

# START

## ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 169357  
Proj. ECN

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Cancel/Void <input type="checkbox"/>	Direct Revision <input checked="" type="checkbox"/>	Temporary <input type="checkbox"/>	Discovery <input type="checkbox"/>	
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12. Description of Change The changes to this document are for allowing storage of additional granular activated carbon (GAC) canisters, conducting a Gas Membrane Separation System (GMSS) test, and discussion of instrument reliability and operation in a by-pass mode. The first change addresses storage of additional GACs at the work site. Additional storage capacity is needed to support 24 hour operation. Additional consequence analysis has found that storing additional saturated GAC canisters would not result in exposures that would exceed the limits for a low hazard activity. The second change addresses conducting a GMSS test for determining the efficiency of condensing carbon tetrachloride (CCl <sub>4</sub> ) to a liquid. Additional consequence analysis was performed addressing hazards associated with generating the liquid CCl <sub>4</sub> . The analysis found that any potential consequences were below the limits for a low hazard activity. The third change addresses reliability that assures instruments are fail-safe for blower shutdown. The fourth change discusses provisions for operating the system in a by-pass mode (constant monitoring for CCl <sub>4</sub> ).				
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13b. Justification Details The changes to the document are for providing justification and documenting the results of additional consequence analysis. This analysis found that the interim storage of additional GAC canisters containing CCl <sub>4</sub> and the new work scope involving the GMSS test will not result in unacceptable consequences to the onsite or offsite individuals.				
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SDD/DD <input type="checkbox"/>	Seismic/Stress Analysis <input type="checkbox"/>	Tank Calibration Manual <input type="checkbox"/>
Functional Design Criteria <input type="checkbox"/>	Stress/Design Report <input type="checkbox"/>	Health Physics Procedure <input type="checkbox"/>
Operating Specification <input type="checkbox"/>	Interface Control Drawing <input type="checkbox"/>	Spares Multiple Unit Listing <input type="checkbox"/>
Criticality Specification <input type="checkbox"/>	Calibration Procedure <input type="checkbox"/>	Test Procedures/Specification <input type="checkbox"/>
Conceptual Design Report <input type="checkbox"/>	Installation Procedure <input type="checkbox"/>	Component Index <input type="checkbox"/>
Equipment Spec. <input type="checkbox"/>	Maintenance Procedure <input type="checkbox"/>	ASME Coded Item <input type="checkbox"/>
Const. Spec. <input type="checkbox"/>	Engineering Procedure <input type="checkbox"/>	Human Factor Consideration <input type="checkbox"/>
Procurement Spec. <input type="checkbox"/>	Operating Instruction <input type="checkbox"/>	Computer Software <input type="checkbox"/>
Vendor Information <input type="checkbox"/>	Operating Procedure <input type="checkbox"/>	Electric Circuit Schedule <input type="checkbox"/>
OM Manual <input type="checkbox"/>	Operational Safety Requirement <input type="checkbox"/>	ICRS Procedure <input type="checkbox"/>
FSAR/SAR <input type="checkbox"/>	IEFD Drawing <input type="checkbox"/>	Process Control Manual/Plan <input type="checkbox"/>
Safety Equipment List <input type="checkbox"/>	Cell Arrangement Drawing <input type="checkbox"/>	Process Flow Chart <input type="checkbox"/>
Radiation Work Permit <input checked="" type="checkbox"/>	Essential Material Specification <input type="checkbox"/>	Purchase Requisition <input type="checkbox"/>
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Environmental Report <input type="checkbox"/>	Inspection Plan <input type="checkbox"/>	
Environmental Permit <input type="checkbox"/>	Inventory Adjustment Request <input type="checkbox"/>	

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

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20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog./Project Engineer E. J. Millikin <i>[Signature]</i>	11/13/92	PE	_____
Cog./Project Engr. Mgr. M. C. Hagood <i>[Signature]</i>	11/13/92	QA	_____
QA T. L. Bennington <i>[Signature]</i>	11/16/92	Safety	_____
Safety M. A. Tredway <i>[Signature]</i>	11/16/92	Design	_____
Security	_____	Other	_____
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Def. React. Div.	_____		_____
Chem. Proc. Div.	_____		_____
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Adv. React. Dev. Div.	_____		_____
Proj. Dept.	_____		_____
Environ. Div. L. P. Diediker <i>[Signature]</i>	11-16-92	ADDITIONAL	_____
IRM Dept.	_____		_____
Facility Rep. (Ops.) W. L. Johnson <i>[Signature]</i>	11/16/92		_____
Other SA&R N. R. Kerr <i>[Signature]</i>	11/13/92		_____
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6. Author

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7. Abstract

*11/24/92 D. Soles*

The changes to this document are for providing justification and documenting the results of additional consequence analysis.

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RECORD OF REVISION

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Safety Assessment for the 200 West Area Expedited Response Action for Remediation of Carbon Tetrachloride

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
0-A	(7) Replace "Contents" section; pages 1, 2, and 3; insert page 3.1. Changes reflect new page and sub-page numbers.	<i>[Signature]</i> 11/18/92	<i>[Signature]</i> 11/18/92
0-A	Replace page 4; changes are summarized below:  Section 1.0: first sentence; change reflects new RL title.  Section 1.1, "Work Description," paragraph 1, fourth sentence:  Discussion of the maximum number of fully saturated canisters allowed in interim storage per storage location at the work site.  Paragraph 3, first sentence:  Discussion of Gas Membrane Separation System test.		
0-A	Replace page 5, Section 1.3, "Work Description," paragraph 1; revision is summarized below:  Maximum number of fully saturated canisters allowed per interim storage location at the work site.  Expanded discussion of requirements in item number 2; addition is summarized below:  Discussion of instrument reliability requirements. Also additional options allowing operations in by-pass mode.		

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Safety Assessment for the 200 West Area Expedited Response Action for Remediation of Carbon Tetrachloride

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
0-A	<p>Replace page 7 to incorporate new Prudent Actions (numbers 15 and 16):</p> <p>Emergency notification actions required in the event of off-normal conditions.</p> <p>Not more than one drum (partially or fully loaded with CCl<sub>4</sub>) should be located at the work site.</p> <p>Emergency notification responsibilities and response actions should be addressed in the emergency plans for the CCl<sub>4</sub> work site and adjacent affected facilities.</p>	<p><i>[Signature]</i> 11/18/92</p>	<p><i>[Signature]</i> 11/18/92</p>
0-A	<p>Insert page 7.1.</p>		
0-A	<p>Replace page 23; addition of new Subsection 2.4.4, "Gas Membrane Separation System" is summarized below:</p> <p>Discussion of the GMSS and equipment required for the test.</p>		
0-A	<p>Replace pages 29 and 30; OSHA reference has been revised.</p>		
0-A	<p>Replace page 31; revisions made to the fourth paragraph and Table 4 values are summarized below:</p> <p>The bounding postulated scenario is due to rupturing three fully saturated canisters.</p> <p>Changes to the resultant exposures as identified in Table 4.</p>		
0-A	<p>Replace page 33, Table 6; changes were made to the second item under "Component Failures and Consequences" and additional discussion in the first item (second paragraph) under "Mitigation."</p> <p>Spill of carbon involving three fully saturated GAC canisters and 28 p/m.</p> <p>Discussion of instrument reliability and requirements for constant monitoring for CCl<sub>4</sub> vapors if operating in by-pass mode.</p>		

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(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog./Engr.	(6) Cog. Mgr. Date
0-A	<p>Replace page 35, Section 4.0, Item 4.1.4c, "Requirements"; changes are summarized below:</p> <p>Maximum number of fully saturated canisters allowed per interim storage at the work site.</p>	<p><i>[Signature]</i> 11/18/92</p>	<p><i>[Signature]</i> 11/18/92</p>
0-A	<p>Replace page 36, Item 4.1.8, "Basis" and item 4.2.4, "Requirements," (b); changes are summarized below:</p> <p>The accident analysis is based upon saturated canisters in interim storage and units being used in the process.</p> <p>Instrument reliability requirements for the flow rate meters and control logic. Requirements for operating in by-pass mode.</p>	↓	↓

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0-A Replace pages 37, 38, 39, 40, and 41; Prudent Actions have been numbered and numbers 15 and 16 have been added. Page 41 (Section 5.0) has been revised.

*H.M. 11/24/92*

0-A RS Replace Attachment G.

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## 1.0 INTRODUCTION AND SUMMARY

Westinghouse Hanford Company (Westinghouse Hanford) is preparing to perform remediation activities to mitigate the spread of carbon tetrachloride ( $\text{CCl}_4$ ) within the Hanford Site 200 West Area unsaturated soils for the U.S. Department of Energy, Richland Field Office (RL). This activity is one of three Expedited Response Actions (ERA) that the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology agreed in late 1990 to undertake at Hanford. This safety assessment presents the results of the remediation activities associated with the  $\text{CCl}_4$  ERA. The purpose of this assessment is to determine the potential consequences of an inventory of material associated with a facility or activity exclusive of engineered features or administrative controls (WHC 1990b).

### 1.1 WORK DESCRIPTION

The remediation activities will be conducted using a vapor extraction system (VES) for removal of  $\text{CCl}_4$ . Granular Activated Carbon (GAC) contained in Department of Transportation (DOT) approved canisters are used to adsorb the  $\text{CCl}_4$  vapors. Fully saturated canisters will be stored for an interim period and then transported offsite for regeneration. A maximum of not more than twelve fully saturated canisters in a storage location at the site. The VES process is used nationwide to remove a variety of volatile organic chemicals from vadose zone soils contaminated by leaks from underground storage tanks and other sources. The EPA has approved the use of vacuum extraction at more than 31 sites.

