away from all parked vehicles, and queries personnel at the staging area regarding any suspicious objects in or near the WRAP.

When Security personnel arrive, follow their instructions.

7.5.1.2 Written Threat

Receivers of written threats handle the letter as little as possible. Notify the BED and Security. Depending on the content of the letter, the WRAP may or may not be evacuated. The letter is turned over to Security personnel, and their instructions are then followed.

7.5.2 Hostage Situation/Armed Intruder

The discoverer of a hostage situation or armed intruder reports it to 911 (373-3800 if using a cellular phone) and to the BED, if possible. The BED, after conferring with Security personnel, may covertly evacuate areas of the WRAP not observable by the hostage taker(s)/intruder. No alarms will be sounded.

Security will determine the remaining response actions and will activate the hostage negotiating team, if necessary.

7.5.3 Suspicious Object

The discoverer of a suspicious object reports it to the BED and to 911 (373-3800 if using a cellular phone), if possible, and ensures that the object is not disturbed.

The BED will evacuate the affected WRAP and (based on the description provided by the discoverer) attempt to determine the identity or owner of the object by questioning WRAP personnel at the staging area.

If the identity/ownership of the object cannot be determined, then Security will assume command of the incident. The canine unit will be used to determine if the package contains explosives. If there is a positive indication of explosives or it cannot be assured that there are no explosives, then the Richland Police Department's Explosive Ordnance Disposal Team will be dispatched to the WRAP to properly dispose of the device.

8.0 TERMINATION OF EVENT, INCIDENT RECOVERY, AND RESTART OF OPERATIONS

DOE/RL-94-02, Section 8.0, describes these considerations. The extent by which these actions are employed is based upon the incident classification of each event. In addition, DOE/RL-94-02 also contains considerations for the management of incompatible wastes, which may apply.

8.1 TERMINATION OF EVENT

For events where the RL-EOC is activated, only the RL Emergency Manager has the authority to declare event termination. This decision is based on input from the BED, IC, and other emergency response organization members. For events where the RL-EOC is not activated, the incident command structure and staff will declare event termination.

8.2 INCIDENT RECOVERY AND RESTART OF OPERATIONS

A recovery plan is developed when necessary. A recovery plan is needed following an event where further risk could be introduced to personnel, the WRAP, or the environment through recovery action and/or to maximize the preservation of evidence. Depending on the magnitude of the event and the effort required to recover from it, recovery planning may involve personnel from RL and other contractors. If a recovery plan is required, it is reviewed by appropriate personnel and approved by a Recovery Manager before restart. Restart of operations is performed in accordance with the approved plan.

If this plan was implemented for a WAC emergency (see Section 4.0), the Washington State Department of Ecology (Ecology) must be notified before operations can resume. DOE/RL-94-02, Section 6.1, discusses different reports to outside agencies. This notification is in addition to other required reports and must include information documenting the following conditions:

- There are no incompatibility issues with the waste and released materials from the incident.

- All the equipment has been clean and returned to service or replaced. The notification may be made via telephone conference. Additional information that Ecology requests regarding these restart conditions will be included in the required 15-day report identified in WAC 173-303-360(2)(k).

For emergencies not involving activation of the RL-EOC, the BED ensures that conditions are restored to normal before operations are resumed. If the RL-EOC was activated and the emergency phase is complete, a special recovery organization is appointed at the discretion of RL to restore conditions to normal. The makeup of this organization depends on the extent of the damage and its effects.

8.3 INCOMPATIBLE WASTE

After an event, the BED or the onsite recovery organization ensures that no waste that might be incompatible with the released material is treated, stored, and/or disposed of until cleanup is completed. Cleanup actions are taken by WRAP personnel or other assigned personnel. DOE/RL-94-02, Section 8.3, describes actions to be taken. These actions might include, but are not limited to, any of the following:

- Neutralization of corrosive spills
- Chemical treatment of reactive materials to reduce hazards
- Overpacking or transfer of contents from leaking containers
- Use of sorbents to contain and/or absorb leaking liquids for containerization and storage and/or disposal
- Decontamination of solid surfaces impacted by released material, e.g., intact containers, equipment, floors, containment systems, etc.
- Disposal of contaminated porous materials that cannot be decontaminated and any contaminated soil
- Containerizing and sampling of recovered materials for classification and determination for proper management
- Followup sampling of decontaminated surfaces to determine adequacy of cleanup techniques as appropriate.

Waste from cleanup activities is designated and managed as newly generated waste. A field check for compatibility before storage is performed, as necessary. Incompatible wastes are not placed in the same container. Containers of waste are placed in storage areas appropriate for their compatibility class.

If incompatibility of waste was a factor in the incident, the BED or the onsite recovery organization ensures that the cause is corrected. Examples include modification of an incompatibility chart or increased scrutiny of waste from a generating unit when incorrectly designated waste caused or contributed to an incident.

8.4 POST EMERGENCY EQUIPMENT MAINTENANCE AND DECONTAMINATION

All equipment used during an incident is decontaminated (if practicable) or disposed as spill debris. Decontaminated equipment is checked for proper operation before storage for subsequent use. Consumables and disposed materials are restocked. Fire extinguishers are recharged or replaced.

The BED ensures that all equipment is cleaned and fit for its intended use before operations are resumed. Depleted stocks of neutralizing and absorbing materials are replenished, self-contained breathing apparatus are cleaned and refilled, protective clothing is cleaned or disposed of and restocked, etc.

Factors to consider when establishing an equipment and personnel decontamination station are as follows:

- Water supplies
- Containment/catch basins and/or systems
- Personnel necessary to accomplish proper decontamination
- Protective clothing
- Decontamination supplies (buckets, brushes, soap, chemicals as needed)
- Risk to personnel
- Weather conditions [i.e., severe heat, cold (current and forecasted)]
- Toxicity of material
- Porosity of equipment to be decontaminated
- Disposal requirements of decontamination rinse
- Use of controlled zones to maintain contamination control.

9.0 EMERGENCY EQUIPMENT

Hanford Site emergency resources and equipment are described and listed in DOE/RL-94-02, Appendix C.

