DRAFT

Five-Year Review Report

Second Five-Year Review Report

for

Hill Air Force Base, Utah

June 2003

PREPARED FOR:

United States Department of Defense
Hill Air Force Base Environmental Management Directorate

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Appendix A

Comments on Preliminary and Draft Versions of Five-Year Review Report

A.1 Hill AFB EMR Response to May DRAFT of Five-Year Review Report

A.2 Restoration Advisory Board Comments on May DRAFT of Five-Year Review Report

A.3 Hill AFB EMR Comments on Preliminary Versions of Five-Year Review Report

Appendix A.1

Hill AFB EMR Response to May DRAFT of Five-Year Review Report

Hill Air Force Base Response to
Five Year Review for Operable Unit 1

Five Year Review Item	Hill AFB Response	URS Action
Recommendation 1, Section IX - "Re-evaluate the non-source area monitored natural attenuation remedial action to determine if it is still applicable in all non-source areas (specifically in the area of measurable hydrocarbon concentrations outside Trench D)."	Concur	No action.
Recommendation 2, Section IX – "Modify ERPIMS to indicate springs and seeps that are dry during a sampling event."	Concur	No action.
Recommendation 3, Section IX – "Review the long term monitoring sampling and analysis plan to ensure that locations where the hydrocarbon concentrations were located during the Source Zone Area Delineation project (Intera 2001) are sampled."	Concur	No action.
Recommendation 4, Section IX – "Proceed with the delineation and excavation of the arsenic contaminated soils at the springs."	Hill AFB is currently working to evaluate the efficacy of the extraction trenches and continues to monitor spring flows in the area. Arsenic contamination will be remediated when Hill is convinced that the extraction trenches are effectively preventing flow at the springs, especially during wetter years.	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 1 (continued)

Five Year Review Item	Hill AFB Response	URS Action
Recommendation 5, Section IX – "Determine if the trenches are containing/capturing the contamination in the source area by evaluating the gradient around the trenches. Additional monitoring points may be necessary to confirm that the prescribed water levels in the sumps are adequate to maintain containment"	Concur. Work related to this recommendation is planned for this year.	No action.
Recommendation 6, Section IX – "Re-evaluate the risk analysis for OU 1 to determine if revised contaminant action levels are warranted based on new standards and toxicity factors, as explained in the Technical Assessment above."	Concur	No action.
Recommendation 7, Section IX – "Re-evaluate the RI data on indoor air and determine if the new action level for TCE (0.43 ppbv) in indoor air warrants additional mitigation measures in off-Base residential areas."	Concur. Hill AFB has plans in place to sample indoor air in residential areas associated with OU1 next fall/winter.	No action.
Recommendation 8, Section IX – "Address drainage and ponding issues on Landfills 3 and 4 as soon as they are identified to ensure the landfill cap integrity."	Concur	No action.
Recommendation 9, Section IX – "Ensure that all gates and fences are locked in accordance with the ROD-specified institutional controls."	Concur	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 1 (continued)

Five Year Review Item	Hill AFB Response	URS Action
Recommendation 10, Section IX – "Determine if the plume mean concentrations are decreasing, using the described locations and monitoring frequency outlined in the PSVP and the results of the PSVR, scheduled for 2006."	Concur	No action.
Recommendation 11, Section IX – "Ensure that the method detection limits (MDL) are low enough to detect a contaminant of concern (i.e., MDL equal to or less than the MCL or PRG)."	Concur	No action.
Recommendation 12, Section IX – "Collect samples from all locations described in the PSVP and ensure that the results are entered in ERPIMS.	Concur	No action.
Recommendation 13, Section IX – "Continue to perform landfill cap inspections."	Concur	No action.
	Protectiveness Statement: Hill AFB concurs with the protectiveness statement.	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 2

Five Year Review Item	Hill AFB Response	URS Action
Recommendation 1, Section IX - "Jointly evaluate the effectiveness of the SRS and the containment wall."	Concur. Work related to this recommendation is planned for this year.	No action.
Recommendation 2, Section IX – "Identify the appropriate action level for well field operations and document new level and rationale in the PSVP."	Concur	No action.
Recommendation 3, Section IX – "Water level and analytical data in the vicinity of the NIT, the performance of the NIT, and the location of the NIT with respect to the dissolved-phase plume should be thoroughly evaluated."	Concur. Work related to this recommendation is planned for this year.	No action.
Recommendation 4, Section IX – "Expedite submittal of LTM data to ERPIMS for timely review of remedy effectiveness."	Concur	No action.
Recommendation 5, Section IX – "Continue use of the portable DNAPL pump assembly to remove free-phase DNAPL from wells. Consider purchase of a second system, which would enable simultaneous recovery of DNAPL from wells within the containment wall and from wells in the G-Pool."	Concur	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 2 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
Recommendation 6, Section IX – "Investigate the relationship between new residential development and the plume."	Concur	No action.
Recommendation 7, Section IX – "Re-evaluate the risk analysis for OU 2 to determine if revised contaminant action levels are warranted based on new standards and toxicity factors, as explained in the Technical Assessment above."	Concur	No action.
Recommendation 8, Section IX – "Consider the need to restrict water rights in the northeast quarter of Sect. 29, T5N R1W."	Concur	No action.
Recommendation 9, Section IX – "Evaluate whether a thorough review of the remedies at OU 2 can be performed before 2006."	Concur	No action.
	Protectiveness Statement: Hill AFB concurs with the protectiveness statement.	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 3

Five Year Review Item	Hill AFB Response	URS Action
Section IX, Recommendation 1 – "Re-evaluate the risk analysis for the active sites at OU 3 to determine if revised contaminant action levels are warranted based on new standards and toxicity factors as explained in the Technical Assessment above."	Concur. Since the remedy is in place, effectively preventing a completed exposure pathway, changes in toxicity factors will not alter the remedies protectiveness. If however in the future work compromised the integrity of the cap, then a re-evaluation of the risk analysis would be warranted.	Text revised as follows: "~~Re-evaluate~~ **If future work compromises the integrity of the remedies at OU 3,** the risk analysis for the active sites ~~at OU 3~~ **should be re-evaluated** to determine if revised contaminant action levels are warranted based on new standards and toxicity factors as explained in the Technical Assessment above."
ST004 – Sodium Hydroxide Tank Site		
Section IX, Recommendation 2 – "Continue inspection and monitoring program for the cap."	Concur	No action.
Section IX, Recommendation 3 – "Patch any damaged areas of the cap in the areas where the roll-off bins were located."	Concur	No action.
Section IX, Recommendation 4 – "Continue with the current groundwater-monitoring plan."	Concur	No action.
Section IX, Recommendation 5 – "Add painted delineations to the perimeter of the asphalt cap."	Concur	No action.
Section IX, Recommendation 6 – "Post warning signs prohibiting storage of equipment and excavation without permission."	Concur	No action.
Section IX, Recommendation 7 – "Develop procedures for excavation and equipment storage to minimize defects in the asphalt cap."	Concur	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 3 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
WP005 – Berman Pond		
Section IX, Recommendation 8 – "The PSVP should be revised to document the change of remedial actions at the site (the groundwater contamination from Berman Pond is captured by the OU 8 interim remedial action and therefore the pumping action level is not required)."	Concur	No action.
Section IX, Recommendation 9 – "Change the watering scheme for the landscaping around the asphalt cap at Berman Pond according to the recommendations made following the September 2002 cap inspection (Vicelja, J. 2002)."	Concur	No action.
Section IX, Recommendation 10 – "Slurry seal the asphalt cap in the summer of 2003 to prevent excess infiltration according to recommendations made following the September 2002 cap inspection (Vicelja 2002)."	Concur	No action.
Section IX, Recommendation 11 – "Post warning signs prohibiting storage of equipment and excavation without permission."	Concur	No action.
Section IX, Recommendation 12 – "Add painted delineations to the perimeter of the asphalt cap."	Concur	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 3 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
SD046 – Pond 2		
Section IX, Recommendation 13 – "Determine what restrictions, if any, were applied to the deed."	Do not concur. Investigations were completed at this site, before the sale to ensure it was not a source of ground water contamination. These investigations showed there was no significant contamination present and consequently there was no need to consider restricting activities by a restriction to the deed.	Agreed. This recommendation has been deleted.
	Protectiveness Statement: Hill AFB does not concur with the protectiveness statement. The current remedy is protective because there is no completed exposure pathway. Changes in risk factors do not alter the protectiveness of the remedy. If however, future work compromised the integrity of the cap, then a re-evaluation of the risk analysis would be warranted.	Text revised as follows: "~~A protectiveness determination of~~ **T**~~t~~he remedies associated with OU 3 ~~cannot be made until further information is available~~ **are protective of human health and environment**. **However, w**~~W~~ithin the time between the remedy selection and this Five-Year Review, USEPA has published changes to toxicity factors that affect chemical-specific clean-up levels at OU 3. Therefore, **if future work at OU 3 compromises the integrity of the remedies,** a re-evaluation of potential risk ~~at OU 3~~ must be conducted **to determine if revised contaminant action levels are warranted based on new standards and toxicity factors.** ~~before the protectiveness of the current remedies can be determined.~~ Additional items that need to be addressed are described in the previous issues and recommendations and include revision of the PSVP to document the change of remedial action at the site. A completed PSVR, due in

Hill Air Force Base Response to
Five Year Review for Operable Unit 3 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
		2006, will be useful for determining the protectiveness of the remedial actions at OU 3 during the next Five-Year Review (2008).”

Hill Air Force Base Response to
Five Year Review for Operable Unit 4

Five Year Review Item	Hill AFB Response	URS Action
Thoroughly evaluate existing data and determine if additional data and/or modeling are required to develop a plume management plan that meets the RAOs.	Concur	No action.
Evaluate clean-up levels for COCs and amend the ROD, if required, to address current ARAR levels.	Concur	No action.
Complete an investigation to identify all source areas near the Landfill 2 (LF012) and the North Gate Dump areas (OT014) as well as sources near the HDUS contributing to the OU 4 contaminant mass.	Do not concur: Hill will continue to monitor wells in the plume area. Additional wells may be installed to fill data gaps. A study is currently being initiated to evaluate the OU 4 monitoring system and recommend additional wells if needed. If sustained increasing trends are observed, which result in an expansion of plume boundaries, an evaluation will be made to determine if additional source area characterization is warranted.	Concur. Recommendation revised as follows: "Continue to monitor wells in the plume area and if sustained increasing trends are observed, which result in an expansion of plume boundaries, an evaluation should be completed to determine if additional source area characterization is warranted."
Address the above issues and recommendations in a PSVR prior to the scheduled timeframe of 2006 (FFA schedule).	Concur: See previous comment.	No action.
Complete an in-depth review of the existing data as they pertain to the effectiveness of the landfill cap. If the existing data do not provide an adequate assessment of the landfill cap effectiveness, make recommendations for additional data.	Do not concur: During construction of the cap quality control measures were taken to ensure the target permeability ($1x10^{-7}$ cm/s) specifications were met. The current cap maintenance program identifies damage done to the surface that might affect the caps performance. If damage is identified, repairs are made to ensure the cap continues to inhibit infiltration of surface water.	This recommendation stemmed from the analytical results from the downgradient landfill monitoring locations (U4-046 and U4-047). U4-047 has shown an increase in TCE concentration from 2,000 ppb in 1999 to 12,000 ppb in 2002. Recommendation revised as follows: "Complete an investigation into the increase of TCE concentrations in U4-047 and closely monitor future analytical results from this location."

Hill Air Force Base Response to
Five Year Review for Operable Unit 4 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
Establish flow levels for implementation of a surface water collection and treatment system at the seeps.	Concur	No action.
Conduct a site investigation of the buried drain line area to determine the extent of contamination.	Concur: This was accomplished after the drain line was repaired. Trace levels (low ppb) of TCE were detected in the soil that should not pose a threat to the environment.	Concur. Recommendation removed.
Protect drain lines from damage with proper soil cover.	Concur: The exposed 2' sections are elbows where cleanouts are planned. Eroded areas will be backfilled with soil.	No action.
Install additional signage to prevent unauthorized off-Base excavation.	Concur	No action.
Evaluate the causes of reduced flows in the HDUS drain sets (upper, middle, and lower horizontal drain sets) (see Figure OU 4-1) using video logs and flow data. Access points at each drain line may be necessary to allow a video log and to obtain the flow data of each line.	Concur: Flows were evaluated and plans are in place to clean the upper, middle, and lower drain sets.	No action.
Data from the sumps in Landfill 1 and the drain set flows of the HDUS system should be included in the ERPIMS database to allow for trends to be examined. All data that are required in the PSVP should be included in the database. If no data are available during the sampling round or if a point has been discontinued, it should be noted in the database for clarification.	Concur	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 4 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
In the case of a change of circumstances (flow rates, land use, land ownership, land access, etc.), surface water controls will need to be reevaluated and implemented.	Concur	No action.
	Hill AFB is currently evaluating the existing well network to determine if it is adequate to monitor conditions within and at the distal edges of the plume. Initial indications are that the current network needs to be expanded, particularly at the distal end of the western lobe.	Recommendation added: "Evaluate existing well network to determine if it is adequate to monitor conditions within and at the distal edges of the plume and add additional monitoring locations as necessary."
	Protectiveness Statement: Hill AFB concurs that the remedies at OU 4 are currently protective of human health and the environment. No one is currently being exposed to contaminants in the groundwater at the site. However, there are issues that need to be addressed. Hills evaluation of the western lobe suggests this is an area where there is potential for plume expansion. Additional monitoring will be done to assess whether or not the plume is stable, and hence may or may not represent a potential future risk to residents that live down gradient.	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 5

Five Year Review Item	Hill AFB Response	URS Action
Section VIII, Issue 5 – "There has been no published evaluation of indoor air quality in residences above the plumes. However, according to EMR, the Draft RI, to be completed the summer of 2003, includes indoor air sampling that indicates indoor air is not a problem."	Recent sampling events have not detected indoor air problems. However, due to improved sampling methods and understanding of indoor air issues, Hill AFB will continue to monitor indoor air in the OU5 area.	No action.
Section IX, Recommendation 1 – "Evaluate the life expectancy of the site SS017 Phase I (aeration curtain) system and if appropriate replace the blowers with an air compressor."	Concur. Hill AFB has already performed an engineering cost evaluation and determined that replacing the existing air sparge blowers with air compressor is not cost effective. Oil- less air compressors are expensive and the system will need two (2) air compressors.	No action.
Section IX, Recommendation 2 – "Clean the site SS017 Phase I (aeration curtain) sparge lines and develop a preventive maintenance process to prevent unplanned system shutdowns in the future."	Concur. Procedures for sparge line cleaning are included in the O&M manual. Hill AFB will follow up with the O&M contractor to ensure that appropriate maintenance activities are being completed.	No action.
Section IX, Recommendation 3 – "Increase ventilation in the site SS017 Phase I (aeration curtain) blower building."	Concur. Hill AFB is currently evaluating alternatives to increase ventilation in the blower building.	No action.
Section IX, Recommendation 4 – "Shut down the site SS017 Phase II (groundwater extraction) system."	Concur	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 5 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
Section IX, Recommendation 5 – "Continue all institutional controls, primarily, groundwater-use restrictions on the shallow aquifer beneath sites SS017 and SS091 (HAFB 1998)."	Concur	No action.
	Protectiveness Statement: Hill AFB concurs in general with the protectiveness statement. However, the statement that "It appears that the 5 to 100 µg/L portion of the SS017 plume has passed the Phase III (groundwater extraction trench) location and, therefore, will continue to migrate further into the city of Clinton", is contrary to the results of analyses performed by Hill AFB. Hill's analysis suggests that dissolved TCE plume in Clinton may grow by another 500 feet, but that concentrations will decrease rapidly and will be below the MCL in less than twenty years.	After review of the document that prompted this response (Final Contaminant Transport Model Report for Operable Unit 5, Feb, 2002, MWH), the text was revised as follows: "Currently, conditions in the groundwater downgradient of the trench (Figure OU 5-1) are between 5 and 100 µg/L. According to modeling conducted for Hill AFB (MWH 2002d), contamination at these concentrations will remain in the groundwater for between 20 and 30 years."

Hill Air Force Base Response to
Five Year Review for Operable Unit 6

Five Year Review Item	Hill AFB Response	URS Action
Continue the long-term monitoring program as described in the Performance Standard Verification Plan. The monitoring at Cooley's Pond could be reduced if data indicates that surface water quality is not being affected by the contaminated groundwater (i.e., TCE concentrations remain at or below 5 µg/L and do not show an increasing trend). Also, fix well U6-030 and continue sampling to monitor plume stability.	Concur: Monitoring at the Cooley pond has been reduced from monthly to quarterly. If the current trend (<5 ppb) continues, the quarterly monitoring frequency will be adjusted accordingly. U6 –30 has recently been replaced. The new well will be included in future long-term monitoring rounds.	No action.
Evaluate long-term monitoring data to determine if the remedy is preventing plume migration, to determine the remedial progress, and to update the estimated remedial timeframe. The Performance Standard Verification Report should be conducted as scheduled in 2006.	Concur	No action.
Evaluate the need for active treatment in the northern arm of the off-Base contamination plume, as required by the ROD.	Concur	No action.
Continue operation and maintenance of the extraction and discharge components of the Craigdale PTS. Discontinue anti-scaling treatment in the off-line air stripper and bring extraction well U6-213 on-line as soon as possible (scheduled for Spring 2003).	Concur: Plans are in place to discontinue anti-scaling. Extraction Well U6-213 was brought back on line on 28 April 2003.	Well U6-213 was repaired after initial FYR document review. Recommendation was revised to reflect new information. Text was changed as follow: "Continue operation and maintenance of the extraction and discharge components of the Craigdale PTS. Discontinue anti-scaling treatment in the off-line air stripper. ~~stripper and bring extraction well U6-213 on-line as soon as possible (scheduled for Spring 2003)~~."

Hill Air Force Base Response to
Five Year Review for Operable Unit 6 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
Continue operation and maintenance of the on-Base pump and treat system. Evaluate the pumping strategy and, if necessary, upgrade the air stripper discharge pump so that the extraction system can be operated as designed (per the O&M Manual).	Concur with continuation of the on-Base pump and treat system. Do not concur with the recommendation to upgrade the air stripper discharge pump. Its capacity is 90 gpm. 40 gpm is the current actual discharge rate.	Text was revised as follows: "~~Evaluate the pumping strategy and, if necessary, upgrade the air stripper discharge pump so that the extraction system can be operated as designed (per the O&M Manual)~~. **Evaluate treatment system to determine why target groundwater levels at the extraction wells, an indication of plume capture, have not been achieved. System upgrades may be required or plume capture indicators may need to be updated in the O&M Manual."**
Develop a long-term maintenance strategy to closely monitor the bio-fouling problem at the extraction wells and to ensure that adequate treatment is implemented.	Concur: Extraction wells are chlorinated quarterly to prevent bio-fouling.	No action.
Continue all institutional controls. In addition, perform routine checks of locks, fences, and signs at wells and treatment facilities to prevent accidental exposure to contaminated water.	Concur	No action.
Reevaluate indoor air data to determine if the new action level for TCE (0.43 ppbv) in indoor air would warrant additional mitigation measures in off-Base residential areas.	Concur. A plan is currently being prepared to sample air in homes above the OU 6 plume during the upcoming winter season (03-04).	Revised recommendation to include additional air sampling: "Reevaluate indoor air data**, and if necessary obtain additional air samples,** to determine if the new action level for TCE (0.43 ppbv) in indoor air would warrant additional mitigation measures in off-Base residential areas."

Hill Air Force Base Response to
Five Year Review for Operable Unit 6 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
	Protectiveness Statement: Hill AFB concurs that the remedies implemented at OU 6 are currently protective of human health and the environment in the short term. TCE concentrations generally are decreasing across the plume. However, in light of new direction and emphasis on the air exposure pathway, Hill will implement additional in-door air sampling during the upcoming winter season of 2003-04. If vapors are detected at levels above the new action limit, and are found to be originating from shallow groundwater contamination coming from Hill AFB, then steps will be taken to remove vapors from residences.	Evaluating indoor air quality was one of the recommendations but it was not mentioned in the Protective Statement. The Protectiveness Statement was revised to include the following: "**Also, indoor air quality should be evaluated to determine if it has been adversely affected by the OU 6 groundwater plume. Remedial action should be implemented as necessary.**"

Hill Air Force Base Response to
Five Year Review for Operable Unit 7

Five Year Review Item	Hill AFB Response	URS Action
Institutional Controls Section IX, Recommendation 1 – "Change the warning sign verbiage to provide a warning of the presence of contaminated soils that could pose a hazard if exposed."	Do not concur. Current signage "Caution: Do Not Disturb Floor, Contact EMR, Phone 7-7890" is the language that was determined to be most appropriate by Bldg 225 managers, SGB management, EMR, and regulators.	Recommendation revised as follows: "**When signs are replaced or additional signs are added, change wording** to provide a warning of the presence of contaminated soils that could pose a hazard if exposed. **For example: "Caution: Do not disturb floor or soil under floor. Disturbance could cause exposure to contaminated soils. Contact EMR, 7-7890".**"
Inspection and Maintenance Program Section IX, Recommendation 2 – "Remedy defects in floor slab as soon as they are identified to ensure minimal infiltration. Floor slab cracks are scheduled for repair during 2003."	Concur	No action.
Section IX, Recommendation 3 – "Replace tape, which outlines the areas of attainment, with paint or another method of delineation. The marking tape is scheduled to be replaced during 2003."	Do not Concur. Painting the delineation lines has been tried previously and has performed more poorly than the current tape however, Hill AFB is not opposed to another method if it proves to be more successful.	Recommendation revised as follows: "Replace tape, which outlines the areas of attainment, with ~~paint or~~ another method of delineation. [The marking tape is scheduled **for replacement** during 2003.]"
Performance Monitoring Section IX, Recommendation 4 – "Review historical soil moisture data in an effort to ascertain the cause of the migration of hexavalent chromium above MCLs in the groundwater underlying the areas of attainment and the elevated concentrations of hexavalent chromium downgradient of the source area."	Do not concur. Hexavalent chromium has been in the water table prior to the Remedial Investigation and was carried there as part of the initial release when the plating shop was active and discharging fluids to the corroded waste lines. When the plating area closed the fluids that acted as a carrier in the leaking pipes was eliminated and contamination could	Recommendation revised as follows: "Investigate source of elevated hexavalent chromium concentrations in the groundwater underlying the SS027 site. Investigate potential remedial options if necessary."