Task 7 of the Phase I site evaluation for the ERA compiled information on the volume and contaminant types found, contaminant concentration, and identification of the influence zone using the VES (WHC 1990c; DOE-RL 1991). Based on the test results, the VES successfully removes  $\text{CCl}_4$  vapors from the vadose zone of the Hanford Site soils.

The scope of this assessment includes activities that will involve the use of two VES units to complete the ERA and conduct a treatability demonstration for performing a Gas Membrane Separation System (GMSS) test. The VES unit used during the Task 7 activities will be used primarily for site characterization work and will also be used for remediation until larger units are available. There will be a second VES procured and used for the overall remediation work. This assessment also addresses the hazards associated with the operation of the larger units (planned for the full scale remediation activities) based upon the current proposed design. Changes to the proposed design will necessitate an evaluation of any new hazards and a possible addendum to this assessment. The design of the current system is discussed in Section 2.4.

The first phase of  $\text{CCl}_4$  vapor removal will use existing vertical wells. The second phase will use existing vertical wells plus new vertical or horizontal wells. The installation (drilling) of any new wells is not evaluated and addressed in this safety assessment. The three major waste site locations are in close proximity to the Plutonium Finishing Plant (PFP). These sites were the major contributors of  $\text{CCl}_4$  to the soil and groundwater

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and will be the focal point for the remediation activities. The extracted vapors will be treated using carbon adsorption technology.

## 1.2 ASSESSMENT SUMMARY

This completed assessment found the design and plans to be safe. The report summarizes the findings and conclusions of the assessment for this ERA. The potential consequences of this remediation work indicate that the toxicity of  $\text{CCl}_4$  is the controlling hazard for an accident involving airborne releases. The calculated results are conservative.

## 1.3 SUMMARY OF COMMITMENTS

The recommendations and controls identified are necessary to insure the bases of the boundary inventory release. The following are the required controls:

The analysis disclosed this activity would be classified as a low hazard operation provided that fuel sources (other than the fork truck or similar equipment having small quantities of fuel) are maintained a minimum of 50 ft (15 m) away from the GAC canisters. The electric generator must also be maintained a minimum of 25 ft (8 m) away from the GAC canisters. A maximum of not more than twelve fully saturated canisters will be allowed per storage location at the work site.

The analysis indicates that the primary cause of a release of  $\text{CCl}_4$  is high temperatures intense enough to regenerate the carbon, thereby stripping the  $\text{CCl}_4$ . Removing the fuel sources that could support a fire intense enough to strip the  $\text{CCl}_4$  eliminates the only credible postulated mechanisms for a release that would result in consequences to the uninvolved individual and the public exceeding the threshold limit values (TLV) for a low hazard operation.

The analysis also disclosed that concentrations of  $\text{CCl}_4$  at 330 ft (100 m) from the work site could exceed the time weighted average (TWA) limit. An operational safety limit (OSL) has been established indicating the requirements needed to mitigate the potential consequences to the uninvolved worker. The following are the mitigating features:

1. Placement of a  $\text{CCl}_4$  detector downstream of the final GAC canister that is set to alarm (also interlocked with the logic system to shut down the blower) if concentrations of  $\text{CCl}_4$  exceed 25 p/m<sub>v</sub>.
2. Flow rate meters, located upstream of the blower and downstream of the final GAC canister, will be in place and interlocked with the logic system to shut down the blower if there is a flow rate variance greater than 10%. Reliability of system (flow rate meters and logic system) must ensure instruments fail-safe to assure shutdown of the blower. Monitoring of flow rate meters will be required by operations personnel as prescribed in the work procedures if instrumentation cannot reliably detect a flow rate variance of greater than 10% (exceeding 10% variance will require shutdown of the VES). Constant monitoring (with instruments for detection of  $\text{CCl}_4$  vapors) of the portion of the VES under positive pressure is required if operating in by-pass mode (flow rate meters or logic system inoperable). Detection of  $\text{CCl}_4$  vapors will necessitate immediate shutdown of the VES.

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3. A minimum of two GAC canisters in place (two in series) to adsorb any  $\text{CCl}_4$  if breakthrough of the first GAC canister occurs.

The controls in the form of an OSL can be found in Section 4.0.

The following recommended prudent actions are provided to minimize the probability of occurrence or the consequences of a release of  $\text{CCl}_4$  to the receptor groups of concern: the occupational workers, uninvolved personnel, public, and the environment.

1. Monitor ambient air and worker's breathing zone for detection of  $\text{CCl}_4$  vapors in areas where workers will be required to perform their work activities. Concentrations detected that exceed the TWA limits should require removal of personnel from the work area or donning of appropriate protective gear as required by the Job Safety Analysis (JSA) or Hazardous Operations Work Permit (HWOP).
2. Even though radioactive particulates are not expected to be removed during the remediation activities, in-line monitoring should be provided. In the event continuous air monitor (CAM) alarms indicate possible radioactive contamination, the process shall be shut down. Concurrence for restart will be required from the Health Physics supervisor.
3. Radon ( $^{222}\text{Rn}$ ) gas monitoring equipment should be used to indicate the total quantities of  $^{222}\text{Rn}$  and daughters adsorbed by the GACs during the VES operation. The quantities of  $^{222}\text{Rn}$  measured will determine if the GAC canisters can be released from radiological controls. The  $^{222}\text{Rn}$  gas concentrations of the stack effluent should be monitored.
4. A routine survey program should be implemented to monitor the GAC canisters for potential gamma exposures that may result from  $^{222}\text{Rn}$  buildup in the canisters. If exposure rate exceeds 2mR/h outside the canisters, the area should be posted per the identified requirements in the *Radiation Protection Manual* (WHC 1988d).
5. The sites identified for remediation or site characterization work should be cleared of vegetation and combustibles not necessary to the project.
6. The electric generator should be located a minimum of 25 ft (8 m) from the propane storage tank as prescribed by fire code.
7. Replacement of existing in-line heaters should be with heater units that have a maximum air stream temperature capacity that does not exceed 400° F (205° C).
8. Whenever saturated GAC canisters are removed from the process, covers will be placed over the inlet and outlet ports of the canister and verified to be secure.
9. The components of the VES required for providing confinement of  $\text{CCl}_4$  monitoring should be identified as Safety Class 3 components in a safety equipment list.

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10. Provide notification to the fire department of the potential hazards involving  $\text{CCl}_4$  in a fire and production of phosgene.
11. Employees assigned (drivers) responsibility for handling the saturated canisters must have completed hazardous material training.
12. Maintain a 50 ft (15 m) exclusion zone around the VES operation to prevent inadvertent access by uninvolved individuals at the work site.
13. The site workers should not come into close proximity to the heaters during periods of operation. The maximum air stream temperatures of  $400^\circ\text{F}$  ( $205^\circ\text{C}$ ) is required to be maintained. The temperatures within one inch of the heater cal rod may exceed the  $400^\circ\text{F}$  ( $205^\circ\text{C}$ ) resulting in some production of phosgene. The site workers should be made aware of potential hazards associated with the operation of the heaters during VES operations. Heater will be shut down when the blower is not running or the individual hose line is not in use.
14. During the GMSS test no more than one drum containing up to a maximum of 115 L (30 g) of liquid  $\text{CCl}_4$  should be located at the work site. Remove loaded drum from the work site before continuing GMSS test.
15. Emergency notification responsibilities and response actions should be addressed in the emergency plan for the  $\text{CCl}_4$  work site and in the emergency plans for the adjacent affected facilities.

## 2.0 WORK DESCRIPTION

### 2.1 LOCATION AND DESCRIPTION OF DISPOSAL SITES

This section provides descriptions of disposal sites that were the principle contributors of the inventory of contamination to the soil and ground water (DOE-RL 1991). Figures 1 and 2 provide a basic site orientation. Figure 3 provides the location of the three PFP waste discharge sites.

Past waste disposal practices included the discharge of actinide-bearing liquid waste, generated from plutonium purifying processes, directly to the ground via structures called cribs. The PFP disposed of liquid  $\text{CCl}_4$ -bearing organic solvents and associated high salt, acidic aqueous wastes primarily to three waste sites from 1955 to 1973 (when solvent discharge to soil was stopped): the 216-Z-9 Trench, the 216-Z-1A Tile Field, and the 216-Z-18 Crib.

#### 2.1.1 216-Z-9 Trench

The 216-Z-9 Trench operated from 1955 to 1962 to receive all PFP Recuplex facility solvent and aqueous wastes discharged to the soil. The 216-Z-9 Trench is an enclosed earthen trench, located about 705 ft (215 m) east of the PFP. The trench excavation base is 60-by-30 ft (18-by-9 m) and 20 ft (6 m) deep. The surface is a 120-by-90-by-0.75 ft (36.5-by-27-by-0.23 m) thick concrete trench cover at ground level. Six 23 ft (7 m) tall concrete columns support the cover. Waste was transferred by gravity through one of two 1.5 in. (4 cm) stainless steel pipes which entered the trench about 16 ft (5 m) above its bottom.