9.1 FIXED EMERGENCY EQUIPMENT AT WRAP

Fixed Emergency Equipment		
Type	Location	Capability
Local Fire/Smoke Detectors	2336-W	Provides notification of a fire
Fire Alarm Pull Boxes	2336-W	Activates the building fire alarm systems
Wet/Dry Pipe Fixed Sprinkler Systems	2336-W	Assists in fire suppression
Dry Chemical Fire Suppression Systems	2336-W Process Gloveboxes	Assists in fire suppression in the process gloveboxes
Emergency Lighting	2336-W	Low-level lighting during power outages
Decontamination Shower	2336-W Room 111	Flushing radiological/ chemical material from eyes, clothes, and body
First Aid Kits	2336-W	Provide materials for immediate first aid response
Eye Wash Stations and bottles	2336-W	Flushing chemical/ radiological material from eyes

9.2 PORTABLE EMERGENCY EQUIPMENT

Portable Emergency Equipment		
Type	Location	Capability
Fire Extinguishers	2336-W	Assist in fire control
Emergency Monitoring Kit (Silver Suitcase)	Incident Command Post in the conference room at WRAP and the conference room of Building 2740-W	Emergencies use: radiation detection equipment, PPE clothing, respiratory protection equipment

9.3 COMMUNICATIONS EQUIPMENT/WARNING SYSTEMS

Communications Equipment		
Type	Location	Capability
Public Address (PA) System	Throughout the 2336-W facility areas	Notification of WRAP personnel
Crash Alarm Telephone System	2336-W, Room 125	Site notifications and communications
Telephone System	2336-W	Communication with onsite and offsite personnel and organizations
Radios	2336-W	Job Specific communications within WRAP

Evacuation Siren (Steady Buzzer) - Manually activated alarm that alerts WRAP personnel of an evacuation condition.

Take Cover Siren (Wavering Buzzer) - Manually activated alarm that alerts WRAP Complex personnel of a take cover condition.

CAM Unit - Continuous Air Monitor Unit. Has a steady ringing bell and flashing red beacon when used for monitoring local air spaces. CAM units used for monitoring non-local, or remote, air spaces have steady ringing bells and flashing amber beacons.

Fire Alarm (Hi Pitched Beep and Flashing Strobe) - There is an emergency fire signal system in the 2336-W Building. Activation of this alarm by either smoke/heat detectors or manual pull stations alerts personnel in the affected facility to perform an evacuation.

Plant Control System Alarms (PCS) - Monitored system parameters associated with the 2336-W facility operations (ventilation, electrical, air, exhaust emissions, radiation levels, etc.) will provide alarm conditions in the 2336-W Control Room, Local Alarm Panels, and selected alarm indications on the remote alarm panel located in room 120.

9.4 PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment		
Type	Location	Capability
Personal Protective Clothing (PPE)	2336-W Change room Areas and Clean STP Storage Area (Room 132)	Protect personnel from skin exposure to particulate contaminants
Acid Suit, Aprons, Face shields, Gloves	2336-W Material Preparations Area (Room 152)	Protect personnel when working with acids and caustics

9.5 SPILL CONTROL AND CONTAINMENT SUPPLIES

Spill Kits and Spill Control Equipment		
Type	Location	Capability
Portable Spill Response Carts (Absorbents, pillows, spill pigs, Non-sparking cleanup tools, protective clothing, etc.)	2336-W Shipping/Receiving Area	Provide immediate access to required materials necessary to stabilize hazardous material spills in the facility
Spill Response Locker (Absorbents, pillows, spill pigs, containers, Non-sparking cleanup tools, protective clothing, etc.)	2336-W Material Preparation Area (Room 152) and process area	Provide immediate access to required materials necessary to stabilize hazardous material spills in the Material Preparation Area

9.6 INCIDENT COMMAND POST

The primary ICP for WRAP is the conference room of Building 2336-W. The secondary ICP location is the conference room of Building 2740-W. At such a time that either the primary or secondary ICP locations cannot be established/maintained due to unsafe conditions, then the BED will identify an alternate location or request the utilization of the mobile command vehicle.

10.0 COORDINATION AGREEMENTS

The RL has established a number of coordination agreements, or memoranda of understanding (MOU) with various agencies to ensure proper response resource availability for incidents involving the Hanford Site. A description of the agreements is contained in DOE/RL-94-02, Table 3-1.

11.0 REQUIRED REPORTS

Post-incident written reports are required for certain incidents on the Hanford Site. The reports are described in DOE/RL-94-02, Section 6.1.

12.0 PLAN LOCATION

Copies of this plan are maintained at the following locations:

- Operations Management Offices
- WRAP Managers Office
- ICP equipment bag
- RL-EOC
- Hanford Local Area Network (HLAN).

13.0 BUILDING EMERGENCY ORGANIZATION

The complete building emergency organization listing of positions, names, work locations and telephone numbers for the WRAP is maintained in a separate, internally controlled, WRAP document. Copies are distributed, at a minimum, to appropriate WRAP locations and to Hanford Site Emergency Preparedness. In addition, names, work and home telephone numbers of the BEDs and alternates are available from the Patrol Operations Center (373-3800), in accordance with the *Hanford Facility RCRA Permit*, Dangerous Waste Portion, General Condition II.A.4.

14.0 REFERENCES

DOE/RL-94-02, *Hanford Emergency Response Plan*, as amended.

DOE Order 232.1, "Occurrence Reporting and Processing of Operations Information," U.S. Department of Energy, Washington D.C.

NIOSH, 1996, *Pocket Guide to Chemical Hazards*, National Institute of Occupational Safety and Health, U.S. Department of Health and Human Resources, Public Health Service, Centers for Disease Control, Washington, D.C., updated periodically.

WAC 173-303, "Washington State Dangerous Waste Regulations," *Washington Administrative Code*, Washington State Department of Ecology, Olympia, Washington, as amended.

Hanford Facility RCRA Permit, Dangerous Waste Portion, Washington State Department of Ecology, Olympia, Washington, as amended.