Hill Air Force Base Response to
Five Year Review for Operable Unit 7 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
Section IX, Recommendation 5 – "Once the source and fate of the migrating hexavalent chromium is identified, review potential remedial options."	no longer reach the groundwater. Since the monitoring wells were installed and sampling began, the trends indicate decreasing hexavalent chrome concentrations that support the site conceptual model. In addition, an evaluation of soil moisture data performed by Hill AFB conclusively shows that soil moisture has not changed since the baseline soil moisture readings were collected. Please be aware that increases in soil moisture have to exceed the field capacity (f_p) of a soil prior to transport occurring. Soil moistures at OU7 do not exceed 16% and that is in clay soils which are naturally going to be higher in soil moisture. Overall that data from this sites shows that the floor slab remedy is performing as expected and is effective.	Concur. Recommendation removed.
Section IX, Recommendation 6 – "Determine if a soil moisture probe is required in the middle chromium plating area of attainment."	Do not concur. The only sources of water near the areas of attainment at OU7 were located to the north and south as stated above in comment 2. Because of the locations of potential water supplies it was determined by EMR and Regulatory agencies that neutron probes were only needed on the north and south attainment areas.	Information not previously available. Recommendation removed.
Section IX, Recommendation 7 – "Establish an appropriate action level for an increase in soil moisture content based on soil moisture results."	Concur	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 7 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
Section IX, Recommendation 8 – "Determine what actions should be taken if an increase in soil moisture content occurs at a particular depth."	Concur	No action.
Section IX, Recommendation 9 – "Evaluate soil moisture logs along the length of the monitoring point, not just 7-8 feet bgs."	Do not concur. The interval from 7 to 8 feet bgs was chosen as an evaluation point because it corresponds to the top of the clay layer that is found at all the areas of attainment and will be the first location where excess soil moisture will accumulate. However, hill AFB is also in accord with evaluating the data from all depths.	After discussions with EMR, recommendation revised as follows: "Annual reporting is inadequate to determine if neutron logging data are being compared to the previous logging event and the baseline log developed during initial installation of soil moisture probe locations. The annual report should be modified to capture current, historical, and baseline data for all intervals to ensure proper evaluation of these data."
Section IX, Recommendation 10 – "Schedule soil moisture data collection in the same months of each year to ensure comparable results."	Concur	No action.
Section IX, Recommendation 11 – "Incorporate historical data from annual reports and current neutron logging data at all intervals into ERPIMS to ensure data availability for future comparisons."	Concur	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 7 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
General Section IX, Recommendation 12 – "Review the PSVP and ensure either the LTM or O&M contractor is addressing all aspects of monitoring and reporting."	Do not concur. It is the understanding of Hill AFB that measures outlined in the PSVP are currently being followed.	URS has identified two areas in the PSVP that are not being followed. The PSVP states that the SCM for OU 7 will be reviewed empirically annually using data collected in the TSOR, IMMR, and Annual Groundwater Sampling Report, and elsewhere. Based on interviews with EMR and O&M personnel and reports available to URS, this review is not being conducted. Per the PSVP, graphs will be prepared of the concentration (VOCs, hexavalent chromium, chromium, and cadmium) at each monitoring well (T-228-001, U7-008, and U7-012) and presented in the annual report. This is not included in the annual reports to date and is not being graphed independently by EMR. Changes in concentrations of these contaminants is critical to understanding if the remedy is performing as designed. Therefore, these data should be reviewed at least annually. Therefore, the recommendation has not been modified.
Section IX, Recommendation 13 – "Re-evaluate risk analysis due to change in hexavalent chromium reference dose levels."	Concur. Reference dose levels have changed, however the exposure pathway has not. A reinforced concrete floor prevents the exposure pathway being completed. If construction activities, requiring the concrete floor to be removed, were to occur at some point in the future then a revised risk analysis should be conducted to provide protectiveness to workers	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 7 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
	Protectiveness Statement: Hill AFB does not concur with the protectiveness statement. Hill AFB believes the remedy is protective. Soil moisture data indicate the continued transport of metals is unlikely beneath the slab because there is no more vertical migration of fluid to the water table. Monitoring data indicate that metals concentrations are decreasing suggesting that the source area is no longer impacting the shallow ground water.	Although the remedy is not protective of the environment, the elevated hexavalent chromium levels do not pose an unacceptable risk to human health or the environment. Based on the FYR guidance document, a "not protective" statement cannot be concluded without unacceptable risk. Since there are no receptors nor are there likely to be any receptors in the near future, the determination has been changed to protective. The Protectiveness Statement was revised as follows: "The remedy at OU 7 is protective of human health because there is no pathway for exposure. However, there is adverse impact to the environment based on concentrations that exceed MCLs in the groundwater directly below the Building 225 Chromium Spill site (Site SS027) and evidence of downgradient contamination. The actions outlined in the recommendations need to be addressed to ensure continued protectiveness, particularly identification of the source and fate of increasing hexavalent chromium concentrations in groundwater. Based on the results of these investigations, potential remedial options should be identified."

Hill Air Force Base Response to
Five Year Review for Operable Unit 8

Five Year Review Item	Hill AFB Response	URS Action
Section IX, Recommendation 1 – "Clarify appropriate COCs in the final ROD."	Concur	No action.
Section IX, Recommendation 2 – "Investigate the following options: a. Reduce the frequency of sampling for the East system wells due to their historical contaminant concentration stability and low contaminant levels to ensure a cost effective sampling plan, b. Reduce the MDL with the laboratory to a reporting limit less than 5 µg/L for better quantification of contaminant concentration to support taking wells off-line, c. Take some or all of the East System wells off-line (U8-201, U8-207, U8-208) based statistically-proven concentrations below MCLs and modeling to ensure capture of the 5 µg/L contour is not compromised, and d. Change the discharge point of the East System from the sanitary sewer to the storm drain due to the low concentrations being captured by this section of the system."	a. Do not concur. Quarterly sampling is conducted at eight extraction wells so that the mass of VOC removal can be calculated for annual Treatment System Operating Report b. Concur c. Do not Concur. Hill AFB recommends that U8-201 be shut down and the regulatory community be notified d. Concur	Recommendation revised as follows: "Investigate the following options: a. Reduce the cost of the sampling program by reducing the frequency of sampling for the East system wells if the change does not significantly impact the accuracy of the mass removal calculation." b. No action. c. The Hill AFB response is in agreement with the DRAFT recommendation. Recommendation revised as follows: "**In an effort to reduce system operating costs,** take some or all of the East System wells off-line (U8-201, U8-207, U8-208) based **on** statistically-proven concentrations below MCLs and modeling to ensure that capture of the 5 µg/L contour is not compromised, and" d. No action.
Section IX, Recommendation 3 – "Calculate maximum shutdown durations for each well within the IRA system to ensure future capture of the entire plume transect. Compare the maximum well shutdown durations for each well to determine the maximum system shutdown duration."	Concur	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 8 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
Section IX, Recommendation 4 – "Address operational issues: a. Replacement pump purchases should be based on actual flows and not modeled projections, as the currently installed pumps fail. b. Clean and maintain spare pumps. c. Complete a cost-benefit analysis for replacement or re-engineering of the current pressure transmitter enclosures."	a. Do not concur. Current practice is to purchase new pumps of a size commensurate with actual flows. During the next revision of the O&M plan, the pump specifications based on predicted flows will be replaced by the pump specifications for actual flows. There is no electromechanical evidence in broken pumps to suggest that a pump sizing has caused the failure. b. Concur c. Concur	a. Recommendation revised as follows: "a. During the next revision of the O&M Plan, the pump specifications based on predicted flows should be replaced by pump specifications based on actual flows." b. No action. c. No action.
Section IX, Recommendation 5 – "Review previous indoor air results to ensure future residents' health based on the new criteria of 0.43 ppbv of TCE."	Concur. Plans are being made to implement additional air sampling during winter 03-04 to assess this issue	Recommendation revised as follows: "Re-evaluate indoor air data**, and if necessary obtain additional air samples,** to determine if the new action level for TCE (0.43 ppbv) in indoor air would warrant additional mitigation measures in off-Base residential areas."
Section IX, Recommendation 6 – "Perform additional sampling at U3-610 to develop a representation of the current exposure risks at this location."	Do not concur. The surface sampling point in question is U3-633 not U3-610. U3-610 is covered by a metal grating and physical contact with the water is not possible. U3-633 is a field drain on private property. It was last sampled in April 2003 and analytical results are pending.	[The April 2003 sampling event results were published after the review period for this FYR (through Sep 2002).] Recommendation revised as follows: "Review analytical sampling results for U3-633 to quantify exposure risks at this location. Continue sampling at this location to develop a statistically relevant representation of the exposure risks."
	Protectiveness Statement: Hill AFB concurs with the protectiveness statement.	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 9

Five Year Review Item	Hill AFB Response	URS Action
IX Recommendations and Follow-up Actions for OU 9	No comments. The recommendations and follow-up actions are acceptable and accurate.	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 10

Five Year Review Item	Hill AFB Response	URS Action
IX Recommendations and Follow-up Actions for OU 10	It is recommended that a follow-up action to conduct indoor air sampling be added to the list.	Recommendation added as follows: "Conduct air sampling in off-Base residences to determine if the new action level for TCE (0.43 ppbv) in indoor air warrants mitigation measures in off-Base residential areas."

Hill Air Force Base Response to
Five Year Review for Operable Unit 11

Five Year Review Item	Hill AFB Response	URS Action
Section IX, Recommendation 1 – "Perform a comprehensive groundwater characterization for contaminants of concern in the groundwater. Compile characterization information in the RI report and generate FS."	Concur.	No action.
Section IX, Recommendation 2 – "Select and implement a remedy, if required, in accordance with CERCLA criteria."	Concur	No action.
	Protectiveness Statement: Hill AFB concurs with the protectiveness statement.	No action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 12

Five Year Review Item	Hill AFB Response	URS Action
General Item – Reference to "Roy Plume"	The City of Roy has asked that the OU12 plume NOT be referred to as the "Roy Plume". All references to the "Roy Plume" should be replaced with "OU12 plume" in the document.	All references to the "Roy Plume" were replaced with "OU 12 plume".
Section IX, Recommendation 1 – "Delineate and remove the source area."	Concur. Investigation work is continuing to delineate the OU12 source zone.	No Action.
Section IX, Recommendation 2 – "Continue with installation of the Base Boundary Hydraulic Containment Treatability Study System, as it should allow for continuing work to remove and investigate the source area without concern of contaminant migration off-Base."	Concur. This system has been installed and became operational in April 2003.	No Action.
Section IX, Recommendation 3 – "Consider the possibility of an early action to address the area of the plume off-Base where basements are being affected."	Concur. Hill AFB is currently developing a plan to install a system in the western portion of the OU12 plume.	No Action.
Section IX, Recommendation 4 – "Determine areas of potential risk for indoor air contamination and develop a sampling plan to catch and address any contamination early."	Concur. Because not every home over the plume shows indoor air contamination, Hill AFB is working to identify factors that control the movement of TCE-contaminated vapors into homes. Identification of these factors should increase our ability to determine areas of potential risk.	No Action.

Hill Air Force Base Response to
Five Year Review for Operable Unit 12 (Continued)

Five Year Review Item	Hill AFB Response	URS Action
Section IX, Recommendation 5 – "Institute a sampling plan for the location off-Base where groundwater surfaces to identify any contamination, if it exists, as early as possible."	Concur. Sampling of the surface water discharge and land drain discharge at OU12 is already being performed and has previously been performed.	No Action.
	Protectiveness Statement: Hill AFB concurs with the protectiveness statement for OU12. However, the statement that "Remedial measures to protect human health will be addressed after completion of the RI/FS and ROD and are scheduled to be in place by 2007" is somewhat misleading. Hill AFB has installed vapor removal systems in several residences where TCE concentrations have been found to exceed human-health based screening values. Hill AFB will continue to immediately address any instances where exposure pathways are complete and concentrations are above human-health based risk standards. Hill AFB has installed vapor removal systems in several residences where TCE concentrations have been found to exceed human-health based screening values and will continue to address such cases as they are identified.	Protectiveness Statement revised as follows: "Remedial measures ~~to protect human health~~ **for the contaminated groundwater** will be addressed after completion of the RI/FS and ROD and are scheduled to be in place by 2007. Although……concern. Hill AFB has installed vapor removal systems in several residences where TCE concentrations have been found to exceed human-health based screening levels and will continue to address such cases as they are identified."

Appendix A.2

Restoration Advisory Board Comments on May DRAFT of Five-Year Review Report

Table A.2
URS Response to comments by Al Herring (RAB) and EMR to 5/2 DRAFT

Comment I.D.	Al Herring Comment	EMR Review/Direction	URS Action
General Comments			
1	This is a valuable document which I feel is well worth the effort and expense involved. I learned much by reading the draft, and I would guess that EMR personnel also gained some new insights.	JWW: Noted.	No action.
2	The figures are especially valuable. I consider them so important, in fact, that I recommend that consideration be given using the site figures as the first page for each OU section. The careful thought given to their content is appreciated.	JWW: OK to place OU figures at the beginning of the main OU text or leave them in their current position.	No action.
3	The FYR is *very* repetitive. Using OU2 as an example, recommendations are repeated three times (once in the OU text, once in the Base response, and again in the IRP WP007 section.) I would estimate that at least 50% of the IRP WP007 section is a word-for-word repeat of text in the OU2 discussion. The reader, especially if uninitiated, is probably left wondering, "Why are they driving me crazy with this repetition?" In this regard I have several suggestions:	No EMR response provided.	No action.
3a	First, it is unclear to me if the Base response for each OU is intended for inclusion in the final document, or if they were provided just to help (or bias) the reviewers at this stage. (I personally found them to be helpful and thought that the repetition even gave a useful emphasis.) However, if Base comments are intended for inclusion in the final document, it would be a simple thing to insert them in brackets following each recommendation in the text of each Section IX. For example, (from OU2): "1. Jointly evaluate the effectiveness of the SRS and the containment wall. [Concur. Work related to this recommendation is planned for this year.]" On the other hand, if the decision is to include Base comments and keep the present format, it would be nice to at least dignify them with page numbers. (I note that Base comments were sometimes counted in the pagination sequences and sometimes not. Consistency is needed.) Of course, if they are not intended for inclusion, this is all moot.	JWW: Noted.	All comments and resolution on the 2/ May DRAFT included in Appendix A. Hill EMR comments are A.1, RAB comments are A.2, and Hill EMR Comments on Preliminary versions are A.3.

Table A.2
URS Response to comments by Al Herring (RAB) and EMR to 5/2 DRAFT (Continued)

Comment I.D.	Al Herring Comment	EMR Review/Direction	URS Action
3b	My preference would be to append all IRP sections. (I realize that the OU discussions were built from the IRP sections and that the IRP sections do contain some potentially valuable details. However, I think few people are going to read them.) Appending them would give separation and reduce the impression of endless repetition. However, if the decision is to stick with the present format, it would be nice to at least warn the reader in the Introduction that large sections in the OU discussions will be repeated verbatim in the IRP sections. Perhaps a paragraph on "How to Read This Document" would be appropriate. And if the decision is made to leave the IRP sections in the body of the report, start them just below the Section XIII headings instead of having them "attached." (This would save about 12 pages.)	JWW: Recall we were going to append the site chronologies and site summaries. If URS chooses to remain with this structure, I recommend that URS adopt the AH suggestion alerting readers early in the report of the report structure to avoid reading redundant text.	Concur. Text modified to present the structure of the report to the reader in both Section VII and in Section XIII of each OU Summary.
4	I note that the Base, EPA, and the State agreed on a new and lower action level for TCE in indoor air which may affective protectiveness determinations in many of the IRPs. This got me thinking about 1,2-DCA, which is even more easily transported and has (I gather) about the same toxicity. Does the 1,2-DCA action level for indoor air need to be re-evaluated?	JWW: Recommend that you contact Steve Hicken for further guidance on indoor air issues.	No action. Action levels for VOCs are being evaluated by UDEQ, EPA, and Hill AFB. This issue should be addressed in the 2008 FYR.
Specific Comments			
List of Acronyms	Some acronyms used in the text are not included. Those I noted as missing were IRA, PAH, and SW.	JWW: Noted.	Concur. List updated.
Executive Summary			
a)	To say the review "was intended to: 1) confirm that the remedy is operating as designed" strikes me as inappropriate. Someone could even construe the statement to indicate bias on the part of the reviewer. It is also inconsistent with the more appropriate statement given shortly afterward: "Is the remedy functioning as intended by the decision document?" The second paragraph strikes me as just a clumsy rewording of the "three questions" listed in the third paragraph. This part of the Executive Summary should be rewritten to improve clarity and eliminate repetition.	JWW: Concurs with AH suggestions in (a) and (b).	Concur. Text modified to replace "confirm" with "evaluate whether"..

Table A.2
URS Response to comments by Al Herring (RAB) and EMR to 5/2 DRAFT (Continued)

Comment I.D.	Al Herring Comment	EMR Review/Direction	URS Action
b)	The table lists two determinations as "Not protective" and ends there without further comment. If I were an executive reading this Executive Summary, I would sure want to know more about the "Not protective" sites and the implications of the findings. (For example, is there an eminent danger to public health? Am I at risk of going to jail?) To not provide a brief discussion of the "Not protective" findings means that the executive has to go digging for the answer to his or her perhaps most important question.	JWW: Concurs with AH suggestions in (a) and (b).	Concur. Text modified.
Introduction			
a)	It again bothers me that the review is intended (third paragraph) to "confirm that the remedy is operating as designed." Surely the intent is to "*evaluate whether* the remedy is operating as designed."	No EMR response provided.	Concur. Text modified.
b)	It strikes me that there should be early mention of which OU's have ROD's and which do not, and how this affects the FYR review. This could be done in the Introduction or possibly in the Description of Process, but listing them first in III-3 is too late and too hidden.	JWW: In (b) AH is referring to text in the 3rd paragraph, page III-3.	Concur. Introduction text modified.
c)	In Table 2, it would be nice to flatter the Restoration Advisory Board by listing its formation in 1995.	No EMR response provided.	Concur. Table modified.
Description of Process	Fourth paragraph on II-1, I would like to see the first sentence read, "Members of the Restoration Advisory Board (RAB), a group of local people representing the surrounding communities *and interest groups*, . . ." (Several of us do not represent communities.)	JWW: Concur.	Concur. Text modified.
Conclusions and Recommendations			
a)	This section begins with a paragraph titled, "Five-Year Review Process." This is not a conclusion or recommendation. The prior section was the "Description of Process" and if this first paragraph contains anything significant which is not already covered in that section, it should be added there rather than left to clutter up Conclusions and Recommendations.	No EMR response provided.	This is the introduction for the section and includes the conclusion that the process was successful. The heading was removed.

Table A.2
URS Response to comments by Al Herring (RAB) and EMR to 5/2 DRAFT (Continued)

Comment I.D.	Al Herring Comment	EMR Review/Direction	URS Action
b)	In general, this section strikes me as long on discussing processes and short on any meaningful discussion or conclusions about protectiveness. Again, if I am the person who got concerned about two IRP's being "not protective" while reading the Executive Summary, I would hope to find some more detail concerning those determinations and whether there is any imminent hazard to human health. I suggest that URS rewrite this section with a critical eye given to the recommendations and conclusions that need special emphasis.	JWW: (b) Concurs.	Section III provides a list of the issues and recommendations that are emphasized from all those mentioned in the OU and Site Summaries. Section IV discusses Protectiveness. Text in Section IV was modified to discuss the OU that is not protective.
References (Tab VI)	References for what? These four little references hardly seem worthy of a major section and two pages of basically blank paper. Why not just list them somewhere within the Description of Process section?	JWW: Suggest combining references with those cited in Appendix C. See Response #19 below.	Separate reference lists are for specific sections of the FYR Report. App. C. includes all documents reviewed for the 2003 FYR, not just those called-out in the text. Reference list titles were modified to clarify.