### 2.1.2 216-Z-1A Tile Field

The 216-Z-1A Tile Field operated from 1949 to 1959 to receive overflow liquid waste from three adjacent cribs. The waste stream consisted of neutral to basic (pH 7 to 10) process waste and analytical and development laboratory waste from PFP via the 241-Z-361 Settling Tank. Use of these four disposal facilities stopped in 1959. The 216-Z-1A Tile Field was reactivated in 1964 to receive aqueous and organic waste directly from the Plutonium Reclamation Facility (PRF).

Between 1964 to 1969, the tile field was divided into three working sections (Z-1AA, Z-1AB, and Z-1AC) to prevent waste buildup at the northern end of the field. No other facility received PRF wastes from 1964 to 1969 except on two brief occasions during tile field effluent piping upgrades. During this time the PRF wastes were discharged to the 216-Z-1 and-216-Z-2 cribs, located immediately north of the tile field.

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The following are trailer components:

- A vacuum pump designed to produce a maximum of 750 cfm at 150 in. Wg. for the test unit.
- Vacuum pumps designed to produce a maximum of 1,500 cfm at 150 in. Wg. for the full-scale remediation unit.
- Outlet and return manifolds for flow to and from the GAC canisters.
- One series of a minimum of two 1,000 lbs (450 kgs) to a minimum of 2,000 lbs (900 kgs) GAC canisters for the test unit.
- Three parallel GAC canister series with a minimum of two 2,000 lbs (900 kgs) GAC canisters in series. Specifications require DOT approved canisters.
- In-line instrumentation to measure and record air temperature, pressure, vacuum, relative humidity, flow rates,  $^{222}\text{Rn}$  gas and  $\text{CCl}_4$  concentrations.
- A sample cabinet.
- A DAS that includes a computer, software for trend analysis, alarm logic, and control software.
- A record sampler located at a 20 ft (7 m) tall exhaust stack.

#### 2.4.4 Gas Membrane Separation System

The GMSS test is designed to remove VOCs from the vacuum extracted air stream and condense it to a liquid form. The air stream will be obtained by tapping into the VES. The system will require about 35 scfm. The four primary pieces of equipment for this system consist of a compressor, condenser, membrane modules and vacuum pump. The system is a closed loop with a clean air stream being returned to the VES upstream of the GACs.

### 3.0 HAZARDS

#### 3.1 BASES FOR HAZARDS CONSIDERED

An evaluation of the unmitigated intrinsic hazards associated with this project and the initiating events were assessed for their potential to create a source term release. This evaluation and inventory analysis identifies the potential accident events.

The results from the evaluations determined that process hazards involving a continuous release of  $\text{CCl}_4$ , heated  $\text{CCl}_4$  or carbon, dropped canisters, vehicle accidents and fires involving fuel sources are credible. Natural force events such as high winds/missiles, seismic events, range fires, and lightning were considered to be credible. Process hazards involving regeneration of the carbon releasing  $\text{CCl}_4$  were found to be incredible. Criticality was assessed and determined not to be credible as a result of the vacuum extraction operations. Natural force events involving a flood and

tornado were considered to be of no significant impact or would not result in significant consequences, therefore not requiring further analyses. A basis for these conclusions is discussed in this section.

### 3.2 HAZARDS INVENTORY

This assessment addresses the hazards associated with removal and treatment of  $\text{CCl}_4$  using the VES units. The dominant VES hazard inventory anticipated is  $\text{CCl}_4$ .

There are several other chemical contaminants found in the unsaturated zone around the three primary  $\text{CCl}_4$  disposal sites. The contaminant distribution data comes from soil gas analysis, historical well log data, measurements of  $\text{CCl}_4$  vapors in boreholes, soil analysis, and data collected during the VES test. The contaminant data is divided into two sections; the near field (includes the three primary  $\text{CCl}_4$  disposal sites), and the far field (includes the 200 West Area).

The near field hazardous substances identified (before the VES test phase) were tributylphosphate, dibutyl butyl phosphonate, n-butyl alcohol (which is from possible hydrolysis of TBP), and chloroform (a  $\text{CCl}_4$  degradation product) (DOE-RL 1991). The volatile organic compound (VOC) substances, along with  $\text{CCl}_4$ , will vaporize based on the vaporization pressures and temperatures.

The sample results from the test phase show that the VOC extracted were  $\text{CCl}_4$  and 2-butanone with trace amounts of chloroform.

Far field soil samples identified other contaminants in the soils. The contaminants identified are: acetone, benzene, chlorobenzene, chloroform, 1,2-dichloroethane, 1,1-dichloroethylene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, ethyl benzene, fluoromethane, methylene chloride, methyl isobutyl ketone, tetrachloroethylene, toluene, 1,1,1-trichloroethane, trichloroethylene, p-xylene, m-xylene, and o-xylene. Samples of these contaminants from various wells indicate that the concentrations are very low. These compounds were analyzed for but not detected during the test phase.

The radionuclides discarded to the cribs are identified in Table 1. The high concentrations of radionuclides were found in sediments located immediately below the crib. The high concentration of actinides at this location is possibly due to the filtering and ion exchange by sediments of plutonium oxide particles that were originally present in the waste stream (Attachment A). The concentration of plutonium and americium in sediments generally decreases with depth beneath the bottom of the crib. An increase in plutonium and americium concentration at depth is generally associated with an increase in the silt content of sediments or with boundaries between sedimentary units. The bulk of the actinide contamination appears to be contained within the first 50 ft (15 m) of sediments beneath the bottom of a disposal site. The maximum vertical penetration of plutonium and americium contamination (defined by the  $10^{-2}$  nCi/g isopleth that is approximately 100 ft (30 m) below the bottom of the 216-Z-1A crib (Price 1979).

During the test phase  $^{222}\text{Rn}$  gas was detected using spectral gamma energy logging. Readings at the outside walls of the GAC canisters showed that the GAC had collected  $^{222}\text{Rn}$  and that the  $^{222}\text{Rn}$  was decaying to form decay products  $^{214}\text{Bi}$  and  $^{214}\text{Pb}$ , both of which have short half-lives. The test could not determine if the  $^{222}\text{Rn}$  was from naturally occurring uranium or from uranium waste.

Criticality:

The criticality safety issues involving the VES process were evaluated prior to the VES test to ascertain whether some of the plutonium bearing waste solutions (discarded in the past to the three crib disposal sites) could possibly be vaporized and draw off plutonium with the gases.

The VES technique for extracting  $\text{CCl}_4$  from the soil below the crib did not draw off any plutonium with the gases as expected during the test phase. The discussion provided in Attachments A and C indicate that removal of plutonium in the gases or redistribution of the material trapped in the soil would not occur. The criticality prevention specification was revised and approved by criticality engineering for allowing vapor vacuum extraction operations at the crib sites for the overall remediation activities (Attachment F).

**3.5.2 Natural Forces Events**Flood:

The Columbia River probable maximum flood elevations (the flood discharge that may be expected from the most severe combination of meteorologic and hydrologic conditions reasonably possible in the region) would be about 425 ft (130 m) at the 100-N Area (with respect to msl). This flood would not affect the central part of the site (the 200 East/West Areas plateau), where the cribs are located because this area has an elevation greater than 500 ft (150 m). Similarly, waters of the 100-yr flood would have no effect on this area. A flood affecting this site having significant adverse effects is therefore considered incredible.

Tornado:

A severe tornado of the Midwest type is highly unlikely under the climatologic and orographic conditions of the Pacific Northwest. There have been only two tornado funnel clouds and one small tornado (June 16, 1948) observed at the Hanford Site in the 34-yr period between 1945 and 1978. Although one of these touched ground, it caused no damage. The nearest reported tornado damage was in Yakima (April 30, 1957), about 45 mi to the west, and at Wallula Junction (June 26, 1958), about 50 mi to the southwest. Only minor damage was noted. The potential consequences in terms of airborne concentrations have been found below risk acceptance consequences (WHC 1988b).

**3.6 THRESHOLD VALUES**

The inventory and resulting source terms were analyzed for  $\text{CCl}_4$ . The other VOCs that were extracted during the test phase (based upon the temperatures required to vaporize these contaminants) were 2-butanone and trace amounts of chloroform. Because these other contaminants are present in much lower quantities than that of  $\text{CCl}_4$ , and the toxicity of both chloroform and 2-butanone are less than  $\text{CCl}_4$ , these contaminants are bounded by the  $\text{CCl}_4$  analysis.

The toxicity limit values for the chemical contaminants identified in this section are provided in Table 3. These limits were derived from the guidelines using the concentration values reported in the American Conference of Governmental Industrial Hygienists Threshold Limit Values for Chemical

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Substances and Physical Agents and the Occupational Safety and Health Administration, Department of Labor Standards (ACGIH 1990; 29 CFR 1910).

Table 3. Toxicity Limit Values.

Inventory of Contaminants	IDLH		TWA		STEL	
	p/m	mg/m <sup>3</sup>	p/m	mg/m <sup>3</sup>	p/m	mg/m <sup>3</sup>
2-Butanone	3,000	8,847	200	590	300	885
Carbon Tetrachloride*	300	1,887	2	13		
Chloroform*	1,000	4,883	2	10		

IDLH = The Immediately Dangerous to Life or Health level represents a maximum concentration from which one could escape within 30 min without any escape-impairing symptoms or any irreversible health effects.

TWA = The Time-Weighted Average concentration limit for a normal 8-h workday and a 40-h workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect (The term "TWA" may be expressed in either p/m or mg/m<sup>3</sup>).