FIGURE 1. EVACUATION ROUTES - 2336-W

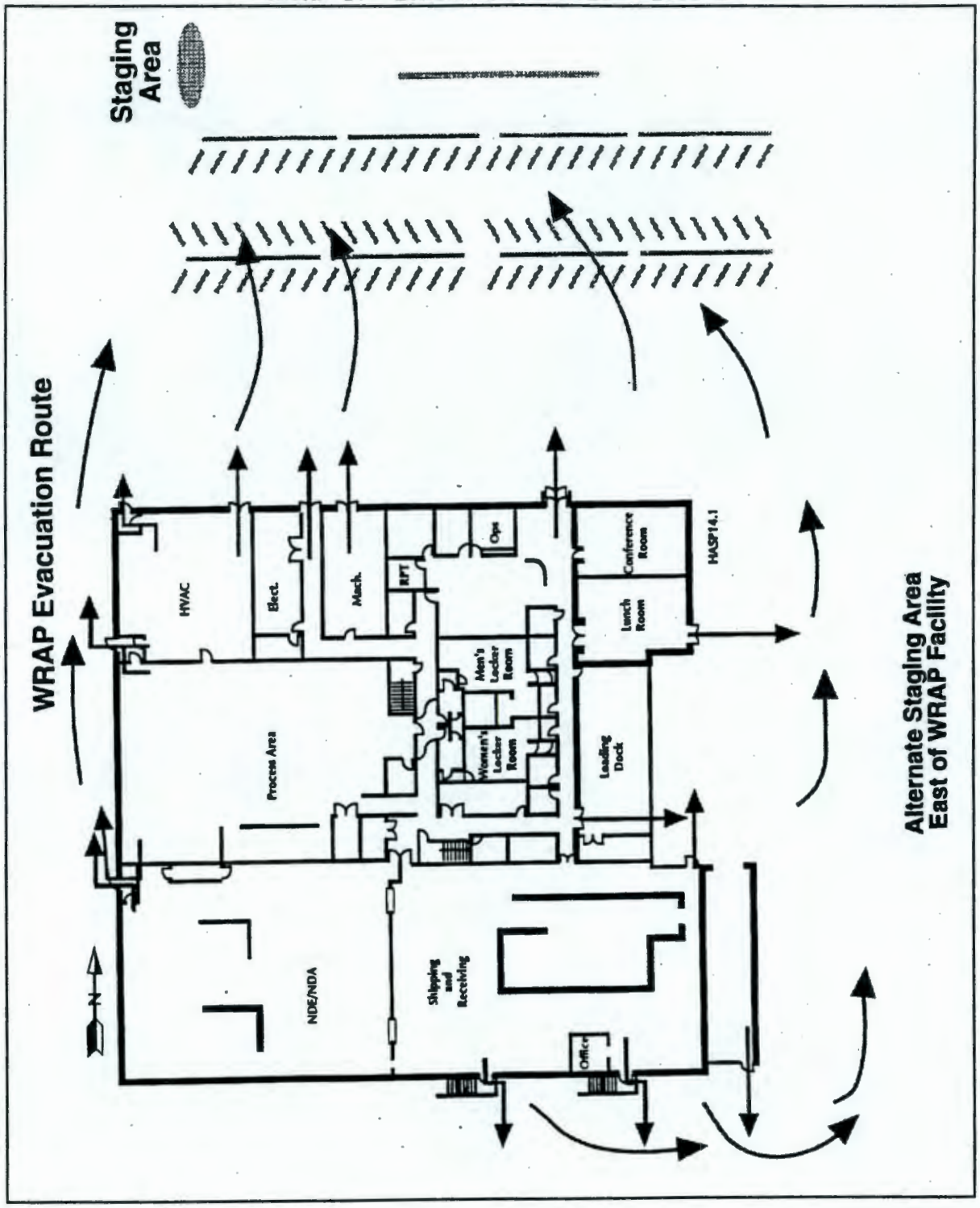
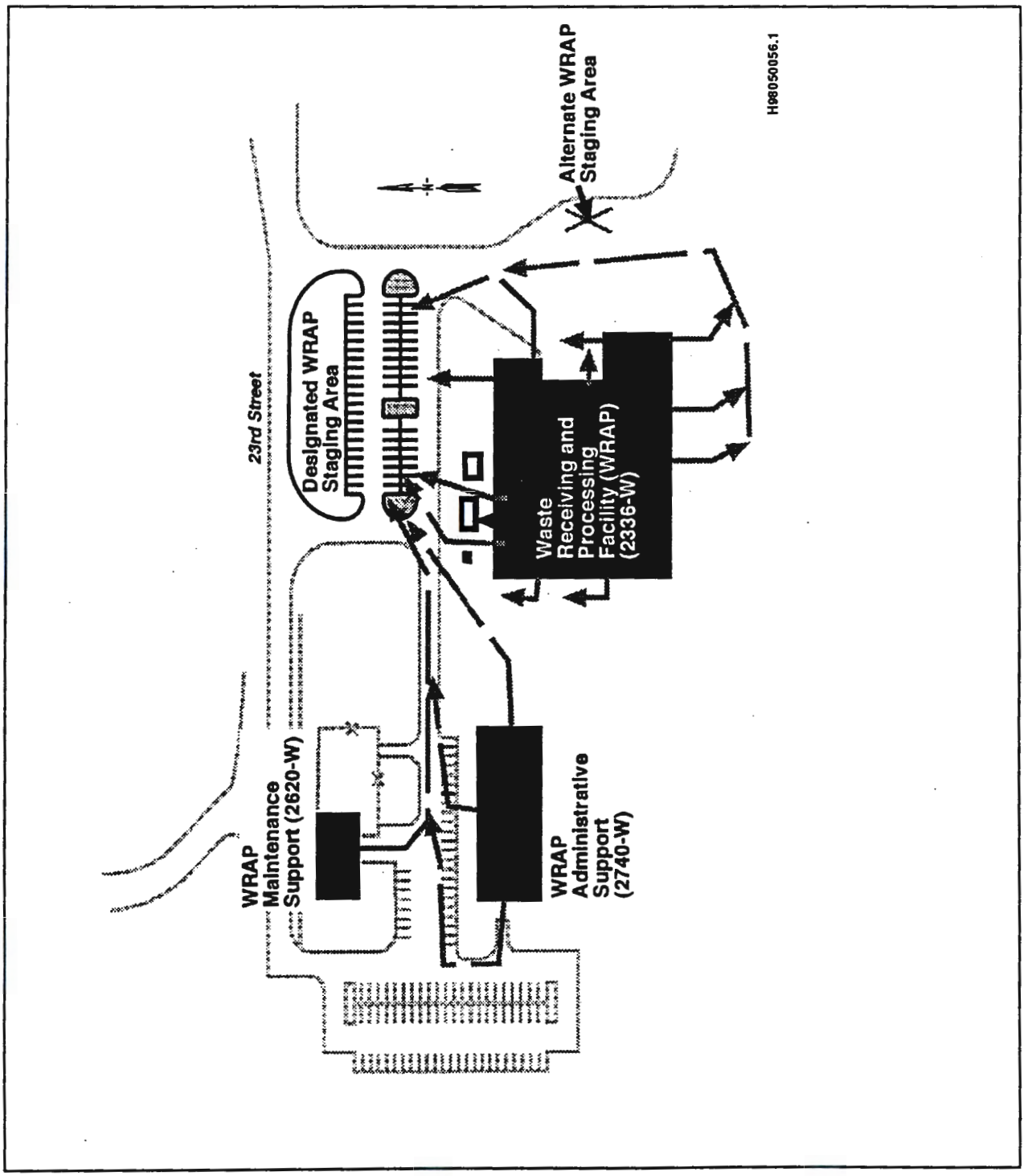