Table A.2
URS Response to comments by Al Herring (RAB) and EMR to 5/2 DRAFT (Continued)

Comment I.D.	Al Herring Comment	EMR Review/Direction	URS Action
OU 1	In the Background section, I see no mention of a possible source for arsenic contamination. However, on page OU 1-2, the statement is made that "Sediments from spring areas with arsenic contamination above 11 mg/kg will be identified and excavated after the springs have ceased to flow." Furthermore, for WP005 (Berman Pond in OU3) the cleanup level required for arsenic in soil is listed at 4.1 mg/kg. Three questions: (1) Are the elevated arsenic levels found in OU 1 spring sediments possibly natural? (2) Why the difference in cleanup targets? (3) Why is arsenic soil contamination not mentioned in lists of Contaminants of Concern for any of the OU 1 IRP's?	JWW: Noted. It is likely that Arsenic is natural in the soil. The release of various organic compounds is thought to have mobilized it. KG: 1) concur with Jeff's response; 2) both of the cleanup targets are based on determination of the "background" concentration of arsenic in the soil. Background is determined by collection and analysis of samples from outside the area of known contamination. The background level for OU3 was determined to be the upper 95% confidence limit from 14 samples collected from OU3 and OU7. The background level for OU1 was based on the results of 26 samples collected and analyzed from OU1, OU2, and OU4. The background level was determined to be the maximum measured arsenic concentration (2 samples had 11 mg/kg); 3)?	1) The concentrations in the soil at OU 3 are within background concentrations; 2) Concur with K. Gorder's comments; 3) Arsenic is not an indicator chemical for carcinogenic/noncarcinogenic effects for soil since the concentrations at the time of the RI were within background levels (1.2-22 mg/kg, maximum of 10 mg/kg). However, arsenic was detected in the groundwater and surface water at a maximum of 1,160 ug/L. This is because conditions in the groundwater at OU 1 are reducing. Chemically reducing conditions (low dissolved oxygen, low redox potential) in OU 1 ground water influences concentrations of some constituents, particularly iron, arsenic, and organic compounds such as TCE, PCE, and vinyl chloride. Text Modified.
OU 2	On page OU 2-5, the statement is made that "The baseline risk assessment considered the inhalation of indoor air in conjunction with showering as a potentially significant current and future pathway for both onsite and offsite residential exposure." This implies that potable water in this area is contaminated with TCE, a possibility that is surely deserving of comment.	JWW: Noted. Suggest clarification or further comment. The 1992 BRA may have considered showering with water obtained from local, shallow contaminated groundwater sources.	Concur. Text modified.

Table A.2
URS Response to comments by Al Herring (RAB) and EMR to 5/2 DRAFT (Continued)

Comment I.D.	Al Herring Comment	EMR Review/Direction	URS Action
OU 2		KG: Upon further review of the 1992 BRA, I disagree with the FYR section in question. The BRA did not consider inhalation during showering as a completed exposure pathway for the current scenario (was considered a potential future). Page 3-2 indicates that existing shallow potable water wells are (were?) located downgradient of the OU2 plume. However, the exposure assessment on page 3-25 has inhalation during shower crossed out with the explanation that "Currently, all residences use municipal water supply". The BRA did (crudely by today's standards) attempt to quantify the risk from ambient air and recognized the potential for indoor air contamination. Suggest adding this clarification to the response to comments and changing the text to read "…considered the inhalation of ambient and indoor air as a potentially significant current and future pathway for both onsite and offsite residential exposure." May want to add statement that calculated risk did not indicate that immediate action was required (?)	
OU 3			
a)	In Background, it would be nice to give some indication of what the contaminants of concern are for Berman Pond. The fourth sentence would be smoother if it began, "Performance indicators for these two sites include. . . ."	JWW: (a) Noted.	Concur. Text modified.
b)	In answering the three questions (pages OU 3-4 and 5) the writer departs from the format followed for all other OU's in the FYR by not giving a simple "Yes" or "No" answer before expanding on the reason.	JWW: (b) Noted. Suggest URS maintain consistency in format.	Concur. Text modified.

Table A.2
URS Response to comments by Al Herring (RAB) and EMR to 5/2 DRAFT (Continued)

Comment I.D.	Al Herring Comment	EMR Review/Direction	URS Action
c)	On page OU 3-4, the first sentence for ST004 would be more straight forward if it began, "Performance indices include significant increases in groundwater pH or in concentrations of TDS, sodium, arsenic, or selenium downgradient. . . . "	JWW: (c) Noted.	Concur. Text modified.
d)	More importantly, the writer notes (page OU 3-4) that "Groundwater levels at the extraction sumps at Berman Pond show that the elevations are approximately 10 feet above the action level prescribed in the PSVP and have been since 1998. Pumps have not been installed in the groundwater extraction sumps, as prescribed in the ROD." However, in Table OU 3-3, the answer to the question "Is the remedy function as intended by the decision documents?" is given as "Yes"! Surely the answer must be "No." (EMR staff may believe the perched contaminated groundwater is being captured by the OU 8 interim wells, but the fact seems to remain that the groundwater levels at Berman Pond are 10 feet above the action level.)	JWW: (d) Noted, URS reasoning seems adequate.	No action.
e)	In the Issues section (page OU 3-5) the statement is made for Berman Pond that "When the perched groundwater elevations exceed the action level, pumps should be installed and a pumping strategy, sampling and analysis plan, and continued groundwater lever monitoring should be implemented." Then the writer seems to contradict him or herself in the Recommendations section (page OU 3-6) by saying "The PSVP should be revised to document the change of remedial actions at the site. . . ." Which is it to be? (I would favor addressing the problem as prescribed in the ROD, rather than changing the paperwork.)	JWW: (e) Noted, perhaps insert text, "The ROD states that when the perched GW elevations…."	Concur. Text modified.
f)	It is not obvious to me why Contaminants of Concern for ST004 are given as "NA," whereas there is a long list for WP005.	JWW: (f) Noted.	No action. There is no chemical contaminant of concern at ST004. The condition requiring action is pH.
g)	On page 1 of 5 for WP005, I think "1WTP" should be "IWTP."	JWW: (g) Concur.	Concur. Text modified.

Table A.2
URS Response to comments by Al Herring (RAB) and EMR to 5/2 DRAFT (Continued)

Comment I.D.	Al Herring Comment	EMR Review/Direction	URS Action
h)	On page 3 of 5 for WP005, Question B, the ingestion and inhalation CSF's for PCB-1254 look scrambled. More importantly, why are they even being discussed since PCB is not listed as a Contaminant of Concern for this IRP?	JWW: (h) Noted, AH is referring to the Site Summary for WP005.	Concur. Text modified to clarify unit. PCB-1254 is listed as a COC for WP005.
OU 4	In the second paragraph (page OU 4-1), it sounds funny to say that an area of high TCE concentration "was *recently* discovered in the vicinity [of] well U4-080 in 1996."	JWW: Noted.	Concur. Text modified.
OU 6	The classification of "Protective in the short-term" for OT026 (page 6 of 7) strikes me as inconsistent and far too optimistic considering the Technical Assessment observation on page OU 6-4 that "Several of the indoor air results from the original RI were above this new [TCE] action level, creating the potential for air quality issues that have not been addressed," and the Recommendation made on page OU 6-5 to "Re-evaluate indoor air data to determine if the new action level for TCE (0.43 ppbv) in indoor air would warrant additional mitigation measures in off-Base residential areas." The OU 6 protectiveness classification of "Protective in the short-term" also strikes me as inconsistent with the classification made for WP002 in OU 1 (on page 9 of 9 for WP002) which was, "Protectiveness cannot be determined until further information is obtained." As noted under Issues (page 8 of 9), "some of the indoor air sampling results, collected during the RI, exceed the new action level for TCE in indoor air (0.43 ppbv)," and a recommenddation was made to "Reevaluate the RI data on indoor air and determine if the new action level for TCE (0.43 ppbv) in indoor air warrants additional mitigation measures in off-Base residential areas." Thus, we have two separate IRP's which had TCE levels in indoor air samples above the new action level, but the protectiveness classifications and statements are quite different. I feel strongly that the protectiveness classify-cation for OT026 should also be "Protectiveness cannot be determined until further information is obtained."	JWW: Concur.	Concur. Text modified.

Table A.2
URS Response to comments by Al Herring (RAB) and EMR to 5/2 DRAFT (Continued)

Comment I.D.	Al Herring Comment	EMR Review/Direction	URS Action
OU 7			
a)	On page OU 7-3, the statement is made that "The reference dose for hexavalent chromium has changed from 5E-3 to 3E-5 in soil (100 times more stringent). . ," and this statement is repeated on page 3 of 3 in Appendix E. However, I interpret this to mean that the standard has changed from 1/(5)(5)(5) to 1/(3)(3)(3)(3)(3), or 1/125 to 1/243. This is approximately two times as stringent, not 100 times.	JWW: (a) Noted.	5E-3 is engineering notation for 5×10^{-3} or 0.005. Text modified so that numbers greater than 10^{-4} are written out and smaller numbers are written in engineering notation. Engineering notation is explained in the List of Acronymns.
b)	I agree with Base EMR personnel that the designation of "Not protective" for SS027 seems too harsh. I note on page 5 of 5 that the Protectiveness Statement says "There are no current human health risks at this site because the areas of contamination are beneath the concrete floor slab prevent the completion of an exposure pathway. However, due to the apparent migration of contamination of above MCLs from the source area to surrounding soil and groundwater, this remedy is not protective of the *environment*." Speaking as the Sierra Club representative on the RAB and as a person who is highly concerned about protecting the environment, I have no idea of what if any threat hexavalent chromium in the area of SS027 poses to the environment, nor does the author offer any explanation. I would also contrast the concerns expressed for migrating chromium at SS027 with the statement made on page OU 8-2: "Reduction of hexavalent chromium to immobile trivalent forms occurs in subsurface environments and may be sufficient to mitigate its transport."	JWW: (b) Noted.	Concur. Text modified.
c)	For the Base response to Recommendation 9, *hill* needs to be capitalized.	JWW: (c) Noted.	No action.
OU 8			
a)	In the Introduction, it needs to be stated that OU 8 does not yet have a ROD. The Introduction for OU 5 handled this situation nicely and could be used as a model.	JWW: (a) Noted.	Concur. Text modified.

Table A.2
URS Response to comments by Al Herring (RAB) and EMR to 5/2 DRAFT (Continued)

Comment I.D.	Al Herring Comment	EMR Review/Direction	URS Action
b)	Layton may not be as sensitive as Roy, but I think there could be a better name for this plume. In addition, I think it is somewhat misleading to call it a "TCE plume" since 1,2-DCA may ultimately turn out to be the bigger issue. How about calling it something like the "South TCE/DCA Plume"?	JWW: (b) Noted.	No action.
c)	On page OU 8, the term "abiotic" degradation is used. My dictionary and I are not familiar with "abiotic" and it would be helpful if there were a brief explanation.	JWW: (c) suggest "abiotic" be defined to mean any transformation not mediated by biotic agents.	Concur. Text modified.
d)	The argument on well pumps being oversized seems a bit specious. If the pump capacities were based on needed flows (from the model) but actual flows are less, it seems to me that the recommendation should be to get flows up to design (through actions such as cleaning screens, "fracing" wells, or acid cleaning) rather than replacing with smaller pumps.	JWW: (d) suggest clarification.	Text modified to suggest that pump specifications be based on actual flows instead of predicted flows.
OU 9			
a)	Introduction needs to state that OU 9 has no ROD.	JWW: Noted.	Concur. Text modified.
b)	Background needs to give some background on SD034. For example, what are the primary contaminants of concern? (Right now these are buried on page OU 9-15.)	JWW: Noted.	Concur. Text modified to direct reader to the CoCs in the Site Summary.
OU 10	Clarify in Introduction that there is no ROD for this unit.	JWW: Noted.	No action.
OU 11			
a)	Clarify in Introduction that there is no ROD for this unit.	JWW: Noted. SR: I reviewed Al's comments on OU11 and concur with them.	Concur. Text modified.
b)	In line four of the Introduction, it should be "benzene, toluene, ethylbenzene, and xylenes (BTEX)"	JWW: Noted.	Concur. Text modified.
c)	In second paragraph of Background, use of "ethyl [sic]" is awkward. Why not call it the "Ethyl" tank? Otherwise the reader is left wondering why the writer wanted to *sic* it.	JWW: Noted.	Concur. Text modified.

Table A.2
URS Response to comments by Al Herring (RAB) and EMR to 5/2 DRAFT (Continued)

Comment I.D.	Al Herring Comment	EMR Review/Direction	URS Action
OU 12	Clarify in Introduction that there is no ROD for this unit.	JWW: Noted.	Concur. Text modified.
Appendix A	Interesting, but I see no reason to include it in the final draft.	JWW: Concur	All comments and resolution on the 2/ May DRAFT included in Appendix A. Hill EMR comments are A.1, RAB comments are A.2, and Hill EMR Comments on Preliminary versions are A.3.
Appendix C	Aren't the "Documents Reviewed for Hill AFB 2003 Five-Year Review" just a re-listing of the documents given in Section VII for each of the OU's? If so, I would say delete this section. (Why be repetitive?) Similarly, the list of Personal Communications could be easily moved to the Description of Process Section (if it is needed at all), thus eliminating the whole appendix.	JWW: Concur, see Response #6 above. Perhaps general references could be included in Reference tab (VI) and OU-specific references can be included in the main OU summaries. Concur with AH for Personal Communications.	Separate reference lists are for specific sections of the FYR Report. App. C. includes all documents reviewed for the 2003 FYR as well as all personal communications, not just those called-out in the text. Reference list titles were modified to clarify.

Appendix A.3

Hill AFB EMR Comments on Preliminary Versions of Five-Year Review Report

General
Comments Prepared By: Jeff Watkins

----- Forwarded by B Hall/SaltLakeCity/URSCorp on 02/06/03 01:23 PM -----

Watkins Jeffrey W Civ OO-ALC/EMR <Jeffrey.Watkins@HILL.af.mil>

02/05/03 09:51 AM

To:"'B_Hall@urscorp.com'" <B_Hall@urscorp.com>
cc:Elliott Bob T Civ OO-ALC/EMR <Bob.Elliott@HILL.af.mil>, "Al Herring (E-mail)" <al.mary.herring@worldnet.att.net>, "Gregor"Fisher(Email)" <gfisher@utahsbr.edu>, "'Michele Straube'" <mstraube@mindspring.com>, Fisher Barbara Contr OO-ALC/EMR <Barbara.Fisher2@HILL.af.mil>, Harris Dave Contr OO-ALC/EMR <Dave.Harris2@HILL.af.mil>
Subject:Review Comments, Preliminary Test Models

Hi B
Please see the attached for my comments on the preliminary test models. In general, they look good. Be merciless with verbiage to include only that information directly relevant to remediation and pursuit of easy readability. There should be a logical flow from Background through each section to the Protectiveness Statement, with minimum redundancy.
Many thanks!
Jeff

<<FYR Test Model Review Comments.doc>>

FYR Test Model Review Comments.doc

OU: General
Comments Prepared By: Jeff Watkins and Mark Holt

Watkins Jeffrey W Civ OO-ALC/EMR
Jeffrey.Watkins@HILL.af.mil
02/07/03 06:54 AM

To:'"B_Hall@URSCorp.com"' <B_Hall@URSCorp.com>,
Holt Mark S Civ OO-ALC/EMR <Mark.Holt@HILL.af.mil>
cc:Remmet_deGroot@URSCorp.com, Jeremy_Cox@URSCorp.com
Subject: RE: Most Efficient Figure Generation - Proposal

Hi Folks
For a figure in the main text showing a plume, perhaps the overall plume footprint is sufficient, with minimum individual layering required to support text. Treatment systems and monitoring networks in skeletal format should be placed on it, also w/o showing any more detail than necessary to support main text. For instance, piping from wells to air strippers is not necessary. For plumes that extend off-base onto private property, it is important to include just enough urban and system detail for citizens to understand where the plumes, major monitoring points (as in PSVPs perhaps), and systems are relative to their homes, schools, major roadways, etc. The text will reference more detailed sources for those interested in further pursuit. The goal is to clearly illustrate salient points.

B and Team, if you think additional figures showing more detail for plumes, monitoring point networks, or treatment systems are valuable, consider placing them in an appendix. The FYR audience is quite diverse, ranging from layman to highly technical, making a balance difficult. At least for these early first chapters, I choose simplicity.

Many thanks!
Jeff

-----Original Message-----
From: B_Hall@URSCorp.com [mailto:B_Hall@URSCorp.com]
Sent: Thursday, February 06, 2003 5:31 PM
To: Holt Mark S Civ OO-ALC/EMR
Cc: Watkins Jeffrey W Civ OO-ALC/EMR; Remmet_deGroot@URSCorp.com; Jeremy_Cox@URSCorp.com
Subject: RE: Most Efficient Figure Generation - Proposal

Mark-
I appreciate your suggestion. Let me talk this over with Remmet and see what he thinks is the best way to go.

To some extent, there will be variability among OUs only because we want to keep the figures as simple as possible - to only include information on them that is pertinent to this type of review or that are necessary to either save text (picture = 1000 words) or are expressly discussed in text (e.g., for some OUs we need to illustrate MWs, for others, no wells). That said, there is a basic minimum that should be on all the figures, and consistency across the base and through-out the report is desirable and I suspect that starting w/ your EM-GIS files is the best way to go. Lemme talk to Remmet and I'll give you a call in the morning. Thanx again for the input. B.

Holt Mark S Civ OO-ALC/EMR

To:"'B_Hall@URSCorp.com'" <B_Hall@URSCorp.com>
cc:<Mark.Holt@HILL.af.mil>
Watkins Jeffrey W Civ OO-ALC/EMR <Jeffrey.Watkins@HILL.af.mil>,
Remmet_deGroot@URSCorp.com
Subject: RE: Most Efficient Figure Generation - Proposal
02/06/03 04:51 PM

B.
What are you looking for in the figures? What layers do you want to see?

Do you have a list of "features" you would like to see on the figures? Is it
going to vary by OU or will it be consistent across them all?
I don't disagree with the approach below. However, we may be able to help you more on this end. I can get you the "native" files for most of the recent figures. Most of the data that make the figures has also been imported into the EM-GIS. We could potentially create a map of all the OU areas, save it as a EPS file or other format and then your graphics people could "cut" out the section or sections for each OU. This would make all the
figures in the FYR consistent.

Let me know what you want to do, I'll wait on the request for the figure from the OU9 ADR until I hear back.

Mark.

-----Original Message-----
From: B_Hall@URSCorp.com [mailto:B_Hall@URSCorp.com]
Sent: Thursday, February 06, 2003 1:16 PM
To: Watkins Jeffrey W Civ OO-ALC/EMR
Cc: Holt Mark S Civ OO-ALC/EMR
Subject: RE: Most Efficient Figure Generation - Proposal

Roger!

So Mark, does this sound like the best way to do this? What can we do on our end to make it easier for you to find the native files we need? B.

OU: General
Comments Prepared By: Jeff Watkins and Mark Holt

Watkins Jeffrey W Civ OO-ALC/EMR

To:"'B_Hall@URSCorp.com'" <B_Hall@URSCorp.com>
cc:<Jeffrey.Watkins@HILL.af.mil>
Holt Mark S Civ OO-ALC/EMR <Mark.Holt@HILL.af.mil>
Subject: RE: Most Efficient Figure Generation - Proposal
02/06/03 01:09 PM

B
First, I am dismayed (but not surprised) that other KTRs dragged out their responses because we have repeatedly asked our KTRs to cooperate with each other. Henceforth, please let me know of all requests you have for other KTRs, and I will tactfully encourage them to assist you in a timely manner, including follow-up. Second, I think Mark Holt is the person best positioned
to help you with native files for figures. He's very good at it and can help
you immensely as needed.
Many thanks!
Jeff

-----Original Message-----
From: B_Hall@URSCorp.com [mailto:B_Hall@URSCorp.com]
Sent: Thursday, February 06, 2003 12:37 PM
To: jeffrey.watkins@hill.af.mil
Cc: Remmet_deGroot@URSCorp.com; Jeremy_Cox@URSCorp.com
Subject: FYR: Most Efficient Figure Generation - Proposal

Jeff-
I'm trying to work out a system to most efficiently get figures generated for the FYR Report. Except for figures which URS/SLC produced originally, we do not have native files that contain many of the features for the Sites and OUs. I think that the most efficient way to do this is as follows:
URS will identify figures in existing documents that we'd like to use
(or at least have features on them that we need to include)
URS will provide your designee at EMR with
the name of the document for said figure
Figure Number
page number in the .pdf file for the figure
"EMR designee" will provide URS with all of the components (native
files) required to recreate said figure
URS will select appropriate layers, etc. from the packet of native files
and generate the FYR figures

Can you select someone there in EMR that can perform this function? I don't know whether it's Dave Harris or Mark Holt or someone else that has most direct access to those native files? For capturing the recent plume map files, we worked directly with the original map producer (MWH or CH2) and that proved VERY time consuming. I suspect that this approach will be more efficient. What say you? B.

****
Barbara L. Hall, PhD
Sr. Environmental Engineer

OU: General
Comments Prepared By: Jeff Watkins, 03/25/03 02:58 PM

To all
My guidance for figures, given previously, is to provide an uncluttered view of the salient features of an OU, site or plume in support of the text. Since the FYR text is brief and concise, it stands to reason the figure should also be brief and concise. The figure should include only major roadways and treatment system components, relative to the plume, sufficient to help readers understand the text. Monitoring points w/o labels can be included to indicate their presence but it isn't necessary to show all of them if there is no value added. A judgment call is necessary. The FYR references will guide readers to more detailed information.
Many thanks!
Jeff

-----Original Message-----
From: B_Hall@URSCorp.com [mailto:B_Hall@URSCorp.com]
Sent: Tuesday, March 25, 2003 2:28 PM
To: Mark.Loucks@hill.af.mil; jeffrey.watkins@hill.af.mil
Cc: Tammi_Messersmith@URSCorp.com; Jeremy_Cox@URSCorp.com
Subject: Re: FW: Comments to OU12 5-Year review writeup

Mark/Jeff-
Just trying to understand the nature of your comments, Mark, on the OU 12 figure.....

Are there specific features in the figure you provided that you're interested in seeing on the FYR OU12 figure? For consistency, we need to start w/ the GIS generated figure and go from there - and decide at that point what to pull off of the native file for the figure you provided. The figure you attached contains a lot of detail on the off-Base areas (buildings, street names) and all of the wells are labeled. Is that what you were hoping to see? Recall that this will be an 8-1/2 X 11 figure (not 11 X 17) so detail will be lost (especially proposed vs. existing MWs). Tell us the features you'd like to see, and we'll get them on the figure. Or was there something more general that lead to your assessment of the figure as "poor"?