STEL= The Short-Term Exposure Limit is a 15-min TWA exposure that should not be exceeded at any time during a workday.

\* Ca = Any chemical designated as "Ca," is considered to be a chemical that should be treated as an occupational carcinogen.

### 3.7 ASSESSMENT SUMMARY

This assessment analyzed CCl<sub>4</sub> as the hazardous inventory of concern because CCl<sub>4</sub> is the predominant contaminant found during the test phase as discussed in the ERA proposal (DOE-RL 1991). Scenarios were analyzed and the results are provided in order to determine the potential consequences associated with these events. The worst case consequences have been identified and are addressed in this section.

The requirements for determination of hazard classification indicates that this activity will require review and approval for that of a low hazard operation. This safety assessment satisfies the requirements of WHC 1988b, WHC 1990b, and DOE Order 5481.1B, "Safety Analysis and Review System" (DOE 1988b). The requirements considered also included the protective action guidelines (PAG) that were developed to limit inhalation exposures to the public to levels below which they would not be expected to experience or develop irreversible or other serious health effects or symptoms that could impair their ability to take appropriate protective action (WHC 1990a).

The hazard classification criteria for this activity complies with the procedural criteria of WHC 1988b and is consistent with the guidance in

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WHC 1990b. Because  $CCl_4$  is not defined in PAG concentrations (WHC 1990a) or in the emergency response action guidelines in WHC 1990b, concentrations with conservative fractions of IDLH is used as the criteria. Onsite criteria and offsite criteria for low hazard is  $<0.1$  of the IDLH (30 p/m  $CCl_4$ ) WHC 1990b and  $< TLV-TWA$  (2 p/m  $CCl_4$ ) WHC 1988b respectively.

The assessed consequences have been evaluated against the toxicological risk acceptance curve. The potential concentrations of  $CCl_4$  are within the acceptance guidance (WHC 1988b).

The receptors of concern are the nearest onsite and offsite individuals. The closest onsite facility to the remediation sites is the PFP. The nearest offsite location is Highway 240, 2.8 mi (4.5 km) southwest of the 216-Z-18 crib. The site boundary (nearest resident) is 7.7 mi (12.5 km) southwest of the crib sites.

The bounding postulated scenario involves the rupturing of three fully saturated canisters releasing  $CCl_4$  resulting in consequences to the receptors of concern. This scenario involves a vaporization rate of 2.0 lb/min of  $CCl_4$  with the  $CCl_4$  vapors being released over a period of 16 h. A summary of the receptor exposures for this scenario is provided in Table 4.

Table 4. Receptor Exposures Due to Release of 2.0 lbs/min of  $CCl_4$  Over 16 h.

Release of $CCl_4$ per min over a 16-h period (lbs)	Resultant Exposures			Limits	
	Onsite (100 m)	Nearest public access (4.5 km)	Offsite	IDLH	TWA
2.0	28 p/m 176 mg/m <sup>3</sup>	0.14 p/m 0.88 mg/m <sup>3</sup>	0.05 p/m 0.32 mg/m <sup>3</sup>	300 p/m 1,882 mg/m <sup>3</sup>	2 p/m 13 mg/m <sup>3</sup>

Attachment G provides the data that includes the analysis for the receptor exposures identified in Table 4.

One postulated scenario identified the worst-case production of phosgene gas near heating units in the GAC system. There will be heaters located in the hoses that connect the well head to the GAC system (usually one heater per well), prior to the prefilter, located upstream of the HEPA filtration system. The heaters should not provide sufficient temperatures to heat the GAC units that result in the production of phosgene (hydrolysis could begin to occur if temperatures exceed 400° F (205° C) in the air stream) as indicated in Attachment H, because the in-line heater design will have a maximum air stream temperature capacity of 275° F (135° C) at 50 acfm.

Table 5 provides the consequences if sufficient temperatures could be achieved for phosgene production. The conversion rate of  $CCl_4$  to phosgene assumes temperatures of 1100°-1400° F (600°-760° C) that are required for a much larger conversion ( $CCl_4$  hydrolysis reaction goes to completion or near completion) of  $CCl_4$  to phosgene. The conversion rate is 2.7E-4 lbs phosgene produced per lb of  $CCl_4$  exposed to the stated temperatures in the presence of

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environment without being adsorbed in the GAC unit, and the phosgene produced does not undergo hydrolysis as the temperature decreases.

Even if sufficient temperatures are achieved, the consequences would not exceed the limits for a low hazard activity (Table 5), but the TWA limit for exposure to phosgene could be exceeded for the site worker. Prudent actions are recommended in Section 4.3, addressing the maximum air stream temperature capacity for the heaters.

Table 5. Phosgene Production Near Upstream and Prefilter Heaters.

Flow of CCl <sub>4</sub> Per Min (lbs)	Resultant Exposures			Limits		
	Onsite (100 m)	Nearest Public Access (4.5 km)	Offsite (12.5 km)	IDLH	TWA	Ceiling* Limit
1.6	.007	1.2E-5	4E-6	2 p/m 8.22 mg/m <sup>3</sup>	0.1 p/m 0.4 mg/m <sup>3</sup>	0.2 p/m 0.8 mg/m <sup>3</sup>

\* Ceiling limit = A permissible 15 min TWA excursion limit above the 8 hr TWA limit that should not be exceeded during any part of the workshift.

Attachment G provides the data that includes the analysis for the receptor exposures identified in the above table.

The consequence analysis also indicated that several postulated scenarios could result in consequences to the site and nearest uninvolved worker that exceeds the OSHA limits for exposure to CCl<sub>4</sub>. Table 6 identifies the system or component failures, consequences as a result of those failures and mitigative features available to reduce or eliminate the potential consequences to the site worker and nearest uninvolved worker.

Those components designed for providing or maintaining confinement of the VES are defined as safety class 3 components (WHC 1988c). The consequences of this operation could affect the health and safety of the site workers due to accidental releases of chemicals.

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Table 6. Assessment of Hazards and Controls.

Component Failure and Consequences	Mitigation
<p>Failure of piping (hole in a flex hose), fittings, saturation of both the GAC canisters causing CCl<sub>4</sub> to breakthrough, or failure of a control system could cause a continuous release resulting in consequences to the uninvolved individual. Concentrations of CCl<sub>4</sub> at 330 ft (100 m) would be a maximum of 17 p/m.</p>	<p>A calibrated VOC detector should be installed downstream of the final GAC canister for detection of CCl<sub>4</sub>. The alarm set point of the detector should be set for concentrations of 25 p/m<sub>v</sub> of CCl<sub>4</sub> and should also be interlocked to shut down the blower if the 25 p/m<sub>v</sub> concentrations of CCl<sub>4</sub> are exceeded.</p> <p>Flow rate meters, located upstream of the blower and downstream of the final GAC, should be calibrated to indicate a flow rate variance of not more than 10% above the combined accuracy between the meters. The flow rate meters should also be interlocked to shut down the blower if a greater than 10% variance above the combined accuracy of the two flow rate meters is detected. Reliability of system must ensure instruments fail-safe to assure shutdown of the blower. Constant monitoring of the VES (as prescribed in the work procedures) is required if operating in by-pass mode. Detection of CCl<sub>4</sub> vapors will necessitate shutdown of the VES.</p> <p>A minimum of two GAC canisters in series should be in place at all times with the final GAC canister having ≥ adsorptive capacity than the unit immediately upstream.</p>
<p>Spill of carbon involving three GAC canisters (as a result of a rupture due to dropping a canister) that results in consequences to the uninvolved individual. Maximum concentrations of CCl<sub>4</sub> at 330 ft (100 m) would be 28 p/m.</p>	<p>An emergency response kit should be available for containment of a spill. Immediate notification to hazardous material response team using the 811 emergency notification system should be made in the event of a spill.</p>

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Table 6. Assessment of Hazards and Controls (Cont).

Component Failure and Consequences	Mitigation
<p>In-line heaters that have a maximum air stream temperature capacity of 275° F (135° C) at 50 acfm. The heaters will be used to remove moisture in the process flow stream. Hydrolysis of CCl<sub>4</sub> can occur (resulting in the production of some phosgene gas) due to heating the process flow stream to temperatures that exceed 400° F (205° C).</p> <p>A fuel fire that occurs in close proximity to the saturated GAC canisters providing sufficient temperatures to cause regeneration of the carbon. The heat from the fuel fire would strip and release the toxic pollutants in the smoke plume within a 30 min period.</p>	<p>Replacement of failed heater units should be with units which do not exceed a maximum air stream temperature capacity of 400° F (205° C).</p> <p>Locating the fuel sources a minimum of 50 ft (15 m) away from the GAC canisters whether the canisters are in storage or being used in the process. Locating the generator a minimum of 25 ft (8 m) away from the GAC canisters. Maintaining the fuel sources and generator at the specified distances allows adequate clearance for flames that could result from a failure of the propane tank or fuel hose to the generator. This would provide a conservative distance at which flames could affect the CCl<sub>4</sub> canisters.</p>

The mitigation features and controls required to assure concentrations to the site and nearest uninvolved worker are controlled below the OSHA limit for CCl<sub>4</sub> (identified in Table 6) are discussed in Section 4.0.

#### 4.0 SAFETY FUNCTIONS AND CONTROLS

The analysis disclosed that the VES remediation operations would be classified as a low hazard operation. The safety functions that will be provided for the remediation activities of the CCl<sub>4</sub> VES process are identified in OSLs. The following are the OSLs for the 200 West Area CCl<sub>4</sub> ERA.