FIGURE 2. OVERVIEW OF THE WRAP COMPLEX



ATTACHMENT A

Listing of Procedures and Guides

Site-Wide Procedures

DOE-0223, *Emergency Plan Implementing Procedures*, RLEP-3.4, "Emergency Termination, Reentry, and Recovery"

DOE-0223, *Emergency Plan Implementing Procedures*, RLEP-1.1, "Hanford Incident Command System and Event Recognition and Classification"

Facility Specific Emergency Response Guide

HNF-IP-1262, *Building Emergency Guide for WRAP*

NOTE: The *WRAP Emergency Response Guide* provides more detailed response direction for all emergencies identified in Chapter 7.0 of this Building Emergency Plan.

APPENDIX 8A

TRAINING

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R. W. Reddinger, Manager
Project Support

5-11-98
Date

B. S. Darling, Training Team Leader
Project Support, Training

5-11-98
Date

L. W. Roberts, Manager
Waste Receiving and Processing Facility

5-11-98
Date

H. C. Boynton, Environmental Compliance Officer
Waste Receiving and Processing Facility

5-11-98
Date

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1.0 PURPOSE

This document outlines the Dangerous Waste Training Program (DWTP) for the Waste Receiving and Processing Facility (WRAP) organization. WRAP is a treatment, storage, and/or disposal (TSD) unit on the Hanford Facility. The DWTP implements the requirements of Washington Administrative Code (WAC) 173-303-330 and Title 40 Code of Federal Regulations (CFR) 264.16 for the development of a written dangerous waste training plan.

2.0 SCOPE

This DWTP applies to personnel who perform work at, or in support of WRAP. The DWTP requirements are based on an assessment of duties and responsibilities of personnel responsible for dangerous waste management (e.g., handling, treatment, storage, and/or disposal of dangerous and/or mixed waste. In addition, this training program ensures that personnel are familiar with emergency equipment and/or systems and emergency procedures to safely operate and maintain WRAP.

Processing within WRAP consists of a series of operations. Most of these operations occur manually within the gloveboxes. Some of the operations are automatic once initiated by the operator. Shutdown procedures for the automatic operations are included in each of the individual training courses.

3.0 DEFINITIONS

None.

4.0 RESPONSIBILITIES

Personnel responsibilities are described in the following sections.

4.1 Facility Manager

The Facility Manager has the overall responsibility to meet all training requirements of WAC 173-303-330 and Condition II.C of the Hanford Facility RCRA Permit (Ecology 1994). To meet the requirements in WAC 173-303-330(1)(a), the training director position is described in the *Hanford Facility Dangerous Waste Permit Application, General Information Portion* (DOE/RL-91-28, Chapter 8.0). Because the Facility Manager has overall responsibility in the assignment of training for personnel, the Facility Manager is involved in directing training at WRAP.

4.2 Training Manager

The training manager has overall responsibility for establishing, conducting, and administering the training program for WRAP to ensure personnel are trained to meet their assigned jobs.

4.3 Facility Management

All managers, under the direction of the Facility Manager, are responsible for the following:

- Determining required training for all personnel assigned to the WRAP, as required by job assignment.

- Ensuring that personnel assigned to WRAP receive required initial training, continuing training, and retraining as needed to be qualified to perform their assigned duties in dangerous waste management.

- Maintaining up-to-date personnel training records for assigned personnel.

4.4 Training Personnel

Training personnel are responsible for the following:

- Reviewing training requirements whenever regulations change or annually, at a minimum, for adherence to regulations and to ensure the requirements reflect the current systems, procedures, and policies applicable to each position.

- Developing and conducting training on new and existing systems or equipment.

4.5 Waste Receiving and Processing Personnel

WRAP and WRAP support personnel are responsible for the following:

- Working with their managers to define applicable training
- Completing necessary training to gain/maintain qualifications.

5.0 TRAINING PROGRAM

The WRAP DWTP is implemented based on training requirements related to job responsibilities.

5.1 Training Requirements

Training requirements for individual personnel are tracked in the Training Matrix (TMX).

The responsible manager reviews training requirements when personnel change positions or assume new job responsibilities, when changes are identified to this training plan (other than editorial changes), or annually, as a minimum. Updates to the training requirements are made as necessary.

Personnel must meet the training requirements within 6 months of the date of hire, within 6 months of assignment to the WRAP, or within 6 months of assignment to a new position within the WRAP. Personnel in-training will not make decisions that could affect facility safety. Personnel independently can perform specific jobs or tasks for which they are qualified. Personnel performing work who do not meet all training requirements must be supervised by a qualified person.

As new requirements are identified and indicated in this training plan, WRAP personnel will comply with the new requirements within 6 months of the effective date of the requirement.

5.2 Job Titles and Descriptions

Personnel are assigned a job title and a job description. The job description includes requisite skills, work experience, education, and other qualifications, and a brief list of duties and/or responsibilities. This information is maintained by the human resources department.

5.3 Dangerous Waste Worker Position

WRAP personnel are categorized into six worker positions: (1) All Employee, (2) General Worker, (3) Advanced General Worker, (4) General Manager, (5) General Shipper, and (6) Waste Designator.

Personnel are categorized into these positions based on duties and responsibilities as determined by a job analysis or management assessment. In the event personnel duties and responsibilities fall into more than one position, personnel will complete the training requirements for each position.

The duties and responsibilities described for the positions in this section, coupled with the information described in Section 5.4, provide the necessary information to determine the training for appropriate personnel. The categories are based on duties and responsibilities of personnel associated with dangerous waste management at WRAP and are provided in the following sections.

5.3.1 All Employee

Personnel included in this position are those who do not fall into one of the other five positions and have no duties or responsibilities directly associated with dangerous waste management. Typical job titles of personnel in this position include secretaries, clerks, and oversight personnel.