Also, we need to confirm that we illustrate the most current plume. The source for the plume we'll be illustrating is the data set from MWH 6/2002 ("Draft Conceptual Model for Operable Units 5 and 12"). Correct?

Thanx. B.
****
Barbara L. Hall, PhD
Sr. Environmental Engineer
URS Corporation
756 E Winchester St, Suite 400
Salt Lake City UT 84107
ph: 801-904-4016
fax: 801-904-4100
email: b_hall@urscorp.com

OU: General
Comments Prepared By: Jeff Watkins, 03/25/03 02:58 PM

Change is always different. -- Jonathan Young

----- Forwarded by Jeremy Cox/SaltLakeCity/URSCorp on 03/18/03 08:31 AM

Watkins Jeffrey W
Civ OO-ALC/EMR
To:"'Jeremy_Cox@urscorp.com'" <Jeremy_Cox@urscorp.com>
cc:<Jeffrey.Watkins@HILL.af.mil>
Subject: FW: Comments to OU12 5-Year review writeup
03/18/03 07:05 AM

Jeremy
See Mark's comments.
Jeff

-----Original Message-----
From: Loucks Mark D Civ OO-ALC/EMR
Sent: Tuesday, March 11, 2003 2:41 PM
To: Watkins Jeffrey W Civ OO-ALC/EMR
Subject: Comments to OU12 5-Year review writeup

Jeff, The only comment that I have is that they need a bettter figure. Figure one is poor. I've attached a possible alternative. If they would like to use it and need the natvie microstation format let me know.

MDL

<<1_12propwells0103wplume.pdf>>
(See attached file: 1_12propwells0103wplume.pdf)

OU: General
Comments Prepared By: Jeff Watkins, 04/02/03 09:40 AM

Jeremy and B

Documents are under review, comments to follow. The font size looks OK. I think readability is important enough to justify the additional pages.

Jeff

-----Original Message-----

From: Jeremy_Cox@URSCorp.com [mailto:Jeremy_Cox@URSCorp.com]

Sent: Monday, March 31, 2003 5:33 PM

To: jeffrey.watkins@hill.af.mil

Cc: B_Hall@URSCorp.com

Subject: OU 3 Summary for FYR

Jeff,

I've attached the OU and Site Summaries for OU 3 for your review.

[B adding in here..... These SS are printed w/ a larger font. What do you think? We had to remove the boxes to get it to look 1/2-way decent. Will that make Al happy? It'll add about a page each to the SSs that are already 3 or 4 pages long - probably an add'l 20-ish pages for the whole document. B.]

The figure will follow in a separate e-mail. Thanks.

Jeremy B. Cox

Environmental Engineer

URS Corporation

756 East Winchester Street, Suite 400

Salt Lake City, UT 84107

(801) 904-4065

e-mail: jeremy_cox@urscorp.com

OU: General
Comments Prepared By: Jeff Watkins

Watkins Jeffrey W Civ OO-ALC/EMR
<Jeffrey.Watkins@HILL.af.mil>

03/31/03 06:35 AM

To: "'B_Hall@URSCorp.com'" <B_Hall@urscorp.com>
cc:
Subject:

B
[..] formatting comment from Al Herring. He asked if the font size in the site summaries can be enlarged because its tough to read the smaller print. Since this is a public document, and we are driven by public issues, it has importance. Can you increase the font size, please? The RAB seems to have a positive view of the FYR and URS thus far. Their initial concerns were based more on unfamiliarity than anything specific.

Many thanks!
Jeff

OU: General
Comments Prepared By: Jeff Watkins

Watkins Jeffrey W Civ OO-ALC/EMR
<Jeffrey.Watkins@HILL.af.mil>

04/01/03 10:58 AM

To: "'B_Hall@urscorp.com'" <B_Hall@urscorp.com>
cc:
Subject: Review of Figures

Hi B

RE: Review of Site Figures

Figures should be clear and easy to understand. Include only salient features that are necessary to illustrate the site and support the text. Clarity is important. If additional features are necessary and cannot be shown on one figure without clutter, a second figure showing the additional features should be generated. The text should refer the reader to more detailed reference sources.

1. The most important features to show on a figure are the plume and site boundaries relative to the immediate surrounding area. Include major features of any treatment system present. It isn't necessary to show minor features of a treatment system, nor all monitoring points. Selected MPs in the communities are advisable.
2. Choose color schemes that add clarity to features.
3. Show major infrastructure features, such as major roads, canals, rivers, and community boundaries, to assist the reader in understanding the location of the site relative to the base and community.

Base Plume Figure: The large base plume figure looks really good. Recommend inclusion of an 11 x 14 or 17 foldout figure.

Notes for redlined figures provided for review
OU1: There should be a figure showing the entire plume relative to the base site and the surrounding community, similar to that for OU 2 and OU 4. The figure showing the site and treatment system layout is sufficient. However, the color scheme for the plume is not clear as in OU 2 and OU 4.
OU2: Looks good. Griffith Pool is cluttered. Backup generator and Solvent Storage tank building have no value.
OU3: No plume is shown. Does text explain connection with OU8?
OU4: Looks good. Air stripper facility is not shown.
OU5: Recommend the figure with more color, with treatment systems shown.
OU6: Looks good. Electrical Substation adds no value.
OU7: Looks good. Does text explain connection with OU8?
OU8: Looks good. Label extraction system. May label locations of OU3 and OU7 if text explains that they are incorporated into OU8.
OU9: Looks good.
OU10: Looks good.
OU11: No plume shown. Show plume as understood so far.
OU12: Looks good.

Many thanks!
Jeff

OU: General
Comments Prepared By: Jeff Watkins

B Hall
04/01/03 11:20 AM

Yup - no problem - 11x17 for the basewide figure then. Thanx. B.

Watkins Jeffrey W Civ OO-ALC/EMR
Jeffrey.Watkins@HILL.af.mil
04/01/03 11:13 AM

To:'"B_Hall@URSCorp.com'" <B_Hall@urscorp.com>
cc:
Subject:RE: Review of Figures

B
I think an 11x17 foldout for the entire base would be best, if you can easily choose either option.
Jeff

-----Original Message-----
From: B_Hall@URSCorp.com [mailto:B_Hall@URSCorp.com]
Sent: Tuesday, April 01, 2003 11:10 AM
To: Watkins Jeffrey W Civ OO-ALC/EMR
Subject: Re: Review of Figures

Thanx for the comments. Just want to clarify one thing - my notes from our discussion last Thursday indicate that you wanted to go w/ the smaller basewide map, w/ larger fonts, rather than a foldout in the document. That's contrary to your recommendation here. We can easily go either way, but want to make sure which you'd like before we start adjusting font sizes, etc.

So for the basewide figure (shows all OUs and lists IRP Sites in each OU)?
1) 8-1/2 X 11 (same as all other figures) or
2) 11 X 17 foldout?

Thanx. B.
****
Barbara L. Hall, PhD
Sr. Environmental Engineer
URS Corporation
756 E Winchester St, Suite 400
Salt Lake City UT 84107
ph: 801-904-4016
fax: 801-904-4100
email: b_hall@urscorp.com

OU: 6 and 11
Comments Prepared By: Jeff Watkins

Review Comments, Test Models OU 6 and OU 11
Jeff Watkins
February 4/03

OU 6

Site Chronology: OK to place in an appendix.
Background: Format is OK. Trim text, include site information specifically related to remedial history, activities, contamination, ties to general off-base land use, etc. Refer to the site map showing plume, treatment facilities, etc. Place statements of Risk Assessment in the introductory body of the report rather than by site or OU because the RI/FS has characterized risk and the ROD was developed to address it.
COCs and RAOs: Format is OK.
Remedial Actions: Format is OK. Trim text and refer to site map.
Progress: Format is OK. Explain briefly any changes in treatment systems.
FYR Process: Explain once in the introductory body of the report rather than by site or OU.
Technical Assessment: Format is OK. For the complete draft report, write out the three EPA questions A, B, and C in the introductory body of the report but not for each OU or site. Prepare answers by OU that directly address the specific questions as related to ROD RAOs. Remove irrelevant information such as volumes treated, masses removed, and costs of treatment except total to-date cost of treatment. Place changes in activities (Cooley air stripper shutdown, etc) in Progress section. Brief statements about issues (long term monitoring) or system recommendations are OK if necessary to directly support technical content. Otherwise, place the comments in Issues, Section VIII or Recommendations, Section IX. May mention the PSVP/PSVR relationship as necessary to support the Technical Assessment but should explain the PSVP/PSVR relationship in the body of the report under Monitoring Program, especially that the results of the PSVR will be used to address issues of treatment effectiveness.
Issues: Format is OK. Avoid redundant statements of issues discussed elsewhere. Do not include recommendation-type statements. Place ambiguities, uncertainties, challenges, etc. here and address them in the Recommendations section.
Recommendations: Format is OK. Statements to address Technical Assessment, Issues, etc., are made here. Prepare the statements requiring action in direct action format; other recommendations for improvement in suggestive format, all based on supporting data.
Protectiveness Statement: Format is OK, except place the short answer at the beginning of the Protectiveness Statement text i.e., "The selected remedy is protective." Then explain protectiveness directly (negative or positive) in straightforward terms as supported by data, briefly but clearly linking RAOs, Issues and Recommendations. Avoid redundant statements made elsewhere unless necessary to emphasize important points.
OU Chronology: Format is OK. Recommend that the Chronology be placed in an appendix.

OU: 6 and 11
Comments Prepared By: Jeff Watkins

OU 11

Background: Format is OK and as for post-ROD. No need for discussion of underground utilities, etc. not relevant to remediation. Refer to the site map showing plume, etc.
COCs: Format as for post-ROD. Make reference to specific documents for more details.
Remedial Actions: N/A, unless there are interim early actions, then format as for post-ROD.
Progress: Format and content are OK, and as for post-ROD.
FYR Process: Format as for post-ROD.
Technical Assessment: N/A, unless there are interim early actions, then format as for post-ROD.
Issues: Format as for post-ROD. May comment on current status or findings of Remedial Investigation and Feasibility Report issues here.
Recommendations: Format as for post-ROD.
Protectiveness Statement: Format and content are OK and as for post-ROD.
OU Chronology: Format is OK and as for post-ROD.

OU: General
Comments Prepared by: Jeff Watkins

Watkins Jeffrey W Civ OO-ALC/EMR <Jeffrey.Watkins@HILL.af.mil>
04/22/03 03:00 PM

Maybe I'm confused. For the format of a write-up, issues represent findings and go in the Issues section, recommendations are based on findings that impact remedy protectiveness, and they go in the Recommendations section, and Protectiveness Statements are based on findings and recommendations to remedy deficiencies. Its OK to add text with a PS to clarify a PS, but I don't think recommendations should be repeated in the PS, do you?
Jeff

-----Original Message-----
From: B_Hall@URSCorp.com [mailto:B_Hall@URSCorp.com]
Sent: Tuesday, April 22, 2003 2:05 PM
To: Watkins Jeffrey W Civ OO-ALC/EMR
Cc: Elliott Bob T Civ OO-ALC/EMR; Paul_Bitter@URSCorp.com; Jeremy_Cox@URSCorp.com
Subject: RE: JWW Combined OU2 summary

I'm confused now.... I think we better talk through this issue. We've stuck w/ the model in the guidance for developing the PSs and it sounds like you're suggesting a diversion. I need to understand this better. I'll give you a call and/or please give me a call when you have a minute. Thanx. B.

Watkins Jeffrey W Civ OO-ALC/EMR

To:"'B_Hall@URSCorp.com'" <B_Hall@URSCorp.com>
cc:<Jeffrey.Watkins@HILL.af.mil> "'Jeremey_Cox@urscorp.com'" <Jeremey_Cox@URSCorp.com>, Paul_Bitter@URSCorp.com, Elliott Bob T Civ OO-ALC/EMR <Bob.Elliott@HILL.af.mil>
04/22/03 09:50 AM
Subject: RE: JWW Combined OU2 summary

B
In my mind, this is more of a format/content issue. Recommendations are great but they should be placed in the Recommendation section, typically following an issue raised earlier in the Issues section. And again, for every issue, recommendation or statement that is either negative or positive, there should be an underlying data evaluation to support it. While
the evaluation itself is not included in the summary, there should be a statement coupled with the recommendation or Protectiveness Statement to the
effect that one was done to support the statement, and you should have it ready when the query arises. I am certain there will be queries.
Many thanks!
Jeff

-----Original Message-----

OU: General
Comments Prepared by: Jeff Watkins

From: B_Hall@URSCorp.com [mailto:B_Hall@URSCorp.com]
Sent: Monday, April 21, 2003 9:57 AM
To: Watkins Jeffrey W Civ OO-ALC/EMR
Cc: 'Jeremey_Cox@urscorp.com'; Paul_Bitter@URSCorp.com
Subject: Re: JWW Combined OU2 summary
Jeff-
Rec'd 2 files for OU2, a marked-up version of the OU2 Summary and a set of comments from Ray.

We'll process all these comments. I do want to bring your attention to your suggestion re: the protectiveness statement. The guidance is pretty clear in "recommending" ;-) that Pro Statements where "protectiveness is deferred" (Ex 4-6, p. 4-22) should include what actions are required to get the info. needed and the time frame for those actions. I hear your concern re: "grand-standing" in the issues and will bear that in mind.... but I can't recommend that the whys and hows and whens be peeled completely off of the statement itself. We'll work on a good compromise that meets the guidance and addresses your comments.

B.
****
Barbara L. Hall, PhD
Sr. Environmental Engineer
URS Corporation
756 E Winchester St, Suite 400
Salt Lake City UT 84107
ph: 801-904-4016
fax: 801-904-4100
email: b_hall@urscorp.com

[...]

Watkins Jeffrey W Civ OO-ALC/EMR
To:"'Jeremey_Cox@urscorp.com'" <Jeremey_Cox@urscorp.com>,
cc:<Jeffrey.Watkins@HILL.af.mil>
"'B_Hall@urscorp.com'"<B_Hall@urscorp.com>
04/21/03 09:42 AM
Subject: JWW Combined OU2 summary

Please see the attached summary and Ray Spencer's comments. The figures have
not been reviewed.
Jeff

OU: General
Comments Prepared By: Jeff Watkins

Watkins Jeffrey W Civ OO-ALC/EMR
<Jeffrey.Watkins@HILL.af.mil>

04/24/03 11:56 AM

To:'"B_hall@urscorp.com"' <B_hall@URSCorp.com>
cc: Elliott Bob T Civ OO-ALC/EMR Bob.Elliott@HILL.af.mil
Hicken Steve T Civ OO-ALC/EMR <Steve.Hicken@HILL.af.mil>,
Holt Mark S Civ OO-ALC/EMR <Mark.Holt@HILL.af.mil>
Subject: FYR Figures

B
The following guidance is given for preparation of the figures to be used in the Draft FYR review due Monday, May 5.
1. All map requests should be directed to Mark Holt. Only maps approved by Mark Holt will be used. Photographs are not to be used.
2. There will be one base-wide map showing all OUs and plumes, and sized for clarity.
3. Each OU chapter will contain a plume map showing the plume in its entirety, relative to the immediate surrounding area
a. Show the plume footprint to the appropriate regulatory MCL for the major contaminant of concern. State in the chapter text associated with the figure that other CoCs may be co-mingled with the plume. Show contamination contours if necessary to support the text and is clear. Apply the decision as the standard across all OU plume maps. There will be two plume maps for OU1 showing TCE and DCE, and two plume maps for OU 8 showing TCE and DCA. It is anticipated that the plumes of other OUs will be TCE.
b. Show only major features of the surrounding area and treatment systems. If the text discusses features such as specific monitoring points, areas of special interest, etc., that are connected to the issues, recommendations, and protectiveness statements, indicate those generally on the map with a dashed line area (i.e., box, cloud) and an arrow from a text box.
c. Size either the map text font or the map page size (8.5x11, 8.5x17, etc) as necessary to achieve clear and cost-effective readability.
d. Ensure accuracy of features on the map (i.e. proper name tags for source areas, landfills, caps, trenches, spring collection systems, monitoring points), proper locations on the map, etc.
e. Remove all company logos.

Please see following emails for information relative to other issues.
Jeff

Operable Unit 1

I Introduction

OU 1 is located near the eastern Base property and includes two NFRAP IRP sites (see Table OU 1-1 – Site Identification) and 5 open IRP sites and with active remediation in place to address contaminated groundwater and soil (Hill AFB 1998). Past investigations have focused on the five open sites as a group and subsequently RAOs were written and remedial actions were selected for the region impacted by all sites collectively.

Table OU 1-1: OU 1 Site Identification.

Site ID	Site Name
LF001	LANDFILL NO 4
WP002	CHEMICAL PITS 1 AND 2
LF003	LANDFILL NO 3
FT009	FIRE TRAINING AREA 1
OT014	GOLF COURSE
FT081	FIRE TRAINING AREA 2
WP080	WASTE PHENOL OIL PIT

II Site Chronology

Please see Table OU 1-2 for a history of events in this OU. The table is organized to first describe events that impacted the OU as a whole. Events impacting only specific IRP sites within the OU are listed separately.

III Background

OU1 is located near the eastern Base property boundary, and includes the former waster disposal areas: Landfills (LF) 3 and 4, Fire Training Areas (FTA) 1 and 2, Chemical Disposal Pits (CDP) 1 and 2, the Water Phenol/Oil Pit (WPOP), and the Water Oil Storage Tank (WOST) site. The source area includes LF 3 and 4, CDPs 1 and 2, FTAs 1 and 2, the WPOP, the WOST, and the LNAPL plume emanating from the CDPs (see Figure OU 1-1). The non-source area includes an on-Base groundwater plume west of the LNAPL plume and the off-Base groundwater contamination in the Weber River Valley. The extent of this groundwater plume is depicted in the basewide site map (see Figure I-1).

Historically, hazardous materials and wastes were dumped and/or burned at all of the source areas. These included scrap metal, construction debris, domestic refuse, industrial refuse, sludge drying bed and flocculation wastes from the Industrial Wastewater Treatment Plant (IWTP), sulfuric acid, chromic acid, phenol, methyl ethyl ketone (MEK), waste oil, fuel, spent solvents including Stoddard solvent and paint thinner, paint sludges, paint booth scrubber sludge, plastics, and spent sandblast media.

Because all five of the OU 1 IRP sites that are currently open have a very similar contamination history, the shallow groundwater in the area and downgradient of the five sites was contaminated as a result of those activities. Because of the proximity of the five sites, investigations have focused on them as a group; RAOs were written, and remedial actions were selected for the

region impacted by all sites collectively. All of the sites except Fire Training Area 2 (FT081) were capped during construction activities at Landfill 3 and 4 and the groundwater contamination for the site and off-Base is being addressed through five remedial actions, which include groundwater extraction trenches which extract contaminated shallow groundwater (dewater) and LNAPLs (source area), landfill cap repair (source areas), remediation of contaminated surface water and soil at downgradient springs (non-source area), monitored natural attenuation for contaminated groundwater off-Base (non-source area), and institutional controls.

IV Remedial Actions

Remedial actions have been implemented at OU 1 to address both on-Base and off-Base contamination. The remedial actions for OU 1 are:

1. Source Area - Groundwater Extraction Trenches
   Installation of five groundwater extractions trenches strategically located in the OU 1 source area to dewater the Provo and (Alpine ??) Formations by extracting groundwater and LNAPLs. ~~Other components associated with the groundwater extraction systems include piezometers located up- and downgradient of the extraction trenches to measure groundwater levels and assess the effectiveness of the dewatering trenches; drain line sumps and pumps (a buried piping system to convey extracted groundwater to the treatment system); instrumentation necessary to control the operation of the pumps and the flow rates of the extracted water; gravel and paved access roads to extraction trench sumps; an LNAPL extraction system in areas where LNAPL is present;~~ springs U1-303 and U1-304, previously spring extraction systems, to be used to confirm no flow from the springs (rework??). The extracted ~~contaminated~~ groundwater is treated at the IWTP (can alternately be treated at the Operable Unit 2 ASTP with modifications) and is discharged to the North Davis Sewer Improvement District (or the Central Weber Sewer Improvement District), for further treatment and final discharge. ~~The groundwater is treated in accordance with the existing pretreatment permits for these facilities.~~

2. Source Area - Landfill Cap
   Define the cap as remedial system. Repairs can go in the site chronology. ~~The repair of the landfill caps consisted of repairing the areas of differential settlement in Landfill 4; construction of a new portion of low-permeability cap over the CDP area; and the repair of portions of the low-permeability caps disturbed by the installation of the groundwater extraction trenches. The purpose of the repair of the landfill cap was to minimize the infiltration of surface water into the landfill contents and the possible leaching of contamination into the groundwater.~~

3. Non-Source Area - Spring Remediation System
   The selected remedial action for the springs (U1-303, U1-304, U1-305, U1-307, and U1-318) is to treat the groundwater from the springs that do not cease to flow and have contamination levels above MCLs by the groundwater extraction trenches, and remove arsenic contaminated sediments from spring areas (rework???). The springs are also used to monitor the movement of the non-source area groundwater plume. This remedial action is expected to last approximately two to three years after the springs cease to flow.