##### 4.1 OPERATIONAL SAFETY LIMIT 1 - FUEL SOURCES

4.1.1 Title - Inventory control of fuel sources.

4.1.2 Applicability - This OSL applies to the location of the 1,000 gal propane storage tank, fuel trucks that may be used for refueling the fuel tank and the electric generator at the site. (This limit does not apply to the fork truck or similar equipment having small quantities of fuel).

4.1.3 Objective - The objective of this OSL is to assure that a common mode fire affecting the propane tank, fuel truck, or generator would not provide sufficient temperatures that could affect the GAC canisters resulting in regeneration of CCl<sub>4</sub> causing unacceptable consequences to individuals.

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- 4.1.4 Requirements - a. The propane fuel tank or a fuel truck for refueling the propane tank shall be located a minimum of 50 ft (15 m) from the GAC canisters whether the canisters are in storage or being utilized in the process.
- b. The generator shall be located a minimum of 25 ft (8 m) from the GAC canisters.
- c. A maximum of not more than twelve fully saturated canisters will be allowed per storage location at the work site.

4.1.5 Surveillance - The responsible operating organization shall verify daily (prior to startup and during periods of operation) that the work site is in compliance with the requirements of this OSL. Compliance with the stated requirements shall be documented in an auditable record.

#### 4.1.6 Recovery

##### 4.1.6.1 Non-compliance with the requirements of the OSL:

1. VES operations shall cease until Health and Safety Assurance approves restart of the operation.
2. The fire department will be notified requesting standby at the work site until full recovery actions are completed.
3. The location of the fuel source shall be re-established at a minimum of 50 ft (15 m) as soon as reasonably possible.
4. The location of the electric generator shall be re-established at a minimum of 25 ft (8 m) as soon as reasonably possible.
5. The number of saturated canisters in storage shall be reduced to six as soon as reasonably possible.
6. The OSL violation shall be documented as an unusual occurrence report.

##### 4.1.6.2 Non-compliance with the surveillance requirement:

1. The surveillance shall be performed immediately.
2. If surveillance determines non-compliance with the requirement, the recovery actions identified in Section 4.1.6.1 shall be initiated.
3. Failure to implement a surveillance requirement shall be documented as an off-normal occurrence.

4.1.7 Audit Point - An auditable log shall be maintained at the site documenting the results of the surveillance. This log shall be reviewed weekly by the operating organization assuring compliance with the requirements and surveillance. The audit and surveillance frequencies

shall be determined by the Quality Assurance and Environmental Assurance organizations respectively.

4.1.8 **Basis** - The minimum 50 ft (15 m) separation between the propane tank and the  $CCl_4$  canisters, whether in storage or at the GAC trailer, and a minimum 25 ft (8 m) separation between the generator and the canisters allows adequate clearance for flames that could result from a failure of the propane tank or the fuel hose to the generator. This would provide a conservative distance at which a flame could affect the  $CCl_4$  canisters. The primary cause of a release of  $CCl_4$  is high temperature. Removing the only potential fuel sources (1,000 gal propane tank, fuel carried by a fuel truck) for a fire intense enough to strip the  $CCl_4$  eliminates the credible postulated mechanisms for releasing the  $CCl_4$  causing consequences to the receptors of concern or the environment exceeding the TLV for a low hazard operation. The analysis involving other accidents in this assessment were based upon six saturated canisters that are part of the VES and twelve saturated canisters in a storage area. An accident involving not more than twelve saturated canisters, in storage, would ensure the integrity of this assessment.

4.2 **OPERATIONAL SAFETY LIMIT 2 - LIMITING  $CCl_4$  EXPOSURES TO THE NEAREST UNINVOLVED INDIVIDUAL**

4.2.1 **Title** - Controlling the concentrations of  $CCl_4$  to the nearest uninvolved individual to below the permissible exposure limit.

4.2.2 **Applicability** - This limit applies to mitigating the consequences of a release of  $CCl_4$  below the OSHA 8 h TWA limit of 2 p/m<sub>v</sub> to the nearest uninvolved individual during VES operation.

4.2.3 **Objective** - The objective of this limit is to assure that the concentrations of  $CCl_4$  from the VES operation do not exceed the OSHA limit causing unacceptable consequences to individuals.

4.2.4 **Requirements** - a. A  $CCl_4$  detector, used as the final exhaust monitor, shall be located downstream of the final GAC. The detector shall be set to alarm at 25 p/m<sub>v</sub>  $CCl_4$  concentrations and shall be interlocked to shut down the blower if the 25 p/m<sub>v</sub>  $CCl_4$  concentrations are exceeded. Annual average shall be  $\leq 2$  p/m based on equipment run time.

b. The flow rate meters, located upstream of the blower and downstream of the final GAC, shall be calibrated. A logic system shall be in place to initiate a system shutdown (system shutdown within one min) when flow rate variance is greater than 10% above the combined accuracy of the flow rate meters. Reliability of system (flow rate meters and logic system) must ensure instruments fail-safe to assure shutdown of the blower. Monitoring of flow rate meters will be required by operations personnel as prescribed in the work procedures if instrumentation cannot reliably detect a flow rate variance of greater than 10% (exceeding 10% variance will require shutdown of the VES). Constant monitoring (with instruments for

detection of  $\text{CCl}_4$  vapors) of the portion of the VES under positive pressure is required if operating in by-pass mode (flow rate meters or logic system inoperable). Detection of  $\text{CCl}_4$  vapors will necessitate immediate shutdown of the VES.

- c. There shall be a minimum of two GAC canisters in series. The final GAC canister shall have equal to or greater adsorptive capacity than the unit immediately upstream in order to adsorb any  $\text{CCl}_4$  in the event breakthrough of the first GAC canister occurs.

- 4.2.5 Surveillance
- a. A weekly operability check and monthly system functional check of the  $\text{CCl}_4$  exhaust detector and flow meters, located upstream of the blower and downstream of the final GAC canister, shall be conducted by the responsible operating organization. Test data shall be recorded and documented in an auditable record.
  - b. Prior to startup of operations and during changeout of saturated canisters, the responsible operating organization shall verify that the final GAC canister shall have equal to or greater adsorptive capacity than the unit immediately upstream. The verification shall be documented in an auditable record.
  - c. Quarterly trending should be conducted to verify that the concentrations are below the 2 p/m average.

#### 4.2.6 Recovery

##### 4.2.6.1 Non-compliance with the requirements of the OSL:

1. Once a determination is made that the operating organization is not in compliance with the requirements of this OSL, operations shall immediately cease. The approval of Health and Safety Assurance will be required for restart of the operation.
2. Failure of the  $\text{CCl}_4$  detector and/or logic system to initiate shutdown (if concentrations of  $\text{CCl}_4$  exceed 25 p/m<sub>v</sub>) shall require maintenance troubleshooting and repair prior to restart of the operation.
3. Failure of the flow rate meters and/or logic system to initiate shutdown (if a flow rate variance greater than 10% above the combined accuracy of the two flow rate meters is found) shall require maintenance troubleshooting and repair prior to restart of the operation.
4. Failure to have a final GAC canister in place (with equal to or greater adsorptive capacity than the unit immediately upstream) shall require a unit be installed prior to resumption of operations.

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5. The OSL violation shall be documented as an unusual occurrence report.

#### 4.2.6.2 Non-compliance with the surveillance requirements:

1. The surveillance shall be performed immediately.
2. If the surveillance determines noncompliance with the requirement then initiate recovery actions as identified in Section 4.2.6.1.
3. Failure to implement a surveillance requirement shall be documented as an off-normal occurrence.

4.2.7 **Audit Point** - An auditable log shall be maintained at the site documenting the results of the surveillance. This log shall be reviewed weekly by the operating organization and audit and surveillance frequencies determined by Quality Assurance and Environmental Assurance respectively, assuring compliance with the requirements of the surveillance.

4.2.8 **Basis** - Limiting the concentrations of  $CCl_4$  to below the OSHA 8 h TWA limit to the nearest uninvolved worker assures exposures to occupational carcinogens are maintained at levels that will reduce or eliminate adverse health effects to personnel. Trending allows forecasting and evaluation or identification of potential upset conditions that may result in exceeding the annual average.

### 4.3 PRUDENT ACTIONS

**Function 1-** Minimize occupational workers' exposures of VOC to as low as reasonably achievable.

**Prudent Action 1** - Monitor ambient air and workers' breathing zone for  $CCl_4$  vapors in areas where workers will be required to perform their work activities. Concentrations detected that exceed the TWA limits should require removal of personnel from the work area or donning of appropriate protective gear as required by the JSA or HWOP.

**Function 2** - Monitor VES for potential radionuclide particulate contamination.

**Prudent Action 2** - Even though radioactive particulates are not expected to be removed during remediation activities, provide monitoring for radioactive contamination. In the event CAM alarms indicate possible radioactive contamination, shut down the process. Concurrence for restart will be required from the Health Physics supervisor.

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Function 3 - Monitor for  $^{222}\text{Rn}$ .

Prudent Action 3 - The  $^{222}\text{Rn}$  monitoring equipment should be used to indicate the total quantities of  $^{222}\text{Rn}$  and daughters adsorbed by the GACs during the VES operation. The quantities of  $^{222}\text{Rn}$  measured will determine if the GAC canisters can be released from radiological controls. The  $^{222}\text{Rn}$  concentrations of the stack effluent should be monitored.