Most visitors, categorized as All Employee, generally tour, provide oversight, or are brought onsite for interviews. Other non-Hanford Facility personnel who gain access to the WRAP to complete work in controlled areas but do not become involved in the management of dangerous waste are categorized as All Employee.

5.3.2 General Worker

Personnel with limited dangerous waste management duties, such as activities associated with the generation of dangerous waste or facility maintenance or modification, are categorized as General Workers. Typical job titles of personnel in this position include maintenance personnel, health physics technicians, and transporters.

Personnel categorized as General Workers could be assigned duties and responsibilities for the following:

- Placing waste into pre-approved containers and filling out logsheets where applicable
- Completing radiological surveys of dangerous waste
- Moving containers or loading packaged containers onto trucks
- Responding to a spill or release of known contents where duties and responsibilities are limited to containing the spill/release, returning the container to an upright position, and/or placing the known spilled material or waste into a pre-approved container.
- Applying container markings or labels based on direction from an Advanced General Worker, General Manager, or General Shipper.

5.3.3 Advanced General Worker

Personnel whose duties exceed those of a General Worker for dangerous waste management are categorized as Advanced General Workers. A typical job title of personnel in this position is Nuclear Process Operator.

Responsibilities of an Advanced General Worker for management of dangerous waste in containers can include the following:

- Determining container markings and labels
- Preparing container logsheets
- Completing waste inventories
- Sampling of waste
- Packaging and transporting waste samples
- Responding to spills and releases of waste in accordance with approved procedures
- Performing inspections and surveillances
- Receiving transfers and/or shipments of waste.

5.3.4 General Manager

Personnel identified as General Managers coordinate, direct, and oversee the work of General or Advanced General Workers in the management of dangerous waste or in the operation and control of WRAP. Other duties could include responsibilities during emergency events requiring implementation of the building emergency plan. Personnel at the WRAP who could be categorized as General Managers include: the operations manager (OM), team leads (TLs), environmental compliance officer (ECO), cognizant engineers (Cog Engrs), persons in charge (PIC), hazardous material specialist (HMS), and building emergency director (BED). The TMX identifies personnel currently filling these positions.

5.3.4.1 Operations Manager

OM responsibilities include the following:

- Supervising, coordinating, and directing the activities of the TLs
- Maintaining control over WRAP operations in accordance with established operating procedures and policies, DOE Orders, and federal and state regulations
- Directing, controlling, and coordinating the storage and transfer of dangerous waste
- Complying with WRAP permits
- Providing guidance to TLs during abnormal or emergency conditions.

5.3.4.2 Team Leads

TLs responsibilities include the following:

- Supervising and coordinating WRAP operation and maintenance activities

- Maintaining control of WRAP operations in accordance with established policies and operating procedures, DOE Orders, and federal and state regulations
- Conducting pre-job safety meetings with personnel
- Maintaining operational records
- Reviewing and revising WRAP operations procedures
- Recognizing and responding to abnormal and/or emergency conditions
- Supervising the storage, handling, and transfer of dangerous waste
- Complying with WRAP permits.

5.3.4.3 Environmental Compliance Officer

ECO responsibilities include the following:

- Ensuring WRAP management is aware of environmental compliance requirements and issues
- Providing support to ensure compliance with applicable environmental rules and regulations
- Serving as WRAP liaison on environmental issues and permits
- Advising WRAP management of emerging environmental requirements and policies, and recommending implementation strategies to ensure compliance
- Ensuring compliance with WRAP permits.

5.3.4.4 Cognizant Engineers

Cog Engrs responsibilities include the following:

- Ensuring emergency and monitoring equipment, process equipment, procedures, designs, etc., comply with DOE Orders, federal and state regulations, national standards, and applicable engineering procedures and management standards
- Issuing and maintaining operation documentation, operating procedures, flowsheets, specifications, process test plans and procedures, operational safety requirements, etc.
- Performing evaluations of WRAP process to ensure compliance with process control requirements and permits
- Preparing and approving engineering design documents and drawings in compliance with applicable policies, procedures, and instructions per national standards and codes
- Providing technical assistance for hazardous material and dangerous waste spill response.

5.3.4.5 Person In Charge

PIC responsibilities include providing in-field direction of tasks in progress.

5.3.4.6 Hazardous Material Specialist

HMS responsibilities include the following:

- Supervising and coordinating hazardous waste storage and transfer
- Providing approved storage containers and applicable markings
- Interfacing with other organizations to ensure proper and timely disposal of hazardous waste
- Preparing and maintaining applicable hazardous waste documentation in accordance with DOE Orders and federal and state regulations
- Ensuring nonregulated alternatives are used whenever possible
- Reviewing hazardous waste documentation and providing hazardous waste disposition instructions as required.

5.3.4.7 Building Emergency Director

BED responsibilities include the following:

- Acting as the emergency coordinator
- Assessing incidents to determine response necessary to protect the personnel, facility, and the environment
- Arranging for care of any injured personnel
- Remaining available for fire, patrol, and other authorities on the scene, and provides all required information
- Ensuring proper containerization, packaging, and labeling of recovered spill materials
- Assisting in preparing the necessary post-incident documentation.

5.3.5 General Shipper

Personnel who prepare and sign waste movement documentation for onsite transfers or offsite shipments of dangerous waste are categorized as General Shipper.

5.3.6 Waste Designator

Personnel who perform and/or complete waste designations are categorized as a Waste Designator.

5.4 Required Training

Attachment 1 is a matrix of required RCRA training courses. Training for emergency procedures, emergency equipment, and emergency systems to meet the requirements of WAC 173-330(1)(d) is included in these courses as specified in the course description. Attachment 2 provides required training for personnel by job category.

Personnel who have completed training offsite are required to provide a certificate or other suitable evidence of training course(s) that meet the requirements of WAC 173-303 and this DWTP.

5.5 Non-Hanford Facility Personnel

Non-Hanford Facility personnel who perform work at WRAP must complete the appropriate level of training determined by line management according to the tasks they will perform.

WRAP management is responsible for ensuring that non-Hanford Facility personnel training requirements are met before granting access. Some personnel are granted access without the required training because they are either escorted or supervised by qualified personnel within WRAP.

5.6 Conduct of Training

The training program uses a systematic approach to training. Training design, development, and implementation are based on learning objectives derived from the analysis of the specific job/task. Training is provided using classroom instruction, on-the-job training, required reading, computer-based training methods, individualized instruction, and/or by providing drills. Training is developed and provided by personnel knowledgeable in dangerous waste management policies and/or procedures.