4. Non-Source Area - Monitored Natural Attenuation

The selected remedial action for the non-source area groundwater plumes is monitored natural attenuation (MNA). This remedial action requires long-term monitoring of the groundwater plumes to determine if naturally occurring attenuation processes are meeting the remedial action objectives as stated in the ROD. ~~The components of the remedial action are a long term monitoring program and associated monitoring point network. The monitoring points are sited to assess both the horizontal and vertical extent of contamination. The results of the Performance Standard Verification Report (PSVR) will address the effectiveness of MNA for the off-Base groundwater plume.~~

5. Common to Both Source Area and Non-Source Area - Institutional Engineering Controls
Institutional and engineering controls include restriction of access to landfill cap areas ~~for unauthorized personnel~~ using fencing and warning sign, enforcement of the Hill AFB Commander's office continuing order that limits development within OU 1, ~~distribution of the Hill Restricted Use Access Map to the appropriate Hill AFB personnel to identify OU 1 as a restricted to development~~, and restricting domestic usage of the shallow groundwater in the OU 1 are by the Utah Division of Water Rights restriction of drilling groundwater supply wells within the on- and off-Base portions of OU 1 (rework???).

The remedial actions at OU 1 were developed to achieve the RAOs set forth in the ROD. The individual site summaries include a description of each RAO for OU 1.

V Progress Since Last FYR

OU 1 interim remedies were reviewed in the 1998 Five Year Review report. Since the review in 1998, the ROD has been written and all of the remedial actions outlined in the ROD have been implemented.

VI FYR Process

Site review was conducted per the process described for the overall 2003 FYR.

VII Technical Assessment

Results of the technical assessment for each site in OU 1 and for the operable unit are listed in Table OU 1-2 (Technical Assessment Summary of OU 1) on the following page. Details of the technical assessment for each site in OU 1 are provided in the respective site summary (see Section XIII).

Table OU 1-2: Technical Assessment Summary for OU 1.

Site ID	Remedy	Technical Assessment*			Protectiveness	Next Five Year Review
		Question A	Question B	Question C		
LF001, WP002, LF003, FT081, WP080	Groundwater Extraction Trenches, Spring Remediation, Landfill Cap, Monitored Natural Attenuation, Institutional Controls	Yes	No	Yes	Protective in the short-term	2008
FT009	NA	NA	NA	No	Protective	NA
OT014	NA	NA	NA	NA	Protective	NA
OU 1	Groundwater Extraction Trenches, Spring Remediation, Landfill Cap, Monitored Natural Attenuation, Institutional Controls	Yes	No	Yes	Protective in the short-term	2008

*Question A: Is the remedy functioning as intended by the decision documents?
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable

VIII Issues

Based on the information reviewed, issues that may affect protectiveness of the selected remedies at OU 1 are listed below:

1. Eighteen months of operational data are not sufficient to determine if the remedies at OU 1 are protecting human health and the environment. As discussed in the PSVP (CH2M Hill 2001), five years of data with at least two sampling rounds per year should provide adequate samples across the site and over time to determine if plume mean concentrations are decreasing. A decrease in the plume mean concentration was established as a measure of progress for the remedial actions at OU 1.

2. If unexpected elevated hydrocarbon concentrations and LNAPL are present downgradient and to the west of the exterior trench (Trench D), it is questionable whether monitored natural attenuation in that portion of the non-source area is adequate to remediate the contaminated groundwater to achieve RAOs.

3. Ponding at Landfill 3 and 4 needs to be addressed.

4. A preliminary check of the PSVP sampling requirements and data in ERPIMS showed that 14 out of 44 sampling locations are not being sampled twice yearly for VOCs as prescribed. This may be due to the lag time between sampling activities and the uploading of the results into ERPIMS or that the sampling locations were dry. However, if the locations are dry, the results (i.e. well is dry) should be included in ERPIMS and additional monitoring points should be identified if appropriate.

5. Several sumps are not maintaining water elevations below the action level (pipe entry elevation), which could lead to possible downgradient migration.

6. Water levels in several trench points are not within the action level (dry or within 1.5 feet of the Provo/Alpine Clay Contact elevation).

7. The method detection limits at the analytical laboratory are higher than the PRGs/MCLs for several contaminants of concern. Non-detect values at MDLs greater than the PRGs/MCLs are not usable for determining if the mean plume concentrations are decreasing.

IX Recommendations and Follow-up Actions for OU 1

The recommendations and follow-up actions for OU 1 are:

1. Determine if the trenches are containing/capturing the contamination in the source area by evaluating potentiometric surface maps of the site. Evaluation of additional monitoring points may be necessary to determine the groundwater gradient around the trenches.

2. Review the long term monitoring sampling and analysis plan to ensure that locations where the hydrocarbon concentrations were located during the Source Zone Area Delineation project (Intera 2001) are monitored to track the changes in concentrations. Re-evaluate the non-source area monitored natural attenuation remedial action to determine if still applicable in all non-source areas. If it is determined that it is not still applicable, evaluate the addition of an active treatment action.

3. Address drainage and ponding issues on Landfill 3 and 4 to ensure the landfill cap integrity. Perform yearly landfill cap inspections and neutron probe logging at the landfills to ensure the landfill is performing as designed. Inspect all gates and fences to ensure that they are locked in accordance with the ROD specified institutional controls and implement maintenance activities in accordance with the O&M manual.

4. Determine if the plume mean concentrations are decreasing (using the described locations and monitoring frequency outlined in the Performance Standard Verification Plan (PSVP)

and the results of the Performance Standard Verification Report (PSVR)) by collecting samples from all locations described in the PSVP.

5. Determine if the LNAPL extraction rates are decreasing to less than 0.25 gpd. If extraction rates have decreased, re-evaluate operating the skimmer pumps in the sumps where LNAPL is present (as per PSVP).

6. Re-evaluate the Provo/Alpine contact action level for those piezometers that exhibit dry conditions or cannot maintain water levels (based on the current operation scheme) within 1.5 feet of the contact elevation.

7. Ensure that the method detection limits for contaminants of concern are low enough to detect low concentrations of contaminants of concern (i.e. MDL = MCL/PRG).

X Protectiveness Statement for OU 1

From the activities performed as part of this Five Year Review, the remedies at OU 1 are protective in the short term due to the lack of complete exposure pathways. However, several issues have been identified in this review that could compromise the protectiveness of the remedial actions if no action is taken. Additional tools and evaluations will be available for use in determining the protectiveness of the remedial actions at OU 1 during the next Five Year Review (2008).

XI Next Review

The next FYR for OU 1 is required by 2008. No future review is required for the Fire Training Area 2 or the Golf Course sites because no further remedial actions are planned at these sites.

XII References

(To be exported from database)

XIII FYR of Sites in OU1

See attached site summaries.

Comments prepared by: Kyle Gorder

OU 1 FT009 FIRE TRAINING AREA 1

Site Summary - Hill AFB 2003 Five Year Review

I. Introduction

Fire Training Area 1 (FT009) was used by Hill AFB to extinguish simulated aircraft fires from 1958-1973. Large quantities of oil and combustible waste chemicals were poured into a dirt pit surrounded by an earthen dike and then ignited. However, Fire Training Area 1 was recommended for no further remedial action planned (NFRAP) in July of 1989 when soil borings showed no evidence of shallow soil contamination and Base records indicated that Fire Training Area 1 was also covered by the Landfill 3 clay and asphalt cap during construction activities. Low levels of groundwater contamination were identified downgradient of FTA-1 but were attributed to the upgradient Chemical Disposal Pits 1 and 2 (WP002).

II. Site Chronology

Please see Table OU 1-2 for a history of events at this Site. The table is organized to describe events which impacted the whole OU first with events impacting only specific IRP sites within the OU listed separately.

III. Background

Fire Training Area 1 (FTA-1) covers approximately one-third of an acre and is located within the Operable Unit 1 area in Landfill 3 (See Figure OU1-1). This site was identified for IRP investigation during the Phase II Stage 2 Presurvey meeting in March 1985 where Base records and soil boring and monitoring well analytical results were reviewed. ~~Due to the lack of evidence of shallow soil contamination at the site and that if there had been any contamination it was removed during interim construction activities at Landfills 3 and 4 and capped, FTA-1 was recommended for NFRAP in July of 1989 (SAIC 1989) due to the fact that surface water infiltration was mitigated by the Landfill 3 cap.~~

Contaminants of Concern

Media	Contaminant(s)	Cleanup Level Required
NA	NA - Risk Assessment indicates no risk to human health and the environment.	NA

RAOs

None

IV. Remedial Actions

Not applicable. There are no remedies associated with this site because it has been ~~recommended~~ that no further action is necessary.

V. Progress Since Last Review

FT009 was not specifically reviewed in the 1998 Five Year Review Report. However, interim remedies that had been installed for OU 1 were reviewed in the 1998 Five Year Review report as a whole. Since the review in 1998, the ROD has been written and the remedial actions outlined in the ROD have been implemented.

VI. FYR Process

Site review conducted per the process described for the overall 2003 Five Year review.

VII. Technical Assessment

Question A (Answer)

Not Applicable

Question A (Comment)

Not applicable. There are no remedies associated with this site because it has been ~~recommended~~ that no further action is necessary.

Question B (Answer)

Not Applicable

Comments prepared by: Kyle Gorder

OU 1 LF001 LANDFILL NO 4

Site Summary - Hill AFB 2003 Five Year Review

I. Introduction

Landfill 4 (LF001) was a sanitary refuse landfill from 1967-1973. Groundwater contamination from Landfill 4 is currently being addressed through ~~the OU 1 remedial actions which include groundwater extraction trenches, landfill cap repair, spring remediation, monitored natural attenuation, and institutional controls. There are no remaining soils issues at Landfill 4 since the site has been capped.~~

II. Site Chronology

Please see Table OU 1-2 for a history of events at this Site. The table is organized to describe events which impacted the whole OU first with events impacting only specific IRP sites within the OU listed separately.

III. Background

Landfill 4 (LF001) was a sanitary refuse landfill from 1967-1973 when it received solid wastes including scrap metal, construction debris, domestic refuse, industrial refuse, and small amounts of sludge from the Industrial Wastewater Treatment Plant (IWTP) drying beds, sulfuric acid, chromic acid, phenol, and methyl ethyl ketone (MEK). Landfill 4 is located directly east of Landfill 3 (LF003) and extends to the road which follows the edge of the steep hillside that forms the northeastern Base boundary (see Figure OU 1-1). Landfill 4 covers approximately 21 acres and is approximately 25 feet thick. Landfill 4 also contains 12 parallel drainage trenches, oriented north to south, approximately 15 to 30 feet thick and 20 to 40 feet wide. The landfill was capped with a low permeability soil cover in 1985 to reduce surface water infiltration. ~~Remedial actions regarding groundwater contamination resulting from the activities that historically took place at LF001are currently being addressed through the OU 1-wide remedies.~~

Four additional IRP sites are also included in the overall OU 1 remedies. They are Fire Training Area 2 (FT081), Landfill 3 (LF003), the Waste Phenol Oil Pit (WP080), and Chemical Disposal Pits 1 and 2 (WP002). ~~Historically,~~ all five of the OU 1 IRP sites that are currently open have a very similar contamination history. They were all areas where industrial wastes, fuels, and other toxic substances were dumped and/or burned. Subsequently, the shallow groundwater in the area and downgradient of the five sites was contaminated as a result of those activities. Because of the proximity of the five sites, investigations have focused on them as a group, RAOs were written, and remedial actions were selected for the region impacted by all sites collectively. All of the sites except Fire Training Area 2 (FT081) were capped during construction activities at Landfill 3 and 4 and the groundwater contamination for the site and off-Base (non-source area) is being addressed through five remedial actions, which include groundwater extraction trenches which extract contaminated shallow groundwater and LNAPLs (source area), landfill cap repair, remediation of contaminated surface water and soil at downgradient springs, monitored natural attenuation for contaminated groundwater off-Base, and institutional controls.

All of the OU 1 remedies that pertain to contamination resulting from LF001 are reviewed in this Site Summary. However, because of the physical and management relationship for the five sites, a majority of the conclusions and recommendations are consistent for all of the open IRP sites at OU 1.

Contaminants of Concern

Media	Contaminant(s)	Cleanup Level Required
GW	1,1,1-TRICHLOROETHANE	200 ug/L
SOIL	1,1,1-TRICHLOROETHANE	10 mg/kg
SW	1,1,1-TRICHLOROETHANE	200 ug/L
GW	1,1-DICHLOROETHANE	790 ug/L
SOIL	1,1-DICHLOROETHANE	13 mg/kg
SW	1,1-DICHLOROETHANE	790 ug/L
GW	1,1-DICHLOROETHENE	7 ug/L
SOIL	1,1-DICHLOROETHENE	0.03 mg/kg

OU: 1
Comments Prepared By: Jeff Watkins and Kyle Gorder

Watkins Jeffrey W Civ OO-ALC/EMR <Jeffrey.Watkins@HILL.af.mil>
03/21/03 01:46 PM

Please rework, more editorial reviews.

Jeff

-----Original Message-----

From: Gorder Kyle Civ OO-ALC/EMR

Sent: Friday, March 21, 2003 8:09 AM

To: Watkins Jeffrey W Civ OO-ALC/EMR

Subject: RE: OU 1 Summary for FYR

Jeff -

Lots of editorial comments - kind of got tired of that, someone at URS can do proof-reading as we discussed yesterday. Didn't really see too many inaccuracies or omissions, but I don't have the best historical knowledge of OU1. I assume everyone will have a chance to comment on a complete draft document. Yes, but the purpose of the chapter review is to reduce review of the entire draft JWW.

Kyle Gorder, P.E.

Hill Air Force Base

Environmental Restoration Division

Tel: 801-775-2559

Email: Kyle.Gorder@hill.af.mil

-----Original Message-----

From: Watkins Jeffrey W Civ OO-ALC/EMR

Sent: Thursday, March 20, 2003 7:35 AM

To: Gorder Kyle Civ OO-ALC/EMR

Subject: FW: OU 1 Summary for FYR

OU: 1
Comments Prepared By: Jeff Watkins and Kyle Gorder

Kyle

Please review and comment back to me. I am looking for brevity, accuracy, and completeness.

Many thanks!

Jeff

Operable Unit 1

I Introduction

OU 1 is located near the eastern Base property boundary and includes two NFRAP IRP sites (see Table OU 1-1 – Site Identification) and 5 open IRP sites ~~and~~ with active remediation in place to address contaminated groundwater and soil (Hill AFB 1998). Past investigations have focused on the five open sites as a group and subsequently RAOs were written and remedial actions were selected for the region impacted by all sites collectively.

Table OU 1-1: OU 1 Site Identification.

Site ID	Site Name
LF001	LANDFILL NO 4
WP002	CHEMICAL PITS 1 AND 2
LF003	LANDFILL NO 3
FT009	FIRE TRAINING AREA 1
OT014	GOLF COURSE
FT081	FIRE TRAINING AREA 2
WP080	WASTE PHENOL OIL PIT

II Site Chronology

Please see Table OU 1-2 for a history of events in this OU. The table is organized to first describe events that impacted the OU as a whole. Events impacting only specific IRP sites within the OU are listed separately.

III Background

OU1 is located near the eastern Base property boundary, and includes the former ~~waster~~ waste disposal areas: Landfills (LF) 3 and 4, Fire Training Areas (FTA) 1 and 2, Chemical Disposal Pits (CDP) 1 and 2, the Water Phenol/Oil Pit (WPOP), and the Water Oil Storage Tank (WOST) site. The source area includes LF 3 and 4, CDPs 1 and 2, FTAs 1 and 2, the WPOP, the WOST, and the LNAPL plume emanating from the CDPs (see Figure OU 1-1). The non-source area includes an on-Base groundwater plume west of the LNAPL plume and the off-Base groundwater contamination in the Weber River Valley. The extent of this groundwater plume is depicted in the basewide site map (see Figure I-1).

Historically, hazardous materials and wastes were dumped and/or burned at all of the source areas. These included scrap metal, construction debris, domestic refuse, industrial refuse, sludge drying bed and flocculation wastes from the Industrial Wastewater Treatment Plant (IWTP), sulfuric acid, chromic acid, phenol, methyl ethyl ketone (MEK), waste oil, fuel, spent solvents including Stoddard solvent and paint thinner, paint sludges, paint booth scrubber sludge, plastics, and spent sandblast media.

Because all five of the OU 1 IRP sites that are currently open have a very similar ~~contamination~~ waste disposal (?) history, the shallow groundwater in the area and downgradient of the five sites was contaminated as a result of those activities (I'm not sure what this sentence is trying the say??). Because of the proximity of the five sites, investigations have focused on them as a

group; RAOs were written, and remedial actions were selected for the region impacted by all sites collectively. All of the sites except Fire Training Area 2 (FT081) were capped during construction activities at Landfill 3 and 4 and ~~the~~ groundwater contamination ~~for~~ at the site ~~and off-Base~~ is being addressed through five remedial actions~~;~~. The remedial actions are: 1) ~~which include~~ groundwater extraction trenches ~~which~~ that extract contaminated shallow groundwater (dewater) and LNAPLs (source area), 2) landfill caps ~~repair~~ (source areas), 3) remediation of contaminated surface water and soil at downgradient springs (non-source area), 4) monitored natural attenuation for contaminated groundwater off-Base (non-source area), and 5) institutional controls.

IV Remedial Actions

Remedial actions have been implemented at OU 1 to address both on-Base and off-Base contamination. The remedial actions for OU 1 are:

1. Source Area - Groundwater Extraction Trenches
   Installation of five groundwater extractions trenches strategically located in the OU 1 source area to dewater the Provo and Alpine (?) Formations by extracting groundwater and LNAPLs. ~~Other components associated with the groundwater extraction systems include piezometers located up- and downgradient of the extraction trenches to measure groundwater levels and assess the effectiveness of the dewatering trenches; drain line sumps and pumps (a buried piping system to convey extracted groundwater to the treatment system); instrumentation necessary to control the operation of the pumps and the flow rates of the extracted water; gravel and paved access roads to extraction trench sumps; an LNAPL extraction system in areas where LNAPL is present; springs U1-303 and U1-304, previously spring extraction systems, to be used to confirm no flow from the springs.~~ (I don't see why this info is necessary)-The extracted contaminated groundwater is passed through an oil water separator before being conveyed to the ~~treated at the~~ IWTP for treatment. Treated water from the IWTP ~~(can alternately be treated at the Operable Unit 2 ASTP with modifications) and~~ is discharged to the North Davis Sewer Improvement District ~~(or the Central Weber Sewer Improvement District),~~ for further treatment and final discharge. The groundwater is treated in accordance with the existing pretreatment permits for these facilities. Can discuss alternative treatment schemes here is necessary (i.e., treatment at OU2 prior to discharge to Central Weber).

2. Source Area - Landfill Cap
   If the point of Section IV is to describe the remedial actions taken, I suggest that the caps be described (brief desc of engineering + purpose) before discussion of repair activities. The repair of the landfill caps consisted of repairing the areas of differential settlement in Landfill 4; construction of a new portion of low-permeability cap over the CDP area; and the repair of portions of the low-permeability caps disturbed by the installation of the groundwater extraction trenches. The purpose of the repair of the landfill cap was to minimize the infiltration of surface water into the landfill contents and the possible leaching of contamination into the groundwater (This should be at first of paragraph) Purpose of the cap repairs in the maintain the integrity of the cap(s)).

3. Non-Source Area - Spring Remediation System
   The selected remedial action for the springs (U1-303, U1-304, U1-305, U1-307, and U1-318) is to treat the groundwater from the springs ~~that do not cease to flow and have~~with

contamination levels above MCLs. ~~by the groundwater extraction trenches, and remove arsenic~~ Arsenic contaminated sediments have also been removed from the following spring areas: (list). The springs are also used to monitor the movement of the non-source area groundwater plume (not sure what this means – do you mean to say the springs are part of the network monitoring groundwater contaminantion?). The operation of the groundwater extraction trenches has (or is expected to? Or both?) caused several of the springs dry up. This (what? Arsenic clean-up?) remedial action is expected to last approximately two to three years after the springs cease to flow.

4. Non-Source Area - Monitored Natural Attenuation
The selected remedial action for the non-source area groundwater plumes is monitored natural attenuation (MNA). This remedial action requires long-term monitoring of the groundwater plumes to determine if naturally occurring attenuation processes are meeting the remedial action objectives as stated in the ROD. ~~The components of the remedial action are a long-term monitoring program and associated monitoring point network. The monitoring points are sited to assess both the horizontal and vertical extent of contamination.~~ The results of the Performance Standard Verification Report (PSVR) will address the effectiveness of MNA for the off-Base groundwater plume.

5. Common to Both Source Area and Non-Source Area - Institutional Engineering Controls
Institutional and engineering controls include restriction of access to landfill cap areas for unauthorized personnel using fencing and warning signs, enforcement of the Hill AFB Commander's office continuing order that limits development within OU 1, distribution of the Hill Restricted Use Access Map to the appropriate Hill AFB personnel to identify OU 1 as an area restricted to development, and restricting domestic usage of the shallow groundwater in the OU 1 area by the Utah Division of Water Rights restriction of drilling groundwater supply wells within the on- and off-Base portions of OU 1. Last part of this sentence is extremely awkward. Re-write.

The remedial actions at OU 1 were developed to achieve the RAOs set forth in the ROD. The individual site summaries include a description of each RAO for OU 1.

V Progress Since Last FYR

OU 1 interim remedies were reviewed in the 1998 Five Year Review report. Since the review in 1998, the ROD has been written and all of the remedial actions outlined in the ROD have been implemented.

VI FYR Process

Site review was conducted per the process described for the overall 2003 FYR.

VII Technical Assessment

Results of the technical assessment for each site in OU 1 and for the operable unit are listed in Table OU 1-2 (Technical Assessment Summary of OU 1) on the following page. Details of the technical assessment for each site in OU 1 are provided in the respective site summary (see Section XIII).