Function 4 - Survey program.

Prudent Action 4 - A routine survey program should be implemented to monitor the GAC canisters for potential gamma exposures that may result from  $^{222}\text{Rn}$  buildup in the canisters. If the exposure rate exceeds 2mR/h on contact with the outside of the canisters, the area will be posted per the requirements identified in the *Radiation Protection Manual* (WHC 1988d).

Function 5 - Assure remediation and characterization sites are free of vegetation and combustibles.

Prudent Action 5 - The sites identified for remediation or site characterization will be cleared of vegetation and combustibles not necessary to the project.

Function 6 - Location of generator.

Prudent Action 6 - The electric generator should be located a minimum of 25 ft (8 m) from the propane storage tank as prescribed by the fire code.

Function 7 - Controlling the size (temperature capacity) of the in-line heaters used in the VES design.

Prudent Action 7 - Replacement of failed in-line heaters should be with heater units that have a maximum air stream temperature capacity that does not exceed 400° F (205° C).

Function 8 - Capping of the canister ports.

Prudent Action 8 - Whenever saturated GAC canisters are removed from the process, covers will be placed over the inlet and outlet ports of the canister and verified to be secure.

Function 9 - Establish safety equipment list.

Prudent Action 9 - The components of the VES required for providing confinement of  $\text{CCl}_4$  and monitoring should be identified as Safety Class 3 components in a safety equipment list.

Function 10 - Apprise fire department of hazards.

Prudent Action 10 - Provide notification to the fire department of the potential hazards involving  $\text{CCl}_4$  in a fire and production of phosgene.

Function 11 - Training.

Prudent Action 11 - The employees (drivers) who are assigned responsibility for handling the saturated GAC canisters must have completed hazardous material training.

Function 12 - Exclusion zone.

Prudent Action 12 - Maintain a 50 ft (15 m) exclusion zone around the VES operation to prevent inadvertent access by uninvolved individuals to the work site.

Function 13 - Personnel exposure to heaters during operations.

Prudent Action 13 - The site workers should not come into close proximity to the heaters during periods of operation. The maximum air stream temperatures of 400° F (205° C) is required to be maintained. The temperatures within 1 in. of the heater cal rod may exceed the 400° F (205° C) resulting in some production of phosgene. The site workers should be made aware of potential hazards associated with the operation of the heaters during VES operations. Heater will be shut down when the blower is not running or the individual hose line is not in use.

Function 14 - Minimize consequences of spilled carbon with CCl<sub>4</sub>.

Prudent Action 14 - An emergency response kit should be available on site for containment of spill. If a spill occurs, notify 811 requesting response by hazardous material response team.

Function 15 - Inventory control of liquid CCl<sub>4</sub> at the GMSS test site.

Prudent Action 15 - During the GMSS test no more than one drum containing up to a maximum of 115 L (30 g) of liquid CCl<sub>4</sub> should be located at the work site. Remove loaded drum from the work site before continuing GMSS test.

Function 16 - Notification and emergency response actions.

Prudent Action 16 - Emergency notification responsibilities and response actions should be addressed in the emergency plan for the CCl<sub>4</sub> work site and in the emergency plans for the adjacent affected facilities.

## 5.0 REFERENCES

- ACGIH, 1990, *1990-1991 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio.
- 29 CFR 1910.1000, 1991, "Occupational Safety and Health Standards," *Code of Federal Regulations*, as amended.
- DOE, 1988a, *Radiation Protection for Occupational Workers*, DOE Order 5481.11, U.S. Department of Energy, Washington, D.C.

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- DOE, 1988b, *Safety Analysis and Review System*, DOE Order 5481.1B, U.S. Department of Energy, Washington, D.C.
- DOE, 1990, *Radiation Protection of the Public and the Environment*, DOE Order 5400.5, Chapter 3, "Derived Concentration Guides for Air and Water," U.S. Department of Energy, Washington, D.C.
- DOE-RL, 1991, *Expedited Response Action Proposal for 200 West Area Tetrachloride Plume*, DOE-RL-91-32, Draft B, U.S. Department of Energy Field Office, Richland, Washington.
- Price, S.M., 1979, *Distribution of Plutonium and Americium Beneath the 216-Z-1A Crib: A Status Report*, RHO-ST-17, Rockwell International, Richland, Washington.
- WHC, 1988a, *Environmental Compliance Manual*, WHC-CM-7-5, Appendix A, Rev. 2, "Derived Concentration Guides for Controlling Exposure to Members of the Public," Westinghouse Hanford Company, Richland, Washington.
- WHC, 1988b, *Nonreactor Facility Safety Analysis Manual*, WHC-CM-4-46, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1988c, *Management Requirements and Procedures*, WHC-CM-1-3, Rev. 4, MRP 5.46, "Safety Classification of Systems, Components, and Structures," Westinghouse Hanford Company, Richland, Washington.
- WHC, 1988d, *Radiation Protection Manual*, WHC-CM-4-10, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990a, *Emergency Plan*, WHC-CM-4-1, Rev. 2, Section 4.0, "Emergency Conditions," Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990b, *Implementation Guideline for Hazard Documentation*, WHC-SD-GN-ER-301, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990c, *Safety Assessment for Task #7 of the 200 West Area Carbon Tetrachloride Expedited Response Action*, WHC-SD-ER-HC-001, Rev. 0, Richland, Washington.
- WHC, 1991, *Carbon Tetrachloride Expedited Response Action Vapor Extraction System Action Vapor Extraction System Project Supporting Document*, WHC-SD-EN-TI-010, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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**ATTACHMENT G**

**CONSEQUENCE ANALYSIS**

**FOR CARBON TETRACHLORIDE**

**ACCIDENT SCENARIOS**

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From: Safety Hazards Analysis  
Phone: 6-8009 NI-37  
Date: September 29, 1992  
Subject: CONSEQUENCE ANALYSIS FOR CARBON TETRACHLORIDE REMEDIATION

MAM-29240-92-011

To: R. R. Lehrschall NI-75

cc: R. G. Britton NI-19  
J. S. Davis NI-19  
N. R. Kerr NI-75  
E. E. Leitz NI-37 EEL  
J. C. Van Keuren NI-19  
MAM File/LB

Attached is the information regarding the analysis that you requested. It shows the potential worst-case concentrations of carbon tetrachloride as a result of a handling accident in which 3 Granular Activated Carbon (GAC) units are ruptured. The bases and assumptions made for the analysis are stated in the attachment along with the results.

If you have any questions regarding these results please feel free to call.



Mark A. Medsker  
Engineer

siw

Attachment

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SCENARIO REEVALUATION

The analysis below differs from the analysis in "Scenario 2" of WHC-SD-EN-SAD-004 rev 0, Appendix G (WHC 1992) only by increasing the number of GAC units ruptured from 2 to 3. Otherwise, the scenario assumptions are identical except as modified below.

- o It is assumed that when GAC units are handled, for removal from the system, storage, etc., that one unit at a time is moved.
- o It is assumed that the GAC units themselves are DOT approved shipping containers which are designed to withstand a minimum three foot drop without rupturing.
- o It is assumed that one unit, while being handled, is maneuvered into a physical position which is beyond the testing criteria for DOT approval (e.g. above three feet in height). It is then assumed that the unit is dropped and ruptured. Since the units will be handled near each other, it is assumed that the dropped unit can cause the rupture of two others resulting in the release of the carbon from a total of three units. No more than three units, regardless of the total number present, can be credibly ruptured in a handling accident in which one unit is moved at a time.

SOURCE TERM

The bases for the source term estimate in this analysis are taken from the calculations in Scenario 2 (WHC 1992, Appendix G). The inventory at risk associated with each GAC unit ruptured is 660 lb (300 kg) of  $CCl_4$ . The area associated with the carbon spill from each GAC unit ruptured in Scenario 2 is 30.2 ft<sup>2</sup> (2.81 m<sup>2</sup>). For three units this is an inventory at risk of 1,980 lb (900 kg) of  $CCl_4$  and a release area of 90.6 ft<sup>2</sup> (8.42 m<sup>2</sup>).

The source term is calculated from the assumptions stated above and the WHAZAN computer code (Technica 1988). The mass (900 kg), ambient temperature (305 K), and pool area (8.42 m<sup>2</sup>) were input into the WHAZAN code to facilitate estimation of the vaporization rate of  $CCl_4$ . The WHAZAN code estimated a vaporization rate of 2.0 lb/min of  $CCl_4$ .

DISPERSION

This source term was then used as input into the dispersion model of the ARCHIE computer code (FEMA 1988) to facilitate the estimation of downwind airborne concentrations. These concentrations are given in Tables 2 and 3 for the onsite individual at 100 m, the nearest public access at 4.5 km, and the offsite individual at 12.5 km. The assumptions used in the dispersion estimates are intended to approximate 95% meteorology (a wind speed of 1 m/s and Pasquill stability class F), and a ground level release.