5.7 Documentation of Training

Classroom training is documented on course completion rosters, which are signed by personnel. Written examinations are signed by personnel at the time of taking the examination and when reviewed with the instructor who grades the examination.

Training record files on WRAP personnel are stored in the TMX computer database, which is accessed by the facility records specialist. A report is generated from the database to inform WRAP management when training for personnel is within 90 days of expiration. A TMX report example is included as Attachment 3. Copies of completed TSD unit-specific training certifications/qualifications are available from the WRAP training department. Additional information regarding training records can be accessed through the Human Resources Information System (HRIS). HRIS is managed by the Hanford Training Records organization.

Training records summaries for support organization personnel also are stored in the HRIS. Training records of former personnel are kept on the HRIS for 3 years from the date last worked at WRAP. Original signed and dated training records are maintained by the Hanford Training Records organization. These records are transferred quarterly to the Records Holding Facility in Richland, Washington. After approximately 1 year at the Records Holding Center, the original training records are archived.

5.7.1 Access of Training Records

When a training record is requested during an inspection, an electronic data storage record will be provided. If an electronic data storage record does not satisfy the inspection concerns, a hard copy training record will be provided. Training records on former personnel might not be readily available and could require a representative from the Hanford Training Records organization to access this information.

5.7.2 Determining Current Training Status

The electronic data storage training record, coupled with this DWTP, provides the training status of personnel in the field.

5.7.3 Personnel List

A list of personnel for Advanced General Workers, General Managers, General Shippers, and Waste Designators is maintained on TMX, including the direct link between these positions and the personnel filling the positions. The TMX is updated quarterly.

6.0 REFERENCES

DOE/RL, 1994, DOE-RL/U.S. Army Corps of Engineers to Ecology "State of Washington Department of Ecology Administrative Order No. DE94NM-063" dated April 14, 1994, items 3 and 4.

DOE/RL-91-28, *Hanford Facility Dangerous Waste Permit Application, General Information Portion*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, 1994, *Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste*, Permit Number WA7890008967, Washington State Department of Ecology, Olympia, Washington, modified periodically.

7.0 ATTACHMENTS

ATTACHMENT 1. RCRA TRAINING PROGRAM COURSE DESCRIPTIONS

ATTACHMENT 2. REQUIRED TRAINING FOR WASTE RECEIVING AND PROCESSING FACILITY PERSONNEL

ATTACHMENT 3. EXAMPLE OF TMX DATABASE REPORT

ATTACHMENT 1. RCRA TRAINING PROGRAM COURSE DESCRIPTIONS

The following constitute the RCRA training program courses as determined by (1) WAC 173-303, (2) the Hanford Facility RCRA Permit, and (3) correspondence between DOE-RL and Ecology on dangerous waste training.

Title	**000001 Hanford General Employee Training**
Description	Course covers DOE Orders and applicable policies pertaining to employer and personnel rights and responsibilities, general radiation training, hazard communications, dangerous waste, fire prevention, personal protective equipment, safety requirements, emergency preparedness, accident reporting, and avenues for addressing safety concerns.
Mandating document(s)	Hanford Facility RCRA Permit, General Condition II.C.2 and II.C.4.
Target audience	All personnel working on the Hanford Facility.
Frequency	Annual.

Title	**02006G Waste Management Awareness**
Description	Course introduces personnel to federal laws governing chemical safety in the work place. The course provides hazardous material/waste personnel with the basic fundamentals for safe use of hazardous materials and initial accumulation or storage of dangerous or mixed waste in containers. The concepts covered in this course instruct personnel on specific waste generation procedures and requirements, which include: (1) applicable waste management practices (i.e., waste stream identification, waste segregation practices, completing container logsheets, and housekeeping requirements), (2) proper responses to incidents pertaining to the waste in the accumulation containers, (3) proper responses to dealing with waste of unknown origins, and (4) proper responses to questions posed in the field concerning the above elements.
Mandating document(s)	WAC 173-303-330(1) Letter: DOE-RL/U.S. Army Corps of Engineers to Ecology "State of Washington Department of Ecology Administrative Order No. DE 94NM-063" dated April 14, 1994, items 3 and 4. Hanford Facility RCRA Permit, General Conditions II.C.1 and II.C.4.
Target audience	Hanford Facility personnel categorized as a General Worker, Advanced General Worker, and General Manager, and subcontractors categorized as General Workers. Other courses might provide equivalent training so that credit for this course is provided when the electronic data storage training record is generated.
Frequency	One-time only. (Annual refresher training is not required because training is adequately covered through 035110 and/or 03E306.)

Title	**020159 Advanced Course 2 - Hazardous Waste Shipper Certification**
Description	Course defines responsibilities and liabilities with regard to compliance to manifesting requirements and U.S. Department of Transportation regulations, including placarding, identifying proper shipping names, and loading requirements.
Mandating document(s)	WAC 173-303-330(1), -180, -190, and -370. Hanford Facility RCRA Permit, General Condition II.Q, as applicable
Target audience	General Shippers of dangerous or mixed waste on roadways anywhere on the Hanford Facility.
Frequency	Every 3 years.

Title	**02028B Building Emergency Director Training**
Description	Course provides an overview of the responsibilities of the Building Emergency Director, identifies the building emergency organizations and actions required during an event, discusses implementing the contingency plan, and discusses drill and exercise requirements.
Mandating document(s)	WAC 173-303-330(1), -340, -350, and -360.
Target audience	Hanford Facility personnel categorized as General Managers because they perform the responsibilities of a RCRA Emergency Coordinator through the title of Building Emergency Director or alternate (e.g., On-Call Manager).
Frequency	Initial (retrained annually by 037510 Building Emergency Director/Warden Requalification).