Table OU 1-2: Technical Assessment Summary for OU 1.

Site ID	Remedy	Technical Assessment*			Protectiveness	Next Five Year Review
		Question A	Question B	Question C		
LF001, WP002, LF003, FT081, WP080	Groundwater Extraction Trenches, Spring Remediation, Landfill Cap, Monitored Natural Attenuation, Institutional Controls	Yes	No	Yes	Protective in the short-term	2008
FT009	NA	NA	NA	No	Protective	NA
OT014	NA	NA	NA	NA	Protective	NA
OU 1	Groundwater Extraction Trenches, Spring Remediation, Landfill Cap, Monitored Natural Attenuation, Institutional Controls	Yes	No	Yes	Protective in the short-term	2008

*Question A: Is the remedy functioning as intended by the decision documents?
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable

VIII Issues

Based on the information reviewed, issues that may affect protectiveness of the selected remedies at OU 1 are listed below:

1. Eighteen months of operational data are not sufficient to determine if the remedies at OU 1 are protecting human health and the environment. As discussed in the PSVP (CH2M Hill 2001), five years of data with at least two sampling rounds per year should provide adequate samples across the site and over time to determine if plume mean concentrations are decreasing. A decrease in the plume mean concentration was established as a measure of progress for the remedial actions at OU 1.

2. If unexpected elevated hydrocarbon concentrations and LNAPL are present downgradient and to the west of the exterior trench (Trench D), it is questionable whether monitored natural attenuation in that portion of the non-source area is adequate to remediate the contaminated groundwater to achieve RAOs.

3. Ponding at Landfill 3 and 4 needs to be addressed.

4. A preliminary check of the PSVP sampling requirements and data in ERPIMS showed that 14 out of 44 sampling locations are not being sampled twice yearly for VOCs as prescribed. This may be due to the lag time between sampling activities and the uploading of the results into ERPIMS or that the sampling locations were dry. However, if the locations are dry, the results (i.e. well is dry) should be included in ERPIMS and additional monitoring points should be identified if appropriate.

5. Several sumps are not maintaining water elevations below the action level (pipe entry elevation), which could lead to possible downgradient migration.

6. Water levels in several trench points are not within the action level (dry or within 1.5 feet of the Provo/Alpine Clay Contact elevation).

7. The method detection limits at the analytical laboratory are higher than the PRGs/MCLs for several contaminants of concern. Non-detect values at MDLs greater than the PRGs/MCLs are not usable for determining if the mean plume concentrations are decreasing.

IX Recommendations and Follow-up Actions for OU 1

The recommendations and follow-up actions for OU 1 are:

1. Determine if the trenches are containing/capturing the contamination in the source area by evaluating potentiometric surface maps of the site. Evaluation of additional monitoring points may be necessary to determine the groundwater gradient around the trenches.

2. Review the long term monitoring sampling and analysis plan to ensure that locations where the hydrocarbon concentrations were located during the Source Zone Area Delineation project (Intera 2001) are monitored to track the changes in concentrations.

Re-evaluate the non-source area monitored natural attenuation remedial action to determine if still applicable in all non-source areas. If it is determined that it is not still applicable, evaluate the addition of an active treatment action.

3. Address drainage and ponding issues on Landfill 3 and 4 to ensure the landfill cap integrity. Perform yearly landfill cap inspections and neutron probe logging at the landfills to ensure the landfill is performing as designed. Inspect all gates and fences to ensure that they are locked in accordance with the ROD specified institutional controls and implement maintenance activities in accordance with the O&M manual.

4. Determine if the plume mean concentrations are decreasing (using the described locations and monitoring frequency outlined in the Performance Standard Verification Plan (PSVP) and the results of the Performance Standard Verification Report (PSVR)) by collecting samples from all locations described in the PSVP.

5. Determine if the LNAPL extraction rates are decreasing to less than 0.25 gpd. If extraction rates have decreased, re-evaluate operating the skimmer pumps in the sumps where LNAPL is present (as per PSVP).

6. Re-evaluate the Provo/Alpine contact action level for those piezometers that exhibit dry conditions or cannot maintain water levels (based on the current operation scheme) within 1.5 feet of the contact elevation.

7. Ensure that the method detection limits ~~for contaminants of concern~~ are low enough to detect low concentrations of contaminants of concern (i.e. MDL = MCL~~/~~ or PRG).

X Protectiveness Statement for OU 1

From the activities performed as part of this Five Year Review, the remedies at OU 1 are protective in the short term due to the lack of complete exposure pathways. However, several issues have been identified in this review that could compromise the protectiveness of the remedial actions if no action is taken. Additional tools and evaluations will be available for use in determining the protectiveness of the remedial actions at OU 1 during the next Five Year Review (2008).

XI Next Review

The next FYR for OU 1 is required by 2008. No future review is required for the Fire Training Area 2 or the Golf Course sites because no further remedial actions are planned at these sites.

XII References

(To be exported from database)

XIII FYR of Sites in OU1

See attached site summaries.

OU: 1
Comments Prepared by: Ray Spencer

Watkins Jeffrey W Civ OO-ALC/EMR <Jeffrey.Watkins@HILL.af.mil>
04/21/03 10:30 AM

Review comments - Ray Spencer 4/9/2003

Site Summary - FT081

There are several instances where the document states that "LNAPLs were not expected.....however since the trenches were installed in May 2001, LNAPL has drained into Trench" How was this conclusion reached? How do we know that the LNAPL wasn't already in those locations? Why do you think it drained into new areas?

Site Summary - WP080

Introduction - Last Sentence

"There are no remaining soils issues at CDPs 1 and 2 since the sites have been capped."
Should this be soils issues at the Waste Phenol Oil Pit ?

Operable Unit 1

I Introduction

OU 1 is located near the eastern Base property boundary and includes two IRP sites with NFRAP status (FT009 and OT014) (see Table OU 1-1) and 5 open IRP sites and with active remediation in place to address contaminated groundwater and soil (HAFB EMR 1998). Past investigations have focused on the five open sites as a group and subsequently RAOs were written and remedial actions were selected for the region impacted by all sites collectively.

Table OU 1-1: OU 1 Site Identification.

Site ID	Site Name
LF001	LANDFILL NO 4
WP002	CHEMICAL PITS 1 AND 2
LF003	LANDFILL NO 3
FT009	FIRE TRAINING AREA 1
OT014	GOLF COURSE
FT081	FIRE TRAINING AREA 2
WP080	WASTE PHENOL OIL PIT

II Site Chronology

See Table OU 1-2 for a history of events in this OU. The table is organized to describe events that impacted the OU as a whole, followed by events impacting specific IRP sites within the OU.

III Background

OU 1 is located near the eastern Base property boundary, and includes the former waste disposal areas: Landfills (LF) 3 and 4, Fire Training Areas (FTA) 1 and 2, Chemical Disposal Pits (CDP) 1 and 2, the Water Phenol/Oil Pit (WPOP), and the ~~Water~~ Waste Oil Storage Tank (WOST) site. The source area includes LF 3 and 4, CDPs 1 and 2, FTAs 1 and 2, the WPOP, the WOST (see Figure OU 1-1), and the LNAPL emanating from the CDPs. The non-source area includes an on-Base groundwater plume west of the CDPs and the off-Base groundwater contamination in the Weber River Valley. The extent of this groundwater plume is depicted in the basewide site map (see Figure I-1).

Historically, hazardous materials and wastes were dumped and/or burned at all of the source areas. These included scrap metal, construction debris, domestic refuse, industrial refuse, sludge drying bed and flocculation wastes from the Industrial Wastewater Treatment Plant (IWTP), sulfuric acid, chromic acid, phenol, methyl ethyl ketone (MEK), waste oil, fuel, spent solvents including Stoddard solvent and paint thinner, paint sludges, paint booth scrubber sludge, plastics, and spent sandblast media.

The shallow groundwater under and downgradient of the five open sites was contaminated as a result of the historical disposal activities. Because of the proximity of the five sites, investigations have focused on them as a group; RAOs were written, and remedial actions were selected for the region impacted by all sites collectively. All of the sites, except Fire Training Area 2 (FT081), were capped during construction activities at Landfill 3 and 4 and groundwater

contamination at the site is being addressed through five remedial actions which are: 1) extraction trenches that remove contaminated shallow groundwater (dewater) and LNAPLs (source area), 2) landfill caps (source areas), 3) remediation of contaminated surface water and soil at downgradient springs (non-source area), 4) monitored natural attenuation for contaminated groundwater off-Base (non-source area), and 5) institutional controls.

IV Remedial Actions

Remedial actions have been implemented at OU 1 to address both on-Base and off-Base contamination. The remedial actions are discussed in detail in the Site Summaries (see Section XIII) for OU 1. In summary, the remedial actions are:

1. Source Area - Groundwater Extraction Trenches
   Installation of five groundwater extractions trenches located in the OU 1 source area to dewater the Provo and ~~Alpine~~ Formations by extracting groundwater and LNAPLs. The extracted contaminated groundwater is passed through an oil water separator before being conveyed to the IWTP for treatment. Some trenches are installed into the Alpine to facilitate dewatering the Provo. Treated water from the IWTP is discharged to the North Davis Sewer Improvement District for further treatment and final discharge.

2. Source Area - Landfill Cap
   The remedial action at Landfill 4 consisted of the low permeability soil cover constructed in 1985 and the repair of the areas of differential settlement in 2001. The remedial action at Landfill 3 included construction of a new portion of low-permeability cap over the CDP area and the repair of portions of the cap (installed in 1985) disturbed by the installation of the groundwater extraction trenches. The purpose of the repair of the landfill caps was to minimize the infiltration of surface water into the landfill contents and the leaching of contamination into the groundwater. The caps cover all other NFRAP site except FTA 2.

3. Non-Source Area - Spring Remediation System
   The selected remedial action for the springs (U1-303, U1-304, U1-305, U1-307, and U1-318) is to treat the groundwater from the springs with contamination levels above MCLs. Sediments from spring areas with arsenic contamination above 11 mg/kg will be identified and excavated after the springs have ceased to flow. The removal of the arsenic contaminated soils at the springs is anticipated to take place approximately two to three years after the springs cease to flow.

4. Non-Source Area - Monitored Natural Attenuation
   The selected remedial action for the non-source area groundwater plumes is monitored natural attenuation (MNA). This remedial action requires long-term monitoring of the groundwater plumes to determine if naturally occurring attenuation processes are meeting the remedial action objectives as stated in the ROD.

5. Common to Both Source Area and Non-Source Area - Institutional Engineering Controls
   Institutional and engineering controls include restriction of access to landfill cap areas using fencing and warning signs, enforcement of the Hill AFB Commander's office continuing order that limits development within OU 1 (AFI 32-7020), distribution of the Hill Restricted Use Access Map to the appropriate Hill AFB personnel to identify OU 1

as an area restricted to development, and restricting domestic usage of the shallow groundwater in the OU 1 area with drilling restrictions per the Utah Division of Water Rights.

The remedial actions at OU 1 were developed to achieve the RAOs set forth in the ROD. The individual site summaries include a description of each RAO for OU 1.

V Progress Since Last FYR

OU 1 interim remedies were reviewed in the 1998 Five Year Review Report. Since the review in 1998, the ROD has been written and all of the remedial actions outlined in the ROD have been implemented except for removal of arsenic contaminated soils from the springs which is not planned until after two to three years operation of the groundwater extraction system.

VI FYR Process

Site review was conducted per the process described in this report for the overall 2003 FYR.

VII Technical Assessment

Results of the technical assessment for each site in OU 1 and for the operable unit are listed in Table OU 1-3. Details of the technical assessment for each site in OU 1 are provided in the respective site summary (see Section XIII).

Table OU 1-3: Technical Assessment Summary for OU 1.

Site ID	Remedy	Technical Assessment*			Protectiveness	Next Five Year Review
		Question A	Question B	Question C		
LF001, WP002, LF003, FT081, WP080	Groundwater Extraction Trenches, Spring Remediation, Landfill Cap, Monitored Natural Attenuation, Institutional Controls	Yes	No	Yes	Protective	2008
FT009	NA	NA	NA	NA	Protective	NA
OT014	NA	NA	NA	NA	NA	NA
OU 1	Groundwater Extraction Trenches, Spring Remediation, Landfill Cap, Monitored Natural Attenuation,	Yes	No	Yes	Protective	2008

	Institutional Controls					

*Question A: Is the remedy functioning as intended by the decision documents?
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable

VIII Issues

Based on the information reviewed, issues that may affect protectiveness of the selected remedies at OU 1 are listed below:

1. Eighteen months of operational data are not sufficient to determine if the remedies at OU 1 are containing contaminated groundwater. As discussed in the PSVP (CH2M 2001b), five years of data with at least two sampling rounds per year should provide adequate samples across the site and over time to determine if plume mean concentrations are decreasing.

2. If measurable hydrocarbon concentrations and LNAPL are present downgradient and to the west of the exterior trench (Trench D), it is questionable whether monitored natural attenuation in that portion of the non-source area is adequate to remediate the contaminated groundwater to achieve RAOs.

3. Ponding on the landfill caps was identified during the site inspection portion of this review.

4. A preliminary check between the PSVP sampling requirements and data in ERPIMS showed that the analytical results from 14 out of 44 sampling locations were not available for review. This may be due to both the lag time between sampling activities and the uploading of the results into ERPIMS and the possibility that the sampling locations were/are dry. However, if the locations are dry, the results (i.e., "well is dry") should be included in ERPIMS.

5. Some of the indoor air sampling results, collected during the RI, exceed the new action level for TCE in indoor air (0.43 ppbv).

IX Recommendations and Follow-up Actions for OU 1

The recommendations and follow-up actions for OU 1 are:

1. Re-evaluate the non-source area monitored natural attenuation remedial action to determine if it is still applicable in all non-source areas (specifically in the area of measurable hydrocarbon concentrations outside Trench D).

2. Review the long term monitoring sampling and analysis plan to ensure that locations where the hydrocarbon concentrations were located during the Source Zone Area Delineation project (Intera 2001) are sampled.

3. Proceed with the delineation and excavation of the arsenic contaminated soils at the springs.

4. Determine if the trenches are containing/capturing the contamination in the source area by evaluating the gradient around the trenches. Additional monitoring points may be necessary to confirm that the prescribed water levels in the sumps are adequate to maintain containment.

5. Reevaluate the Remedial Investigation data on indoor air and determine if the new action level for TCE (0.43 ppbv) in indoor air warrants additional mitigation measures in off-Base residential areas.

6. Address drainage and ponding issues on Landfills 3 and 4 as soon as they are identified to ensure the landfill cap integrity.

7. Ensure that all gates and fences are locked in accordance with the ROD specified institutional controls.

8. Determine if the plume mean concentrations are decreasing, using the described locations and monitoring frequency outlined in the Performance Standard Verification Plan (PSVP) and the results of the Performance Standard Verification Report (PSVR), scheduled for 2006.

9. Ensure that the method detection limits (MDL) are low enough to detect a contaminant of concern (i.e., MDL equal to or less than the MCL or PRG).

10. Collect samples from all locations described in the PSVP and ensure that the results are entered in ERPIMS.

11. Continue to perform landfill cap inspections.

XI Next Review

The next FYR for OU 1 is required by 2008. No future review is required for the Fire Training Area 1 (FT009) or the Golf Course (OT014) sites because no further remedial actions are planned at these sites.

XII References

(To be exported from database)

XIII FYR of Sites in OU1

See attached site summaries.

OU: 2

Comments Prepared By: Hill EMR Combined

OU 2

I Introduction

Operable Unit 2 consists of two IRP sites, as shown below in Table OU 2-1. Site SS021 requires no further action (HAFB EMR 1991a; CH2M Hill 1996) and has been included in the Five Year Review for completeness and to document the site background. IRP site WP007, also known as Chemical Disposal Pit 3, consists of two unlined trenches which were used for the disposal of unknown quantities of trichloroethene (TCE) bottoms from solvent recovery units, sludge from vapor degreasers, and plating tank bottoms. The waste solvents migrated downward through the vadose zone into the shallow aquifer and accumulated as a mobile phase DNAPL, pooled in topographic lows of a clay aquitard underlying sandier surface soils. Contaminated soils and the pooled DNAPL are the source of shallow groundwater contamination extending approximately 1500 feet downgradient, and beyond the Hill AFB boundary.

Since the Record of Decision for Operable Unit 2 (CH2M Hill 1996), OU 2 has become synonymous with WP007, although OU 2 includes both SS021 and WP007.

Table OU 2-1: OU 2 Site Identification.

Site ID	Site Name
WP007	CHEMICAL PIT 3
SS021	PERIMETER ROAD

II Site Chronology

See Table OU 2-2 for a history of events in this OU. The table is organized to describe events that impacted the OU as a whole, followed by events impacting specific IRP sites within the OU.

III Background

SS021 (Perimeter Road) was reportedly the site of previously unidentified dumping of waste solvents prior to 1979, in addition to dumping known to have occurred at a number of sites now associated with other Operable Units. The Record of Decision for Operable Unit 2 (CH2M Hill 1996) states that SS021 has been found to be free of contamination except in those areas being addressed as part of existing Operable Units, and that no further action at that site is needed.

IRP site WP007, Chemical Disposal Pit 3, is located approximately 100 feet west of Perimeter Road, near the northeast boundary of Hill AFB, as shown on Figure OU 2-1 (HAFB EMR 1991b). Past disposal of chlorinated solvents at WP007 has contributed to on- and off-Base contamination of the natural environment (Radian 1992a). A steep, terraced, northeast-facing escarpment leading from the Base to the Weber River Valley below separates the on-Base portion of OU 2 from the off-Base portion. There is about 300 feet of relief between HAFB and the valley.

WP007 consists of two unlined trenches several feet wide and approximately 50 to 100 feet long (Radian 1992a). The exact size and depth of the trenches are unknown. The facilities of the Source Recovery System (SRS) and other structures supporting the removal, treatment, and investigation of DNAPL in the subsurface are constructed over and obscure the trenches. From 1967 to 1975 the trenches were used for the disposal of unknown quantities of trichloroethene (TCE) bottoms from solvent recovery units and sludge from vapor degreasers (CH2M Hill 1996).

An unknown volume of plating tank bottoms was disposed at this site in the early 1940s (CH2M Hill 1996). The estimated volume of waste solvents disposed in the trenches exceeds 10,000 gallons, and may exceed 100,000 gallons (HAFB EMR 1991c; CH2MHill 1996, Intera work?). The waste solvents migrated downward through the vadose zone into the shallow aquifer and accumulated as a mobile phase DNAPL, pooled in topographic lows of the Alpine Formation, a clay aquitard underlying the sandier soils of the Provo Formation (HAFB EMR 1991b; Radian 1992a). The DNAPL is approximately 70% TCE (HAFB EMR 1998a).

Contaminated soils near the trenches and the pooled DNAPL are the source of shallow, dissolved phase groundwater contamination extending approximately 1500 feet downgradient, and beyond the Hill AFB boundary (HAFB EMR 1991b; Radian 1992a; CH2M Hill 1996; URS 2002b). Downgradient seeps and springs have also exhibited contamination. Concentrations of TCE in groundwater exceeding 10,000 ug/L occur both on- and off-Base. Groundwater contamination appears limited to the shallow, unconfined aquifer of the Provo Formation, above the Alpine Formation aquitard.

The Record of Decision (ROD) for Operable Unit 2, issued in 1996, specifies both source and non-source remedies to address contamination due to WP007 (CH2M Hill 1996). The source area corresponds approximately to the on-Base regions of contamination, the non-source areas to the off-Base regions. One of the remedies specified by the ROD is a low permeability containment wall encircling the source area to reduce the potential for further contamination of groundwater. After the wall was built, however, an additional accumulation of free-phase DNAPL was identified outside of the wall (URS 1999). This accumulation is informally known as either the "Griffith Pool" or the "G-Pool."

IV Remedial Actions

The remedial actions at OU 2 are described in detail in Section IV of the WP007 (Chemical Pit 3) Site Summary.

Source Area - Containment Wall

The containment wall is a vertical, low permeability, soil/bentonite slurry wall encircling the OU 2 source area, isolating the source area from the shallow aquifer (CH2M Hill 1997). The containment wall acts as a barrier to contaminant migration and, in conjunction with extraction of groundwater from the source area, produces an inward hydraulic gradient along most of the wall Resolve conflict: At year-end meeting, URS indicated that there was an outward gradient at both east and west sides of the containment wall. The upgradient control system (UCS) is a gravel trench upgradient from the containment wall designed to eliminate groundwater mounding, which could lead to slope instability and failure (CH2M Hill 1997). Associated sumps, pumps and piping convey intercepted groundwater to either the Source Recovery System (SRS) process plant or the Air Stripper Treatment Plant (ASTP) for treatment and disposal.

Source Area – Source Recovery System (SRS)

The SRS consists of a free-product and contaminated groundwater recovery well field and a process treatment facility. In conjunction with the containment wall, the SRS extraction well field provides hydraulic control in the source area by lowering the elevation of shallow groundwater within the wall (CH2M Hill 1997). The SRS process plant also receives contaminated groundwater from the G-Pool.

DNAPL from other wells within the containment wall is removed using a portable DNAPL pump assembly. ~~Recovered DNAPL is transported manually to the SRS process plant.~~ Since its initial operation in 1993 through 2001, approximately 43,500 gallons of DNAPL have been recovered from the source area and shipped off-Base (URS 2002). Current piping configurations allow the treated groundwater to be discharged either to the ASTP or to the Hill Air Force Base Industrial Wastewater Treatment Plant (IWTP) for further treatment.

Source Area – Treatability Studies
Several pilot-scale treatability studies involving innovative technologies have been conducted in the source area. Approximately 6,000 gallons of DNAPL have been removed from the source area as the combined result of treatability studies and subsequent full-scale innovative treatments.