The concentrations in Table 1 include the effects of plume meander. The phenomenon of plume meander is the lateral movement of the plume over time as the wind direction changes. Thus, as the plume centerline "wanders" laterally with time, the receptor location is exposed to a lesser concentration (on the average). However, before plume meander may be used on calculated results in a non-radiological (i.e. toxicological) analysis, certain criteria must be met. The atmospheric conditions during the release must be neutral or stable (Pasquill D, E, F, or G); the wind

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speed must be less than 6 m/s; the release or exposure time (whichever is less) must be at least one hour in length; the averaging time of the criteria must be at least one hour; and the peak concentrations must be calculated to ensure that acute effects from exposure to the chemical under analysis do not exceed "prudent guidelines". The first three criteria may be found in Regulatory Guide 1.145 (NRC 1982), the fourth criterion follows from the third, and the fifth criterion is discussed in more detail below. It should be pointed out that strong arguments must be made in the scenario model to show that all of these criteria are satisfied before credit may be taken for plume meander. In this analysis, the effect of plume meander resulted in a reduction of the estimated concentration at 100 m by a factor of 4, at 4.5 km by a factor of 1.7, and at 12.2 km by a factor of 1.2 (NRC 1982).

Table 1: Estimated Consequences With Plume Meander Effects (Averaged Over Time)

RECEPTOR LOCATION	CONSEQUENCES (ppm)
Onsite, 100 m	2.2 E+01
Nearest Public Access, 4.5 km	1.1 E-01
Offsite, 12.5 km	< 5.0 E-02

The concentrations in Table 2 represent peak downwind concentrations at the specified distances. The peak concentrations are calculated to ensure that immediate, acute effects from exposure to hazardous chemicals are not overlooked in an analysis which utilizes a plume meander model. Peak concentrations are to be used for comparison to relevant criteria when the scenario model fails to show that plume meander is applicable.

Table 2: Estimated Peak Consequences Without Plume Meander

RECEPTOR LOCATION	CONSEQUENCES (ppm)
Onsite, 100 m	8.8 E+01
Nearest Public Access, 4.5 km	1.8 E-01
Offsite, 12.5 km	< 5.0 E-02

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REFERENCES

WHC-SD-EN-SAD-004, Rev. 0-A

FEMA 1988, *Handbook of Chemical Hazard Analysis Procedures*, U.S. Department of Transportation, U.S. Department of Energy, and the Federal Emergency Management Agency, Washington, D.C.

NRC 1982, *Atmospheric Dispersion Models For Potential Accident Consequence Assessment at Nuclear Power Plants*, Regulatory Guide 1.145, Office of Nuclear Regulatory Research, Washington, D. C.

Technica 1988, *Whazan User's Guide*, Technica International Ltd., Fullerton CA.

WHC 1992, *Safety Assessment for the 200 West Area Expedited Response Action for the Remediation of Carbon Tetrachloride*, WHC-SD-EN-SAD-004, Westinghouse Hanford Company.

93129031613

From: Safety Hazards Analysis  
Phone: 6-8009 N1-37  
Date: September 30, 1992  
Subject: GAS MEMBRANE SEPARATION SYSTEM ACCIDENT ANALYSIS

MAM-29240-92-012

To: R. R. Lehrschall N1-75

cc: R. G. Britton N1-19  
J. S. Davis N1-19  
N. R. Kerr N1-75  
E. E. Leitz N1-37 EEL  
J. C. Van Keuren N1-19  
MAM File/Letterbook

Attached is the consequence analysis that you requested. It shows the worst-case concentrations resulting from an accident involving the Gas Membrane Separation System (GMSS). The attachment to this memo details the analysis and assumptions which led to the analysis results.

If you have any questions pertaining to this analysis do not hesitate to call.



Mark Medsker  
Engineer

siw

attachment

(Attachment B:\012.sta)

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## GAS MEMBRANE SEPARATION SYSTEM ACCIDENT ANALYSIS

The following analysis examines the Gas Membrane Separation System (GMSS) for potential worst-case consequences under accident conditions. In addition to analyzing new hazards, it includes source term input from Appendix G, WHC-SD-EN-SAD-004 rev 0, *Safety Assessment for the 200 West Area Expedited Response Action for Remediation of Carbon Tetrachloride* (WHC 1992).

The GMSS is a system by which  $\text{CCl}_4$  is removed from an air flow stream by means of a halogenated hydrocarbon-selective membrane. The GMSS is designed to remove the  $\text{CCl}_4$  from the stream prior to entering the granular activated carbon (GAC) units of the vapor extraction system (VES). This reduces the rate at which  $\text{CCl}_4$  is adsorbed onto the GAC units and thus the rate at which the GAC units must be shipped offsite for regeneration.

The only new hazards presented by the GMSS is that the  $\text{CCl}_4$  is collected in liquid form in a drum. The GMSS itself presents no new hazards as it does not introduce any new hazardous substances or energy sources that have not already been analyzed. Appendix G of WHC-SD-EN-SAD-004 rev 0 (WHC 1992) contains the applicable scenarios to determine the potential worst-case consequences of an accident involving the GMSS.

A review of Appendix G (WHC 1992) shows that three scenarios were considered: (1) Excessive Retrieval, (2) GAC Spill, and (3) Phosgene Production. Since no additional  $\text{CCl}_4$  will be retrieved and no new energy sources are present to produce phosgene, only Scenario 2 is impacted by addition of the GMSS. The liquid  $\text{CCl}_4$  inventory associated with the GMSS produces a source term via the following assumptions:

- o The accident initiator which ruptures the 2 GAC units also ruptures the 55-gal drum containing the liquid  $\text{CCl}_4$  associated with the GMSS.
- o The quantity of liquid in the drum is 30-gal, 73% of which is water and 27% of which is  $\text{CCl}_4$  (see Requesting Memos, attached). Thus, the volume of  $\text{CCl}_4$  spilled is  $(0.27) \cdot (30\text{-gal}) = 8.1\text{-gal}$ . Using a specific gravity of 1.594 (CRC 1984) this is 108 lb of  $\text{CCl}_4$  (49 kg).
- o The liquid  $\text{CCl}_4$  spills from the 55-gal drum and forms a pool on a porous surface (the ground) which has a spread factor of  $0.153 \text{ m}^2/\text{kg}$  (AFESC 1983).
- o The pool area is calculated by multiplying the mass of the  $\text{CCl}_4$  in the spill, 49 kg, by the spread factor,  $0.153 \text{ m}^2/\text{kg}$ . Thus, the pool area is  $(49 \text{ kg}) \cdot (0.153 \text{ m}^2/\text{kg}) = 7.5 \text{ m}^2$ .

SOURCE TERM

The source term for this analysis is calculated from the assumptions stated above and the WHAZAN computer code (Technica 1988). The mass (49 kg), ambient temperature (305 K), and pool area ( $7.5 \text{ m}^2$ ) were input into the WHAZAN code to facilitate estimation of the vaporization rate of  $\text{CCl}_4$  from the liquid

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pool. The WHAZAN code estimated a vaporization rate of 1.39 E-02 kg/s (1.8 lb/min) of CCl<sub>4</sub> from the pool.

This source term was added to the source term of Scenario 2 to determine the total source term for this analysis. The source term from Scenario 2 is 0.88 lb/min (6.7 E-03 kg/s) (WHC 1992, Appendix G). Therefore, the total source term for this analysis is (1.8 lb/min)+(0.88 lb/min) = 2.7 lb/min.

DISPERSION

This source term was then used as input into the dispersion model of the ARCHIE computer code (FEMA 1988) to facilitate the estimation of downwind airborne concentrations. These concentrations are given in Tables 2 and 3 for the onsite individual at 100 m, the nearest public access at 4.5 km, and the offsite individual at 12.5 km. The assumptions used in the dispersion estimates are intended to approximate 95% meteorology (a wind speed of 1 m/s and Pasquill stability class F), and a ground level release.

The concentrations in Table 1 include the effects of plume meander. The phenomenon of plume meander is the lateral movement of the plume over time as the wind direction changes. Thus, as the plume centerline "wanders" laterally with time, the receptor location is exposed to a lesser concentration (on the average). However, before plume meander may be used on calculated results in a non-radiological (i.e. toxicological) analysis, certain criteria must be met. The atmospheric conditions during the release must be neutral or stable (Pasquill D, E, F, or G); the wind speed must be less than 6 m/s; the release or exposure time (whichever is less) must be at least one hour in length; the averaging time of the criteria must be at least one hour; and the peak concentrations must be calculated to ensure that acute effects from exposure to the chemical under analysis do not exceed "prudent guidelines". The first three criteria may be found in Regulatory Guide 1.145 (NRC 1982), the fourth criterion follows from the third, and the fifth criterion is discussed in more detail below. It should be pointed out that strong arguments must be made in the scenario model to show that all of these criteria are satisfied before credit may be taken for plume meander. In this analysis, the effect of plume meander resulted in a reduction of the estimated concentration at 100 m by a factor of 4, at 4.5 km by a factor of 1.7, and at 12.2 km by a factor of 1.2 (NRC1982).

Table 1: Estimated Consequences With Plume Meander Effects (Averaged Over Time)

RECEPTOR LOCATION	CONSEQUENCES (ppm)
Onsite, 100 m	2.8 E+01
Nearest Public Access, 4.5 km	1.4 E-01
Offsite, 12.5 km	5.0 E-02

The concentrations in Table 2 represent peak downwind concentrations at the specified distances. The peak concentrations are calculated to ensure

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that immediate, acute effects from exposure to hazardous chemicals are not overlooked in an analysis which utilizes a plume meander model. Peak concentrations are to be used for comparison to relevant criteria when the scenario model fails to show that plume meander is applicable.