Title	**306500 WRAP Qualification Package TRU Glovebox Operator**
Description	Course provides training in TRU glovebox operations including packet NDE and NDA, waste handling, sampling, treatment, and loadout.
Mandating document(s)	WAC 173-303-330(1)
Target audience	Personnel who will be performing TRU glovebox operations.
Frequency	24 month(s)

Title	**306511 WRAP Operations Manager/Team Leader Qualification - Phase 2**
Description	Individualized instruction of WRAP Phase 2 operation. A performance demonstration is conducted by the candidate to demonstrate the leadership ability to direct Phase 2 processing activities.
Mandating document(s)	WAC 173-303-330(1)
Target audience	Management personnel who will be supervising WRAP operations.
Frequency	24 month(s)

Title	**306515 WRAP Qualification Package Shipping & Receiving Operator**
Description	Course provides training in receiving, storing, and shipping waste containers.
Mandating document(s)	WAC 173-303-330(1)
Target audience	Operators who will be performing S&R operations.
Frequency	24 month(s)

Title	**306520 WRAP Qualification Package NDA Operator**
Description	Course provides training in NDA requirements and activities for containers and boxes.
Mandating document(s)	WAC 173-303-330(1)
Target audience	Operators who will be performing NDA operations.
Frequency	24 month(s)

Title	**306525 WRAP Qualification Package Low-Level Waste Glovebox Operator**
Description	Course provides training in low-level glovebox operations including waste handling, packet NDE, sampling, and treatment.
Mandating document(s)	WAC 173-303-330(1)
Target audience	Operators who will be performing LLW glovebox operations.
Frequency	24 month(s)

Title	**306530 WRAP Qualification Package - Facility Operator**
Description	Develop proficiency in working with the plant control system, data management system, electrical distribution system, fire protection system, radiation monitoring system, communications system, HVAC, compressed air system, and environmental operations.
Mandating document(s)	WAC 173-303-330(1)
Target audience	Operators who will be performing WRAP surveillance.
Frequency	24 month(s)

Title	**306750 WRAP Facility Orientation**
Description	Course includes WRAP hazard communication and building emergency plan (facility emergency and hazard information checklist, building layout, operations, communications, alarms, evacuation routes, and staging areas).
Mandating document(s)	WAC 173-303-330(1)
Target audience	Personnel who have access to the WRAP.
Frequency	12 month(s)

Title	**03E306 WRAP Facility Emergency and Hazardous Information Checklist**
Description	Review facility-specific hazardous communication program and location of material safety data sheets, chemical & physical hazards, chemical spill procedure, emergency notification system, alarm signals and responses, identify members of building emergency organization, discuss personnel responsibilities during emergencies, review proper marking of containers, and review 90-day and satellite accumulation area requirements.
Mandating document(s)	WAC 173-303-330(1) and WHC-IP-0263-WRP1
Target audience	Personnel who have to access the WRAP.
Frequency	12 month(s).

Title	**035010 Waste Designation**
Description	Course teaches dangerous waste designation according to WAC 173-303. Class content includes section-by-section lecture on the regulations, with examples following each section. Students complete examples using a waste designation flow chart. Examples addressed include: listed waste, characteristic waste, and Washington State criteria of toxicity and persistent.
Mandating document(s)	WAC 173-303-330(1), -070, and -080 through -100.
Target audience	General Shippers and Waste Designators.
Frequency	One-time only. (Annual retrain is only required for those personnel who are required to complete 035012.)

Title	**035012 Waste Designation Qualification**
Description	Course provides qualification to be a Waste Designator.
Mandating document(s)	WAC 173-303-330(1), -070, and -080 through -100.
Target audience	Waste Designators.
Frequency	Annual.

Title	**035020 Facility Waste Sampling and Analysis**
Description	Course presents waste sampling methodologies according to U.S. Environmental Protection Agency Protocols SW-846, "Test Methods for Evaluating Solid Waste Physical/Chemical Methods". This course also covers documentation requirements in a sampling plan and/or waste analysis plan, field and laboratory quality control/assurance, the data quality objectives process, and use of actual sampling equipment as specified by WAC 173-303-110. Finally, topics on listed waste management pertaining to sample management and available onsite sampling services are covered.
Mandating document(s)	WAC 173-303-330(1), -070, -110, and -300.
Target audience	General Managers and/or General Shippers because they perform responsibilities for sampling waste or effluent streams.
Frequency	One-time only.

Title	**035100 Container Waste Management - Initial**
Description	Course covers general training requirements pertaining to waste management of container in less-than-90-day accumulation areas and TSD units. The course incorporates WAC 173-303-200(1), -630, DOE Orders, and container management policy. Course includes practical exercises for hands-on experience with the packaging of dangerous or mixed waste, and preparation of packages for final destination. This course <u>does not cover</u> waste management aspects pertaining to other RCRA waste management units such as tank systems, surface impoundments, containment buildings, landfills, etc.
Mandating document(s)	WAC 173-303-330(1), -630, -200(1) and waste minimization.
Target audience	Advanced General Workers and General Managers, because they are immediate managers of or direct Advanced General Workers, who manage containers of dangerous or mixed waste.
Frequency	Initial (refresher annually by 035110 Core Waste Management Training).

Title	**035110 Container Waste Management - Refresher**
Description	Refresher Course for Container Waste Management - Initial.
Mandating document	WAC 173-303-330(1), -630, -200(1), and waste minimization.
Target audience	Advanced General Workers and General Managers, because they are immediate managers of or direct Advanced General Workers, who manage dangerous or mixed waste in containers.
Frequency	Annual.

Title	**035120 Waste Management Administration - Initial**
Description	Course is designed for personnel preparing to become shippers of dangerous and/or mixed waste. This course covers regulatory and onsite policies, forms, reports, forecasts, and plans. Topics also covered include: waste characterization, waste certification summaries, waste specification system, and solid waste storage/disposal records. In addition, personnel learn how these forms are used to complete shipping papers.
Mandating document(s)	WAC 173-303-330(1), -630, -200, -210, -220, -380, and -390.
Target audience	General Shippers because they direct Advanced General Workers in the management of containers of dangerous and mixed waste.
Frequency	Initial (refresher annually by 035130 - Waste Management Administration).

Title	**035130 Waste Management Administration - Refresher**
Description	Refresher course for Waste Management Administration - Initial.
Mandating document(s)	WAC 173-303-330(1), -630, -200, -210, -220, -380, and -390.
Target audience	General Shippers because they direct Advanced General Workers in the management of containers of dangerous and mixed waste.
Frequency	Annual.

Title	**037510 Building Emergency Director/Warden Requalification**
Description	Refresher for Building Emergency Director Training.
Mandating document(s)	WAC 173-303-330, -340, -350, and -360.
Target audience	General Managers because they have the responsibilities of the RCRA Emergency Coordinator.
Frequency	Annual.

Title	**03E306 Building Emergency Plan for HNF-IP-0263-WRAP**
Description	Course consists of a review of specific chemical hazards associated with operating WRAP, as covered by the WRAP Building Emergency Plan. The training is completed by the supervisor, manager, or a designated individual. Information reviewed includes hazards in the work area and emergency response requirements, including communication and alarm systems, and response to fires.
Mandating document(s)	WAC 173-303-330(1)(d), -340, -350, and -360.
Target audience	WRAP personnel who are General Workers, Advanced General Workers, and General Managers.
Frequency	Annual.