Source Area – Soil Vapor Extraction (SVE)
The source area SVE system specified in the ROD to remove VOCs from subsurface soils has not been implemented, and no timetable is specified in the ROD for implementation. The schedule will be established pending the completion of treatability studies. In 2002, a pilot-scale soil vapor extraction (SVE) study was recommended to HAFB. Implementation of SVE is under review because 1) the vast majority of the contaminant mass in the source zone is associated with DNAPL in the saturated zone and hence is not amenable to removal by SVE and 2) the SVE piping would inhibit potential efforts to enhance treatment of the saturated zone.

Source Area – Surface Cap
A surface cap over the source area, designed to prevent infiltration of surface water and further degradation of groundwater, has not been built. The ROD indicates the cap is to be delayed until source area treatment by either conventional or innovative technologies is completed and their effectiveness evaluated.

Source and Non-Source Area – Air Stripper Treatment Plant (ASTP)
The ASTP is designed to treat extracted groundwater containing relatively low concentrations of VOCs from both the source and non-source areas (CH2M Hill 1997). It can treat flows from the UCS, the SRS (after initial treatment in the steam stripper), and the North Interceptor Trench (NIT, discussed below). In addition, it can treat groundwater extracted from OU 1. Treated water flows by gravity to a sanitary sewer connection leading to the Central Weber Sewer Improvement District (CWSID) treatment facility. During 2001, VOC concentrations in ASTP effluent were consistently below detection limits (URS 2001).

Non-Source Area – Interceptor Trenches
The NIT is a gravel trench drain located near the leading edge of the off-Base plume, designed to intercept contaminated groundwater to prevent further downgradient migration (CH2M Hill 1997). A sump located at the lowest pipe entry elevation of the NIT receives groundwater intercepted by the trench, and also receives water intercepted by similar trenches at springs U2-304 and U2-326. The groundwater collected from the NIT sump is sent to the ASTP for treatment. The NIT has been upgraded to pump untreated NIT flows directly to CWSID.

Institutional Controls
A Continuing Order (AFI 32-7020) has been issued to restrict disturbance of contaminated soil and groundwater and to restrict installation of water wells on-Base at OU 2 (HAFB EMR 1998b). The Utah Division of Water Rights has also restricted water well drilling and the use of shallow

groundwater at off-Base areas near OU 2. On-Base remediation facilities are not fenced, but are locked when unoccupied. Off-Base remediation facilities are fenced and posted with signs.

Environmental Monitoring
The ROD requires a program of long-term monitoring for contaminants and treatment system performance. A Performance Standard Verification Plan (PSVP) (CH2M Hill 2001) was completed in 2001, describing the data needed to assess whether the remedial actions specified in the ROD are operating properly and successfully, and establishing a program to collect the data. The PSVP specifies annual reporting of operations and maintenance (O&M) activities for the treatment systems, the annual cost of O&M, and an annual groundwater sampling report. The annual groundwater sampling report is a summary of the groundwater sampling conducted during the previous year, and includes data reporting and charting; it does not, however, include data interpretation. Thorough interpretation and evaluation of the data is deferred until 2006, when a Performance Standard Verification Report (PSVR) is scheduled. All environmental monitoring data, derived from either the O&M or groundwater sampling reporting, are submitted to ERPIMS.

V Progress Since Last FYR

The 1998 Five Year Review contained no specific recommendations regarding the remedies at OU 2. The estimate of initial free-phase DNAPL accumulation in the G-Pool, outside of the containment wall, has been refined from 5,000-10,000 gallons (1998) to 2,800 gallons (currently). Approximately 2,500 gallons have been recovered from the G-Pool.

Many incremental improvements have been achieved in the operation of the remedies.

VI FYR Process

Site review was conducted per the process described in this report for the overall 2003 FYR.

VII Technical Assessment

Results of the technical assessment of the remedies at OU 2 are presented in Table OU 2-3. Additional details are provided in Section VII of the WP007 Site Summary.

Table OU 2-3: Technical Assessment Summary for OU 2.

Site ID	Remedy	Technical Assessment*			Protectiveness	Next Five Year Review
		Question A	Question B	Question C		
WP007	Source removal, containment, and institutional controls	No	No	Yes	Cannot be determined until further information is obtained	2008
SS021	Not required, NFRAP site	NA	NA	NA	NA	Not required
OU 2	Source removal, containment, and institutional controls	No	No	Yes	Cannot be determined until further information is obtained	2008

OU: 2

Comments Prepared By: Hill EMR Combined

* Question A: Is the remedy functioning as intended by the decision documents? Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid? Question C: Has any other information come to light that could call into question the protectiveness of the remedy? NA = Not applicable

Question A. Is the remedy functioning as intended by the decision documents?

No. Some portions of the remedy appear to be functioning as intended, while others do not.

The SRS process plant, treatability studies and innovative treatments, ASTP, interceptor trench systems, and institutional controls are functioning as intended. However, the SRS extraction wells and the containment wall are not functioning as intended. An inward gradient is not being maintained along the western segment of the containment wall and groundwater elevations are not consistently below action levels in the SRS well field.

Question B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?

No. The risk factors used to develop the cleanup levels for Beta-BHC, methylene chloride, tetrachloroethene, and trichloroethene at OU 2 are now 10-times to 10,000-times more stringent (EPA Region III, 2002; URS 2002).

The baseline risk assessment (Radian, 1992b) considered the inhalation of indoor air as a potentially significant current and future pathway for both onsite and offsite residential exposure. However, no indoor air sampling was performed during the remedial investigation (Radian, 1992a), perhaps because the off-site land use at the time was predominantly agricultural. Since then, EMR, EPA, and Utah DEQ have jointly established a new action level for TCE concentration in indoor air of ~~43~~ 0.43 ppbv. In addition, new homes have been built and new subdivisions developed in formerly agricultural areas downgradient of the source (Curt Himle, personal communication, 2003). The new indoor action level for TCE, combined with the increasing residential use downgradient of the source, raises the potential for indoor air quality issues that have not been addressed.

Per Steve Hicken
Pg 5 Answer to Question B: I think the off-site land use still is predominantly agricultural. There are some new homes, but they are down gradient of the plume, which at least from the standpoint of the sentry wells that have been sampled, has not shown any sign of growth. The wells I am referring to are U2-037 (since 1993), U2-087 (since 1998), and U2-029 (since 1991). I do think the area needs to be looked at in regards to the location of the contamination in relation to homes, but I doubt there are homes over the plume. I think that may have been why no air sampling was done previously and I suspect there are still no homes over the plume area. As I read the BRA addendum (1994) it seems the inhalation scenario evaluated is primarily in conjunction with showering if contaminated gw were used and this is listed as a future off-site scenario. See pg 6-71 and Table 6-17. It was not considered significant for current scenarios. I suggest you use the most current update of the BRA.

Question C. Has any other information come to light that could call into question the protectiveness of the remedy?

Yes. In 1997, after construction of the containment wall, an accumulation of mobile-phase DNAPL was discovered outside of the containment wall during a treatability study. This accumulation, the "G-Pool," was adjacent to the northeast corner of the containment wall and contained an estimated 2,800 gallons of DNAPL. Approximately 2,500 gallons of DNAPL have been recovered from the G-Pool, and small volumes of ~~for~~ free-phase DNAPL continue to be recovered. Groundwater extraction wells maintain the water level below ~~the~~ a specified elevation in ~~of~~ the G-Pool, reducing the potential of the G-Pool as a continuing source of contamination. Aside from reducing the hydraulic gradient across the G-Pool, the containment wall does not control contaminant flux out of the G-Pool. In addition, a recent review of time-series data (URS 2003) of TCE concentration in U2-675 raises the possibility of increasing contaminant concentrations in groundwater downgradient of the NIT.

VIII Issues

Please do not grandstand on issues. Be brief, clear, and direct, and keep recommendations separate.

1. A joint evaluation of the SRS and the containment wall is ongoing. ~~overdue.~~ ~~These two remedies have been operating together since 1996. A statement of the p~~ Protectiveness provided by these remedies~~, through the reduction of downgradient mass flux of contaminant,~~ cannot be determined ~~made~~ until the data ~~pertaining to these remedies~~ have been thoroughly evaluated and interpreted. ~~A thorough evaluation and interpretation of the relevant data are not scheduled until the PSVR in 2006. The performance of the SRS and containment wall is a potential ROD compliance issue, and additional actions may be needed to rectify a problem if one is shown to exist.~~

2. A preliminary evaluation of groundwater elevation and TCE concentration data from wells in the vicinity of the NIT suggests the possibility that during the spring months the NIT fails to intercept contaminated groundwater. ~~The NIT was completed in 1997, yielding five years of operating data.~~ These data, and the performance of the NIT, should be thoroughly evaluated. ~~The performance of the NIT is a potential ROD compliance issue, and additional actions may be needed to rectify a problem if one is shown to exist.~~

3. The data collected by the LTM contractor are not readily available to the O&M contractor, though they may have a bearing on the operation of the remedies. ~~Timely submittal of LTM data to ERPIMS is therefore necessary. For example, in March 2003 the most recent groundwater elevation data in ERPIMS for piezometers U2-640, U2-657, and U2-659 are from April 2002. These piezometers are used to measure groundwater elevation on the downgradient of the containment wall, and are an indicator of the performance of both the wall and dewatering within the wall.~~

4. The portable DNAPL pump assembly currently removes free-phase DNAPL only from wells in the source area. State the issue. ~~An additional portable DNAPL pump assembly could also remove free product from wells in the G-Pool.~~

5. State the issue. The baseline risk assessment (Radian, 1992b) considered the inhalation of indoor air as a potentially significant current and future pathway for both onsite and

offsite residential exposure. Since then, EMR, EPA, and Utah DEQ have jointly established a new action level for TCE concentration in indoor air of ~~43~~ 0.43 ppbv. In addition, new homes have been built and new subdivisions developed in formerly agricultural areas downgradient of the source.

6. The leading edge of the plume is very near the southern boundary of NE ¼, Sect. 29, T5N R1W, which is not subject to water rights restrictions imposed by Hill AFB in conjunction with the Utah Department of Natural Resources. Should the plume advance, it could impinge on this quarter section.

7. A thorough review of several portions of the remedial systems addressing contamination at OU 2 may be justified sooner than the PSVP review scheduled in 2006 because they have been in operation since 1993. ~~is warranted. A thorough evaluation of the remedial actions now implemented is not scheduled until 2006, thirteen years after SRS began operating in 1993, and ten years after the containment wall was completed in 1996. The long delay appears to be related to the seven years (1993 to 1999) needed to construct the various remedial systems now operating and the development of the Operable Unit 2 Performance Standard Verification Plan issued in 2001. The performance evaluation seems driven by the construction schedule rather than by technical considerations. A thorough review of all remedial systems addressing contamination at OU 2 is warranted.~~

IX Recommendations and Follow-up Actions for OU 2

1. Jointly evaluate the effectiveness of the SRS and the containment wall.

2. Evaluate the effectiveness of the NIT.

3. Expedite submittal of LTM data to ERPIMS for timely review of remedy effectiveness.

4. Continue use of the portable DNAPL pump assembly to remove free-phase DNAPL from wells. Consider purchase of a second system, which would enable simultaneous recovery of DNAPL from wells within the containment wall and from wells in the G-Pool.

5. Investigate the relationship between new residential development and the plume.

6. Consider the need to restrict water rights in the northeast quarter of Sect. 29, T5N R1W.

7. Evaluate whether a thorough review of the remedies at OU 2 can be performed before 2006.

X Protectiveness Statement for OU 2

Protectiveness cannot be determined until further information is obtained. The remedies specified by the ROD and now in-place constitute an appropriate response to contamination resulting from WP007 and would be protective if operating as designed. ~~A comprehensive evaluation of all relevant data generated since remediation began is needed, however, in order to make a strong protectiveness statement by comparing operating data against design objectives. In at least one case, failure to achieve an inward gradient along the entire western segment of the containment wall, a remedy is not currently operating as designed. The degree to which this limitation affects protectiveness cannot be established without further study.~~

~~An assessment of the joint performance of the containment wall and the SRS, in operation together since 1996, is overdue, and is needed to make a clear statement about the prevention of continuing downgradient groundwater stemming from the source area.~~

XI Next Review

The next FYR for OU 2 is required by 2008. No future review is required for Site SS021 (Perimeter Road) because no further remedial action is planned at this site.

XII References

(To be exported from database)

XIII FYR of Sites in OU 2

See attached site summaries.

OU: 2
Comments Prepared By: Steve Hicken

Watkins Jeffrey W Civ OO-ALC/EMR <Jeffrey.Watkins@HILL.af.mil>
04/22/03 06:33 AM

Please consider these late comments from Steve Hicken.

Pg 5 Answer to Question B: I think the off-site land use still is predominantly agricultural. There are some new homes, but they are down gradient of the plume, which at least from the standpoint of the sentry wells that have been sampled, has not shown any sign of growth. The wells I am referring to are U2-037 (since 1993), U2-087 (since 1998), and U2-029 (since 1991). I do think the area needs to be looked at in regards to the location of the contamination in relation to homes, but I doubt there are homes over the plume. I think that may have been why no air sampling was done previously and I suspect there are still no homes over the plume area. As I read the BRA addendum (1994) it seems the inhalation scenario evaluated is primarily in conjunction with showering if contaminated gw were used and this is listed as a future off-site scenario. See pg 6-71 and Table 6-17. It was not considered significant for current scenarios. I suggest you use the most current update of the BRA.

Jeff

OU: 2
Comments Prepared By: Ray Spencer

Watkins Jeffrey W Civ OO-ALC/EMR <Jeffrey.Watkins@HILL.af.mil>
04/22/03 10:12 AM

Review Comments - Ray Spencer 8 Apr 2003

OU2 Chronology 030403.pdf

On pages 1 and 2 in the Reference column, interim is consistently misspelled
as "interirn"

WP007 Site Summary

Data referances are all for CY2001. Was CY2002 data not available?

Page 7 VII Technical Assessment

"Source recovery system, extraction wells: no.
Although contaminated groundwater is extracted from the shallow aquifer within the
containment wall, groundwater elevations in the extraction wells increased
over a period of
5 to 6 months during 2001, and exceeded the action level of 4660 feet amsl
for most of the
year. The cause of the exceedance is unknown. The increasing groundwater
elevations in
the extraction wells seems inconsistent with the decreasing trend observed
over several
years in containment wall piezometer nests, and calls into question the degree of
dewatering occurring within the containment wall. This apparent inconsistency also
suggests that the complexity of the shallow aquifer system in the source
area is poorly
understood."

If this is a problem, why isn't it listed in either or both.... VIII Issues
or IX Recommendations?

SRS plant was designed for 20 GPM continuous. Historically the well field is
seldom pumped that hard, and treatment is done in batch modes. Why were
action levels exceeded? What actions have been taken? What recommendations
have been made?

OU: 3
Comments Prepared By: Steve Hickens

Watkins Jeffrey W Civ OO-ALC/EMR
<Jeffrey.Watkins@HILL.af.mil>

04/21/03 10:11 AM

To:"'Jeremey_Cox@urscorp.com'" <Jeremey_Cox@urscorp.com>, "'B_Hall@urscorp.com'" <B_Hall@urscorp.com>
cc:
Subject: OU3 Combined summary

Please see the attached combined summary of OU3 and Steve Hickens comments below. Figures have not been reviewed.
Jeff

Table OU3 - 2:
OU 3: Suggest adding PA/SI from 82 - 91, 1993 OU 3 becomes a soils only OU. GW split off to become OU 8. Also OT 033 listed in the RI sites is the gw that was split off in 1993, before the RI was completed.

WP005: You include operational history for the other sites. I would suggest you include one for the pond. Built when? Used from when to when for receiving industrial waste streams?

ST018: Operational history. Used from when to when for vehicle maintenance?

SD046: When operated? Taken out of service in 1974.

OU: 4

Comments Prepared By: Hill EMR Combined

Operable Unit 4

I Introduction

OU 4 is located on the northern boundary of Hill AFB. It includes five IRP sites (see Table OU 4-1) and has active remediation in place to address contaminated groundwater and soil. The location of each IRP site is shown in Figure OU 4-1. ~~The five sites have been investigated and managed under OU 4 because they are located near one another.~~ OU 4 contains a TCE contaminated groundwater plume that extends off Base in the direction of South Weber Drive and is currently migrating (Has migration been verified? Recent data and geosystem analysis indicate the plume is stable.) in a northwesterly direction (direction verified?), approximately parallel to South Weber Drive. Some ~~C~~ontaminated groundwater surfaces as springs in off-Base areas.

Landfill 1 (LF011) was considered the sole source of contamination in the groundwater at OU 4 in the RI (USGS 1993) and the ROD established four media of concern and chose remedies for each of the media. The Spoils Area (OT020) was accepted as a non-hazardous site with no further remedial action planned (NFRAP) (HAFB EMR 1992) before the ROD was complete. Landfill 2 (LF0012), the North Gate Dump (OT041), and the Munitions Dump (OT042) were found to not have released hazardous substances to the environment and were given NFRAP status (HAFB EMR 1994) (following completion of the ROD?). An ~~additional~~ area of high concentration (TCE in the groundwater above 1,000 µg/L) was recently discovered in the vicinity well U4-080 in 1996, ~~indicating~~ suggesting ~~possibility~~ a potential for an additional source near the Landfill 2 and the North Gate Dump areas ~~that should be investigated further~~.

Table OU 4-1: OU 4 Site Identification.

Site ID	Site Name
LF011	Landfill 1
LF012	Landfill 2
OT020	Spoil Pit
OT041	North Gate Dump
OT042	Munitions Dump

II Site Chronology

See Table OU 4-2 for a history of events in this OU. The table is organized to describe events that impacted the OU as a whole, followed by events impacting specific IRP sites within the OU.

III Background

Operations at the sites of OU 4 included:

- Waste dumping and burning in the late 1940s at Landfills 1 & 2 until burning at Hill AFB was terminated in 1967. Though there are no records of any industrial or hazardous waste disposal at these sites, it has been reported that Landfill 1 received wastes from the Ogden Arsenal that included waste oils and solvents from the vehicle maintenance facility.
- Several drums of waste solvent were reportedly dumped from trucks in the North Gate Dump Area, but no drums have been found in that area.

- The Spoils Area received construction debris (concrete, wood, and soil) from base activities.
- The Munitions Dump was operated by the Ogden Arsenal as an aboveground storage area for munitions during World War II.

~~OU 4 is located along the top of a steep, terraced escarpment of the Weber Delta overlooking the Weber River Valley.~~ The TCE contaminated ~~ion~~ groundwater underlies approximately 69 acres (30-50 ft bgs) and extends north down the steep slope, off-Base, into the cities of Riverdale and South Weber. ~~The ROD suggests that Landfill 1 is the sole source of contamination.~~ Other sources may be contributing to the plume (Landfill 2 [LF012] and North Gate Dump [OT041]), but an investigation will need to be conducted to make that determination.

Beyond the base boundary, the hill continues downward and seeps have been observed slowly flowing out of the hillside. ~~The slope is vegetated with shrubs and grasses.~~ The Davis-Weber Canal, a privately owned irrigation canal used each year from April to October, is in the middle of the slope~~, and is approximately 25-50 feet north of the base boundary.~~ Results of analyses of canal water during the RI indicated that the canal has not been a source of contamination, nor have chemicals from OU 4 contaminated it.

Beyond the slope, there are houses and small farms. The TCE contamination has not extended into any area that includes ~~the~~ homes~~ or farms~~. Groundwater in the shallow contaminated aquifer is not currently used as a source of drinking water.

Recommend combining the 3 paragraphs above with the 2 paragraphs in the Introduction to make a brief but complete description.

IV Remedial Actions

Remedial actions have been implemented at OU 4 to address both on-Base and off-Base contamination. Remedial actions at Landfill No. 1 are associated with four media types: soil (landfill contents), groundwater, surface water and air. No remedial actions or remedies have been applied to the other four IRP sites. ~~The remedial action objectives (RAOs) for OU 4 are:~~ State RAOs are found in the ROD.

~~*Landfill Contents*~~

- ~~Limit cancer risk to less than 1E-4 with a target of 1E-6 due to accidental ingestion, dermal contact, or inhalation of vapors.~~
- ~~Maintain contaminant concentrations low enough to avoid chronic health effects (as indicated by a hazard index of less than 1).~~
- ~~Eliminate the source(s) of ground-water contamination either through removal or source control in accordance with Utah Corrective Action Cleanup Policy (R315.101).~~

~~*Groundwater and Surface Water*~~

- ~~Meet chemical-specific ARARs, which are drinking water MCLs.~~
- ~~Limit cancer risk to less than $1x10^{-4}$ with a target of $1x10^{-6}$ due to accidental ingestion, dermal contact, or inhalation of vapors.~~
- ~~Maintain contaminant concentrations low enough to avoid chronic health effects (as indicated by a hazard index of less than 1).~~
- ~~Prevent further degradation of ground-water quality in accordance with the Utah Corrective Action Cleanup Policy.~~

~~*Air (Indoor)*~~

- ~~Prevent the migration of contaminated soil gas into residences.~~
- ~~Prevent inhalation of carcinogens in excess of $1x10^{-6}$ cancer risk within off-Base residences.~~
- ~~Prevent inhalation of noncarcinogens at levels exceeding a hazard index of 1 within off-Base residences.~~

The remedies in place at OU 4 include:

Landfill Contents Remedy
The landfill contents remedy included regrading and revegetation of the landfill cap to reduce infiltration and control runoff, and the installation of a soil vapor extraction (SVE) system to remove vapor from the landfill contents. The SVE system has not been installed because analysis of soil gases after the ROD was signed showed that gas concentrations were too low to justify the installation. Piping placed beneath the cap as part of the planned SVE system is now used to collect leachate. The leachate is periodically collected and disposed of at the IWTP. There are institutional controls (HAFB 1998) associated with this remedy to restrict access and potential exposure pathways.