Table 2: Estimated Peak Consequences Without Plume Meander

RECEPTOR LOCATION	CONSEQUENCES (ppm)
Onsite, 100 m	1.1 E+02
Nearest Public Access, 4.5 km	2.3 E-01
Offsite, 12.5 km	6.0 E-02

REFERENCES

AFESC 1983, *A Simple Formula for Estimating Source Strengths from Spills of Toxic Liquids*, Engineering and Services Laboratory, Air Force Engineering and Services Center, Tyndall Air Force Base, Florida.

CRC 1984, *CRC Handbook of Chemistry and Physics*, R. C. Weast (editor-in-chief), CRC Press.

FEMA 1988, *Handbook of Chemical Hazard Analysis Procedures*, U.S. Department of Transportation, U.S. Department of Energy, and the Federal Emergency Management Agency, Washington, D.C.

NRC 1982, *Atmospheric Dispersion Models For Potential Accident Consequence Assessment at Nuclear Power Plants*, Regulatory Guide 1.145, Office of Nuclear Regulatory Research, Washington, D. C.

Technica 1988, *Whazan User's Guide*, Technica International Ltd., Fullerton, CA.

WHC 1992, *Safety Assessment for the 200 West Area Expedited Response Action for the Remediation of Carbon Tetrachloride*, WHC-SD-EN-SAD-004, Westinghouse Hanford Company.

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HEDOP REVIEW CHECKLIST  
for  
Radiological and Nonradiological Release Calculations

Document reviewed (include title or description of calculation, document number, author, and date, as applicable):

Memo, M.A. Medsker to R.R. Lehrschall, "Gas Membrane Separation System Accident Analysis," Letter # MAM-29240-92-011, September 29, 1992.

Submitted by: Mark Medsker

Date Submitted: 9/21/92

Scope of Review: Environmental transport/consequences of the release

YES NO\* N/A

- [ ] [ ] 1. A detailed technical review and approval of the environmental transport and dose calculation portion of the analysis has been performed and documented.
- [ ]  [ ] 2. Detailed technical review(s) and approval(s) of scenario and release determinations have been performed and documented.
- [ ]  [ ] 3. HEDOP-approved code(s) were used.
- [ ] [ ]  4. Receptor locations were selected according to HEDOP recommendations.
- [ ] [ ] 5. All applicable environmental pathways and code options were included and are appropriate for the calculations.
- [ ] [ ]  6. Hanford site data were used.
- [ ] [ ] 7. Model adjustments external to the computer program were justified and performed correctly.
- [ ] [ ] 8. The analysis is consistent with HEDOP recommendations.
- [ ] [ ] 9. Supporting notes, calculations, comments, comment resolutions, or other information is attached. (Use the "Page 1 of X" page numbering format and sign and date each added page.)
- [ ] [ ] 10. Approval is granted on behalf of the Hanford Environmental Dose Overview Panel.

\* All "NO" responses must be explained and use of nonstandard methods justified.

Janet S. Davis Janet S. Davis 9/29/92  
 HEDOP-Approved Reviewer (Printed Name and Signature) Date

COMMENTS (add additional signed and dated pages if necessary):

- 2. The scenario was provided by the customer; no evidence of review and approval was provided. The source term development was reviewed and approved by the technical reviewer.

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*J.S. Davis*  
*9/29/92*

3. HEDOP has not approved any codes for nonradiological evaluations. ARCHIE was used to determine the carbon tetrachloride release rate and concentrations downwind.
4. There are currently no HEDOP recommendations regarding receptor locations.
6. ARCHIE requires a Pasquill stability class and a windspeed to perform dispersion calculations. Therefore no "site-specific" data could be used. However, the use of Pasquill stability class F and a 1 m/s windspeed are consistent with the 95% sector X/Qs obtained with Hanford meteorology data.
7. Plume meander corrections were applied in accordance with NRC Regulatory Guide 1.145. Applicability of plume meander to nonradiological releases is scenario- and criteria-dependent, and is generally not appropriate. Since no comparisons to criteria were made (and applicability of plume meander could not be determined), results with and without plume meander were provided.

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CHECKLIST FOR TECHNICAL PEER REVIEW

Document Reviewed: Gas Membrane Separation System Accident Analysis

Submitted by: M. A. Medsker

Date Submitted: 9/25/92

Scope of Review: Entire Document

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- |    | Yes                                 | No*                      | NA                                  |   |
|----|-------------------------------------|--------------------------|-------------------------------------|---|
| 1. | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Problem completely defined.   |
|    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Accident scenarios developed in a clear and logical manner.   |
|    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Necessary assumptions explicitly stated and supported.  |
|    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Computer codes and data files documented.   |
|    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Data used in calculations explicitly stated in document.  |
|    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Data checked for consistency with original source information as applicable.  |
|    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Mathematical derivations checked including dimensional consistency of results.  |
|    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Models appropriate and used within range of validity or use outside range of established validity justified.                                  |
|    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Hand calculations checked for errors. Spreadsheet results should be treated exactly the same as hand calculations.                            |
|    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Software input correct and consistent with document reviewed.   |
|    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Software output consistent with input and with results reported in document reviewed.   |
| 2. | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Limits/criteria/guidelines applied to analysis results are appropriate and referenced. Limits/criteria/guidelines checked against references. |
|    | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Safety margins consistent with good engineering practices.  |
|    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Conclusions consistent with analytical results and applicable limits.   |
|    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Results and conclusions address all points required in the problem statement.   |
|    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Review calculations, comments, and/or notes are attached.   |
|    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Document approved (i.e., the reviewer affirms the technical accuracy of the document).  |

R.G. Britton      R.G. Britton      9/29/92  
 Reviewer (Printed Name and Signature)      Date

- \* All "NO" responses must be explained below or on an additional page.
- \*\* Any calculations, comments, or notes which the reviewer feels should be part of the review record should be signed, dated and attached to this checklist. Such material should be labeled and recorded in such a manner as to be intelligible to a technically qualified third party.

COMMENTS (add additional signed and dated pages if necessary):

1. Customer specified the accident scenario.
2. Scope of this analysis did not include comparison of results to applicable criteria.

Analysis entered into analysis database

Mark A. Medsker      Mark A. Medsker      9/29/92  
 (Printed Name and Signature)      Date

Date Received: 11/18/92

INFORMATION RELEASE REQUEST

Reference: WHC-CM-3-4

Complete for all Types of Release

<input type="checkbox"/> Speech or Presentation <input type="checkbox"/> Full Paper (Check only one suffix) <input type="checkbox"/> Summary <input type="checkbox"/> Abstract <input type="checkbox"/> Visual Aid <input type="checkbox"/> Speakers Bureau <input type="checkbox"/> Poster Session <input type="checkbox"/> Videotape		<input type="checkbox"/> Reference <input checked="" type="checkbox"/> Technical Report <input type="checkbox"/> Thesis or Dissertation <input type="checkbox"/> Manual <input type="checkbox"/> Brochure/Flier <input type="checkbox"/> Software/Database <input type="checkbox"/> Controlled Document <input type="checkbox"/> Other		ID Number (include revision, volume, etc.) WHC-SD-EN-SAD-004, Rev. 0-A
List attachments.				
Attachments A - H				
Date Release Required November 4, 1992				

Title Safety Assessment for the 200 West Area Expedited Response Action for Remediation of Carbon Tetrachloride	Unclassified Category UC-	Impact Level 2 ESQ
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New or novel (patentable) subject matter? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If "Yes", has disclosure been submitted by WHC or other company? <input type="checkbox"/> No <input type="checkbox"/> Yes Disclosure No(s).	Information received from others in confidence, such as proprietary data, trade secrets, and/or inventions? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (Identify)
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Copyrights? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If "Yes", has written permission been granted? <input type="checkbox"/> No <input type="checkbox"/> Yes (Attach Permission)	Trademarks? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (Identify)
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Title of Conference or Meeting	Group or Society Sponsoring
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Date(s) of Conference or Meeting	City/State	Will proceedings be published? <input type="checkbox"/> Yes <input type="checkbox"/> No	Will material be handed out? <input type="checkbox"/> Yes <input type="checkbox"/> No
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Title of Journal
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CHECKLIST FOR SIGNATORIES

Review Required per WHC-CM-3-4	Yes	No	Reviewer - Signature	Indicates Approval	Date
			Name (printed)	Signature	
Classification/Uncontrolled Nuclear Information	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
Patent - General Counsel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	SW BERGLIN	<i>[Signature]</i>	11/20/92
Legal - General Counsel	<input checked="" type="checkbox"/>	<input type="checkbox"/>			
Applied Technology/Export Controlled Information or International Program	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
WHC Program/Project	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
Communications	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
RL Program/Project	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
Publication Services	<input checked="" type="checkbox"/>	<input type="checkbox"/>	L. Hermann	<i>[Signature]</i>	11/24/92
Other Program/Project	<input type="checkbox"/>	<input checked="" type="checkbox"/>			

Information conforms to all applicable requirements. The above information is certified to be correct.

References Available to Intended Audience	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Transmit to DOE-HQ/Office of Scientific and Technical Information	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Author/Requestor (Printed/Signature)	R. R. Lehrscha	Date 11-13-92
Intended Audience	<input type="checkbox"/> Internal <input type="checkbox"/> Sponsor <input checked="" type="checkbox"/> External	
Responsible Manager (Printed/Signature)	N. R. Kerr	Date 11/13/92

INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP	
Stamp is required before release. Release is contingent upon resolution of mandatory comments.	
	
Date Cancelled	Date Disapproved

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