ATTACHMENT 2. REQUIRED TRAINING FOR WASTE RECEIVING AND PROCESSING FACILITY PERSONNEL

Position	Job Title	Required Training
All Employee	All other Job Titles not specifically listed.	000001 306750
General Worker	Radiological Control Technician, Maintenance Personnel (Electrician, Instrument Technician, Insulator, Millwright, Painter, Pipefitter, Power Operator, Process Crane Operator, Rigger, Sign Painter, Truck Driver, Welder), Maintenance Manager, Radiological Control Manager.	000001 02006G 03E306 306750
Advanced General Worker	Nuclear Process Operator * Operations personnel must qualify in their assigned duties unless escorted by a qualified operator. Operators are not required to maintain all qualifications.	000001, 02006G, 035100/035110, 03E306, 306500* 306515*, 306520* 306525*, 306530* 306750
General Manager	Operations Manager/Team Leader * Operations personnel must qualify in their assigned duties unless escorted by a qualified operator. Operators are not required to maintain all qualifications.	000001, 02006G, 02028B/037510, 035100/035110, 03E306, 306500*, 306511, 306515*, 306520*, 306525*, 306530* 306750
	Environmental Manager/Team Leader	000001, 02006G, 035010, 035020, 035100/035110, 03E306, 306750
	Environmental Compliance Officer	000001, 02006G, 035010, 035020, 035100/035110, 03E306, 306750
General Manager (cont)	Environmental Engineer/Scientist Plant Engineer (Environmental)	000001, 02006G, 035010, 035020, 035100/035110, 03E306, 306750

Position	Job Title	Required Training
	Hazardous Material Specialist	000001, 02006G, 035010, 035020, 035100/035110, 03E306, 306750
	Building Emergency Director	000001, 02006G, 02028B/037510, 035100/035110, 03E306, 306750
General Shipper	Shipper	000001, 02006G, 020159, 035010, 035100/035110, 035120/035130, 03E306, 306750
Waste Designator	Waste Designator	000001, 035010, 035012, 03E306, 306750

ATTACHMENT 3. EXAMPLE OF TMX DATABASE REPORT

WRAP POSITION TRAINING REPORT

Tracking Code:
Manager:
Organization : Operations and Maintenance
Position: TIMS - Nuclear Process Operator (Advanced General Worker)

Matrix Last Modified on 05/16/98
30 Days Delinquent Forecast

05/20/98 15:04:38

Position 1
Sheet 1 of 1

	Course No.	Title	Retrain Course	Individual #1
M	000001	HGET	000001	05/07/99
M	003034	LOCK & TAG - AUTH WRKR INITIAL	003037	12/02/98
M	003035	LOCK & TAG: CO INITIAL	003036	02/20/99
M	020001	RAD WORKER II INITIAL	020003	05/29/99
M	020010	CRIT SAFETY - FISSILE	020110	08/22/98
M	02006G	WASTE MANAGEMENT AWARENESS	-------	OK
M	020075	HAZ MAT GEN AWARENESS TRNG	020075	09/26/98
M	020301	CRIT SFTY JSO-FSSL	020301	08/23/98
M	020702	RAD WORKER REFRESHER TRAINING	020702	05/07/00
M	031110	24 HR RCRA TSD HAZ WASTE	032020	04/16/99
M	035100	CONTAINER WASTE MGT. INITIAL	035110	12/08/98
M	03E306	WRAP1 FAC EMERG & HAZ INFO CKL	03E306	12/18/98
M	306750	WRAP1 FAC ORIENT	306750	12/18/98
D	065911	MATHEMATICS	-------	OK
D	065912	NPO CORE CHEMISTRY	-------	OK
	065914	NPO CORE ELECTRICAL	-------	OK
	065915	NPO CORE INSTRUMENTATION	-------	OK
D	065917	NPO CORE MECHANICAL	-------	OK
m	020077	HAZ MAT DRIVERS TRNG - UNIT 1	020077	02/11/01
m	035020	FCLTY WST SMPLNG & ANLYS	-------	OK
d	000390	OJT TRAINING WORKSHOP	-------	OK
d	020030	SCBA INITIAL TRAINING	02R030	<< 06/01/95 >>
d	020032	SCOTT SKA-PAK AIRLINE SYS-INIT	02R032	****
d	020035	MSA PAPR (FULL FACEPIECE) INIT	02R035	<< 04/16/98 >>
d	020041	RESPIRATORY PROTECTION INITIAL	02R041	<< 06/16/98 >>
d	020044	QUANTITATIVE MASK FIT	020044	<< 06/16/98 >>
d	020130	CONFND SPC ENTRY (CSE)	-------	OK
d	020140	FALL PROTECTION TRAINING	-------	OK
d	020510	MSA HOOD - PAPR INITIAL	02R510	
d	040784	BASIC CRANE & RIGGING SAFETY	040788	04/25/00
d	042720	AERIAL LIFT OPER TRNG	043920	02/24/00
d	044383	USERS SCAFFOLD SAFETY	044383	
d	044470	FORKLIFT OPERATNL SAFETY	041890	10/04/99
d	044670	EQUIP SPEC OJT FORK LIFT	044670	10/14/99
d	044680	OJT EVAL CKLST AERIAL LF	044680	06/17/00
d	044690	EQUIP SPEC OJT EVAL CHKL	044690	
d	170656	HANDS-ON FIRE EXTINGSHR	170656	10/23/98
c	306500	WRAP1 QUAL PKG TRU GLVBX OP	306500	
c	306515	WRAP1 QUAL PKG SHPG/REC OP	306515	02/28/99
c	306520	WRAP1 QUAL PKG NDA OPERATOR	306520	06/09/99
c	306525	WRAP1 QUAL PKG LLW GB OP	306525	
c	306530	WRAP 1 QUAL PKG-FAC OPERATOR	306530	02/28/99

LEGEND:

per case (M/D/C/P)	= Course needed by all	Date	= Course retrain date
wer case (m/d/c/p)	= Course needed by some	OK	= Course taken; no retrain required
*	= Retrain not to be maintained	****	= Course taken; retrain requirement not maintained
<< >>	= Course delinquent	Blank	= Course not needed (lower case) and not taken
/ /	= Course needed (upper case) but not taken		

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