Groundwater Remedy
The groundwater remedy~~, the Horizontal Drain Upgrade System (HDUS),~~ includes the installation of a passive groundwater extraction system (Horizontal Drain Upgraded System, HDUS) that includes an air stripper to pre-treat the extracted groundwater prior to discharge to the sewer. There are institutional controls (HAFB 1998) associated with this remedy to restrict access and potential exposure pathways.

Surface Water Remedy
The surface water remedy consists of local collection of contaminated surface water at each spring/seep site, treatment using carbon adsorption, and discharge to the subsurface using infiltration trenches. There are institutional controls associated with this remedy to restrict access and potential exposure pathways. The collection systems have not been installed due to low flows at the spring/seep sites but the springs are monitored on a regular basis.

Air Remedy
The air remedy consists of semi-annual monitoring of the off-Base residences overlying contaminated groundwater that is in excess of MCLs. To date, there has not been any air sampling conducted in homes because there are no homes located over the plume.

V Progress Since Last FYR

In the 1998 Five Year Review, it was anticipated that a ROD amendment might be needed to resolve the usefulness of the SVE system at the Landfill 1, the low flow rates of the seeps and springs, and the overall practicality of reaching MCLs.

- A "Proposed Explanation of Significant Differences for Operable Unit 4 Landfill Contents Remedy", dated March 1995, was completed to address the elimination of SVE as a portion of the landfill remedy. You should mention the 1) the bypass of the OU4 air stripper because of changes in discharge limits by CWSID, 2) overall results of the OU 4 Geosystem study completed by Intera in Dec. 2002, and 3) overall results of the slope stability study.

- The low flow rates of the seeps and springs and the overall practicality of reaching MCLs has not yet been addressed with a ROD amendment. An amendment of the ROD for the seeps and springs is not needed to address the flow rate since the ROD addresses both a low-flow and a higher-flow treatment option.
- The issue of reaching MCLs is a base wide issue that may be addressed at a later date.

VI FYR Process

Site review was conducted per the process described for the overall 2003 FYR.

VII Technical Assessment

Results of the technical assessment for each site in OU 4 and for the operable unit as a whole are listed in Table OU 4-3. Details of the technical assessment for each site in OU 4 are provided in the respective site summary (see Section XIII).

Table OU 4-3: Technical Assessment Summary for OU 4.

Site ID	Remedy	Technical Assessment *			Protectiveness	Next Five Year Review
		Question A	Question B	Question C		
LF011	Landfill Cap, HDUS, seep/spring control, air monitoring	No	No	Yes	Protective in the short-term	2008
LF012	Not required, NFRAP site	NA	NA	NA	NA	2008
OT020	Not required, NFRAP site	NA	NA	NA	NA	Not required
OT041	Not required, NFRAP site	NA	NA	NA	NA	2008
OT042	Not required, NFRAP site	NA	NA	NA	NA	Not required
OU 4	Landfill Cap, groundwater extraction, surface water and groundwater use restrictions, site access restrictions	No	No	Yes	Protective in the short-term	2008

* Question A: Is the remedy functioning as intended by the decision documents?
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not applicable

Question A. Is the remedy functioning as intended by the decision documents?
No.

Groundwater Remedy
The groundwater remedy is not functioning as intended. The system has limited impact on the continued (is the plume continuing to migrate?) plume migration and does not prevent further degradation of groundwater quality in accordance with the RAOs.

Landfill Contents Remedy
The Landfill 1 cap is intended to limit infiltration and reduce the leaching of contaminants from the landfill contents into the underlying groundwater (HAFB EMR 1994). Proper function of the landfill cap cannot be determined without additional data evaluation. Mark Loucks comment: If there is not sufficient data, then there needs to be a statement as to what data needs are required so that an evaluation can be made. Also it would be good to know how a cap function should be evaluated. There are CERCLA caps all over Region 8: how have the cap functions for these sites been evaluated ? I know this has been discussed in the other OU writeups with caps. Lets make sure that we are consistent with our responses.

Question B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
No. Changes in cleanup levels need to be evaluated.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
Yes.

Groundwater Remedy
It appears that plume migration is a problem as well as unsuccessful attainment of the RAOs to prevent further degradation of the groundwater quality. What data show the plume is expanding and GW quality is continuing to degrade? Intera Geosystem study results indicate the possibility of several smaller plumes may be simply merging.

The possibility of additional contamination was discovered in March 2002. Contaminated water from the HDUS system was discharging into the surrounding soil through a hole in the effluent line. The line has since been replaced and soil sampling has been conducted. Results of soil sampling show that contamination is below risk-based levels.

Landfill Contents Remedy
After reviewing the data available for the PSVP-specified monitoring locations, an increasing TCE trend in one of the two monitoring points indicates that additional data evaluation and investigation are required before protectiveness can be determined.

VIII Issues

Based on the information reviewed, issues that may affect protectiveness of the selected remedies at OU 4 are listed below:

OU 4 - Treatment and Containment

- Although the OU 4 plume is not currently impacting receptors, the remedial actions that are presently in place do not prevent further contaminant migration. How do you define contaminant migration as used here? Therefore, the current actions are not in compliance with the RAOs set forth in the ROD, namely to prevent further degradation of groundwater quality in accordance with the Utah Corrective Action Cleanup Policy.
- Regulatory changes to the COC levels may affect the protectiveness of a remedy.
- Additional source areas need to be further investigated near Landfill 2 (LF012) and the North Gate Dump Areas (OT041).

Landfill 1 - Treatment and Containment

- The long-term monitoring data have not been analyzed in detail to provide specific recommendations on proper plume management and future HDUS operations.
- The effectiveness of the landfill cap in limiting infiltration and reducing the contaminant leaching is uncertain.
- No action levels (flow level) exist in either the ROD or the PSVP that would require implementation of a surface water collection and treatment system.
- ~~There are concerns of possible soil contamination from a hole in the buried drain line from the HDUS treatment building to the sewer. It is uncertain how long the contaminated water was draining into the surrounding soil.~~ A leak in a buried drain line was investigated following repairs. Analytical results of soil samples showed trace levels of TCE were found, and the results were compared with Risk-Based Screening Levels (RBSL) to determine if soils present a risk to human health or the environment. It was determined that contamination detected in the soil samples was below Risk-Based Screening Levels. Mention the date the air stripper was bypassed to establish a time frame for leakage of higher concentrations of wastewater.

Landfill 1 - Operations and Maintenance

- Upon inspection of the HDUS, several drain lines were exposed. The lines should have at least 24" of cover to prevent freezing and pipe breakage. Erosion is a significant problem in the area, possibly due to poor compaction during construction.
- No signage is evident in the off-Base area to prevent unauthorized excavation.
- The HDUS flows are declining, but the cause is unknown.
- Operating data were not readily available to evaluate the remedy performance. Please explain this to me and Oscar!
- Currently, the remedies for the seeps are protective. However, protection is based on low flow and not access control in some cases. Please rework the sentence.

IX Recommendations and Follow-up Actions for OU 4

The recommendations and follow-up actions for OU 4 are:

OU 4 - Treatment and Containment

- Thoroughly evaluate existing data and determine if additional data and/or modeling are required to develop a plume management plan that meets the RAOs.
- Evaluate clean-up levels for COCs and amend the ROD, if required, to address current ARAR levels.
- Complete an investigation to identify all source areas near the Landfill 2 (LF012) and the North Gate Dump areas (OT014) as well as sources near the HDUS contributing to the OU 4 contaminant mass.
- Address the above issues and recommendations in a PSVR prior to the scheduled timeframe of 2006 (FFA schedule). The OU4 geosystem report produced by Intera, Fall, 2002, does not indicate a compelling requirement to do this. What data do you have to support acceleration of the PSVR?

Landfill 1 - Treatment and Containment

- Complete an in-depth review of the existing data as they pertain to the effectiveness of the landfill cap. If the existing data do not provide an adequate assessment of the landfill cap effectiveness, make recommendations for additional data.
- Establish flow levels for implementation of a surface water collection and treatment system at the seeps.
- Conduct a site investigation of the buried drain line area to determine the extent of contamination. Completed, see Oscar Torres.

Landfill 1 - Operations and Maintenance

- Protect drain lines from damage with proper soil cover.
- Install additional signage to prevent unauthorized off-Base excavation.
- Evaluate the causes of reduced flows in the HDUS drain sets (upper, middle, and lower horizontal drain sets) (see Figure OU 4-1) using video logs and flow data. Access points at each drain line may be necessary to allow a video log and to obtain the flow data of each line.
- Data from the sumps in Landfill 1 and the drain set flows of the HDUS system should be included in the ERPIMS database to allow for trends to be examined. All data that are required in the PSVP should be included in the database. If no data are available during the sampling round or if a point has been discontinued, it should be noted in the database for clarification.
- ~~In the case of a change of circumstances (flow rates, land use, land ownership, land access, etc.), surface water controls will need to be reevaluated and implemented.~~

X Protectiveness Statement for OU 4

The remedies currently in place at OU 4 are protective in the short term. There is no immediate risk to human health and the environment at this site. This, however, is not due to the implementation of groundwater and landfill content remedies (if you don't have data to evaluate the presence or absence of intended function, how can you say this?), but is due to institutional controls and the lack of receptors. ~~As plume migration continues, completion of an exposure pathway is possible, causing potential risk to human health and the environment.~~ Suggest rewording to "Increasing concentrations observed in some monitoring wells indicates the potential for future plume migration. If plume migration does occur, completion of an exposure pathway is possible, causing……."

~~A PSVR will help to determine the effectiveness of the remedies and resolve how to proceed to ensure future protectiveness. The document should evaluate the historical data, determine the effectiveness of remedies, establish the need for additional investigations, and identify data gaps.~~

XI Next Review

The next FYR for OU 4 is required by 2008. No future review is required for the Spoils Area (OT020), ~~or the~~ Munitions Dump (OT042) ~~sites because no further remedial actions are planned at these sites, nor~~ ~~. No~~ ~~remedial actions are planned at~~ Landfill 2 (LF012) ~~and~~ or the North Gate Dump Areas (OT041). ~~Concerns about potential sources of contamination need to be investigated and these IRP sites need to be reviewed again in 2008.~~

OU: 4

Comments Prepared By: Hill EMR Combined

XII References

(To be exported from database)

XIII FYR of Sites in OU 4

See attached site summaries.

OU: 4
Comments Prepared By: Oscar Torres

Torres Oscar A Civ OO-ALC/EMR
<Oscar.Torres@HILL.af.mil>

04/28/03 07:32 AM

To:"'Stacey_Arens@URSCorp.com'" <Stacey_Arens@URSCorp.com>
cc:Watkins Jeffrey W Civ OO-ALC/EMR <Jeffrey.Watkins@HILL.af.mil>
Subject:RE: OU 4 Questions for the FYR...Help Needed

Stacey,
Attached is the soil sample analytical results from OU4 HDUS sewer line.
Oscar Torres

-----Original Message-----
From: Stacey_Arens@URSCorp.com [mailto:Stacey_Arens@URSCorp.com]
Sent: Friday, April 25, 2003 6:39 PM
To: jarrod.case@hill.af.mil; oscar.torres@hill.af.mil;
jeffrey.watkins@hill.af.mil
Cc: B_Hall@URSCorp.com
Subject: OU 4 Questions for the FYR...Help Needed

Gentlemen,

I am incorporating the final changes to the OU 4 summary per your (EMR's) comments and I have three remaining questions. When responding, please be cogizant of the fact that the draft of the FYR report is due on Wednesday the 30th of April. So your immediate response is GREATLY appreciated.

Jarrod:
1) Are all of the seeps/springs at OU 4 monitored? Or, is it only seeps/springs that are called out in the PSVP? And how often?

Oscar / Jeff / Jarrod:
2) Could you please give me the complete reference name, author, and date for the slope stability report?

3). The OU summary included the following language: "A leak in a buried drain line was investigated following repairs. Analytical results of soil samples showed trace levels of TCE were found, and the results were compared with Risk-Based Screening Levels (RBSL) to determine if soils present a risk to human health or the environment. It was determined that contamination detected in the soil samples was below Risk-Based Screening Levels."

I was not aware that these results were either received or analyzed versus RBSLs. Could you please send me all information pertaining to this statement (date sampled, analytical data, data analysis, RBSL study, etc.)?

OU: 4
Comments Prepared By: Oscar Torres

Thank you very much. I really appreciate your help with these last few questions.

Stacey Arens
Environmental Engineer
URS Corporation
stacey_arens@urscorp.com
Office: 801-904-4060

Letter from CH2M HILL.doc Table 1 Analytical Results.xls OU4 D9689 VOC.pdf U4-793 Soil Boring Log.xls

OU: 4
Comments Prepared By: Jarrod Case

Case Jarrod D Civ OO-ALC/EMR
<Jarrod.Case@HILL.af.mil>

04/28/03 07:39 AM

To:"'Stacey_Arens@URSCorp.com'" <Stacey_Arens@URSCorp.com>
cc: Watkins Jeffrey W Civ OO-ALC/EMR <Jeffrey.Watkins@HILL.af.mil>
Subject: RE: OU 4 Questions for the FYR...Help Needed

Stacey,

In response to your question #1, the springs identified in the PSVP are the only springs monitored unless others are requested somehow. The springs are monitored at the frequency identified in the PSVP as well, which is generally annually.

Let me know if you need anything else.

Jarrod

-----Original Message-----
From: Stacey_Arens@URSCorp.com [mailto:Stacey_Arens@URSCorp.com]
Sent: Friday, April 25, 2003 6:39 PM
To: jarrod.case@hill.af.mil; oscar.torres@hill.af.mil; jeffrey.watkins@hill.af.mil
Cc: B_Hall@URSCorp.com
Subject: OU 4 Questions for the FYR...Help Needed

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statement (date sampled, analytical data, data analysis, RBSL study, etc.)?

Thank you very much. I really appreciate your help with these last few questions.

Stacey Arens
Environmental Engineer
URS Corporation
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OU: 4
Comments Prepared By: Jeff Watkins

Watkins Jeffrey W Civ OO-ALC/EMR
<Jeffrey.Watkins@HILL.af.mil>

04/28/03 08:11 AM

To:'"Stacey_Arens@URSCorp.com"' <Stacey_Arens@urscorp.com>
cc:'"B-Hall@urscorp.com"' <B-Hall@urscorp.com>
Subject:RE: OU 4 Questions for the FYR...Help Needed

Stacey
2) Could you please give me the complete reference name, author, and date
for the slope stability report?

The report is: Geotechnical Report: Hill Air Force Base OU-4 Proposed Extraction Trenches Long-Term Impact Review.
The report was prepared by URS (Craig V. Nelson) via Battelle in 2001. Have
you not read this report? it was prepared in response to a proposed addition
to the OU4 system, apparently as a tactic to demonstrate technical impracticability, and therefore is relevant to the FYR.

My delivery schedule for the Draft FYR is Monday, May 5.

Many Thanks!
Jeff

OU: 5
Comments Prepared By: Jeff Watkins, 03/25/03 02:40 PM

Hi Jeremy
Please see the attachments for recommended edits (combined Torres and Watkins). Mark Loucks is preparing separate comments. I recommend use of the attached figure.
Many thanks!
Jeff

Watkins OU 5 Comments.doc
Watkins SD016 Comments.pdf
ou5_12sitemeetmod.pdf
Watkins SS017 Comments.pdf
Watkins SS091Comments.pdf

OU 5

I Introduction

OU 5 is located along the northwestern boundary of Hill AFB. It includes three IRP sites (see Table OU 5-1) that encompass contaminated groundwater on- and off-Base. There is currently no ROD in place for OU 5. A draft of the reopened Remedial Investigation (RI) for OU 5 is estimated to be complete by mid-summer 2003. There are two early action remedial systems currently in place, and one in the final stages of construction, to address contaminated groundwater off-Base, as well as institutional controls that restrict the use of groundwater from the shallow, contaminated aquifer. It has been determined~~, at the time of this review,~~ that activities at OU 5 are protective of human health and the environment in the short term.

The location of each IRP site is shown in Figure OU 5-1 (OU 5 Site Map). The Tooele Army Rail Shop (TARS) plume (SS017) consists of contaminated groundwater originating on-Base and continuing west beneath the cities of Sunset and Clinton. This site currently has two early action remedial systems operating (one using air sparge~~ing~~ and one using groundwater extraction), and one under construction (to utilize groundwater extraction), to address migration of contaminated groundwater. The Zone 16 plume (SS091) also originates on-Base where it commingles with the TARS plume and then continues off-Base in a separate plume to the north of the TARS plume beneath the cities of Sunset and Clinton. Bamberger Pond (SD016) has been designated as a site with no further remedial action planned (NFRAP) (HAFB EMR 2000) and has been included here for completeness and to document site background information.

Table OU 5-1: OU 5 Site Identification.

Site ID	Site Name
SD016	BAMBERGER POND
SS017	US ARMY TOOELE RAIL SHOP
SS091	BLDG 1607 - EVAP. POND

II Site Chronology

Please see Table OU 5-2 for a history of events in this OU. The table is organized to first describe events which impacted the OU as a whole, followed by events impacting specific IRP sites within the OU.

III Background

OU 5 initially included only the TARS area, with its associated off-Base plume, and Bamberger Pond. An RI and FS were completed in 1995. However, during site inspection investigations performed for the OU 9 North Area, groundwater, contaminated primarily with Trichloroethene (TCE), was discovered in the OU 5 area. This plume was preliminarily delineated in March of 1999 (MWH 2002b) and referred to as the Zone 16 plume (SS091). Its discovery prompted the reopening of the OU 5 RI in 1999.

Bamberger Pond is an unlined storm water runoff holding system. It was built in 1941 and is located on the west side of Hill AFB south of the TARS area. It is still being used to contain storm water runoff. Elevated concentrations of arsenic and manganese in groundwater beneath Bamberger Pond were originally thought to be a result of Base activities. However, through

extensive investigation and research, it was determined that contaminant concentrations are a result of naturally occurring processes (URS Radian 2000).

The TARS area includes a rail shop, a former Base housing area, and the footprint of a former wastewater treatment system. Groundwater contamination associated with the Tooele Army Rail Shop (constructed in 1942 and upgraded in 1944 to service and repair railroad engines for the military) is present in the shallow aquifer and extends off-Base beneath commercial and residential areas. The groundwater is not used for drinking water~~,~~ ; however, there are three known non-culinary users of the groundwater who have been provided with city water by Hill AFB. Historical cleaning of train parts (using TCE) at the rail shop and in the surrounding area is believed to be, in part, responsible for the contamination present in groundwater.

The Zone 16 Complex area is located within the former West Fu~~z~~se Plant, includes the Building 1607 Complex, which refers to the entire fenced area around this group of buildings including the former flash pond, and is believed to be a primary source area for groundwater contamination at site SS091. Degreasing solvents likely were associated with the activities at these facilities.

IV Remedial Actions

Early remedial actions have been implemented at OU 5 to address off-Base groundwater contamination. The RI for OU 5 is not yet complete, and formal contaminants of concern (COCs) or specific clean-up levels are not yet identified. However, numerous contaminants have been identified in the groundwater above their associated MCLs and are presented in the individual site summaries (see Section XIII). The early action remedial systems were primarily designed for TCE removal. The following remedial action objectives (RAOs) for OU 5 are pre-ROD, taken from the 1996 Action Memorandum for OU 5 (Radian Int'l 1996a), and apply to any early remedial actions:

- To reduce or eliminate releases and potential releases of contaminated groundwater flow through seeps and springs.
- To prevent further groundwater degradation from uncontrolled movement of the existing plume.
- To reduce the spread of contamination to currently unaffected residents in Sunset and Clinton.
- To prevent and minimize the effect of contaminant releases on the welfare of residents living in Sunset and Clinton.
- To support and complement the overall remediation strategy considered in the feasibility study for OU 5.

Two early action remedial systems have been constructed to mitigate off-Base plume migration at site SS017, ~~including~~ namely an aeration curtain and a groundwater extraction system. A third early action remedial system (groundwater extraction trench) for site SS017 was in the final stages of construction at the end of 2002. No remedial actions are in place at site SS091, as there are no early actions for this site and the RI is not yet complete. No remedial action was required at site SD016 because it was determined that elevated contaminant concentrations were due to naturally occurring processes and the site was placed in NFRAP status.

V Progress Since Last FYR

Since the 1998 FYR, Bamberger Pond (SD016) was removed from further IRP investigations and accepted by the regulatory agencies as a closed CERCLA site requiring no further action. The soil vapor extraction system at the Phase I, aeration curtain was taken off-line in September 2000, with concurrence from regulators (OU 5 Oscar Torres Interview), because TCE concentrations were not detected in the collected vapor. A Remote Data System (RDS) to monitor the treatment systems was completed in 2002. The OU 5 RI has been reopened and is estimated to have a draft document to be completed by mid-summer 2003.

VI FYR Process

Site review was conducted per the process described for the overall 2003 FYR.

VII Technical Assessment

Results of the technical assessment for each site in OU 5 and for the operable unit as a whole are listed in Table OU 5-3. Details of the technical assessment for each site in OU 5 are provided in the respective site summary (see Section XIII).

Table OU 5-3: Technical Assessment Summary for OU 5.

Site ID	Remedy	Technical Assessment*			Protectiveness	Next Five Year Review
		Question A	Question B	Question C		
SD016	Not required, NFRAP site	NA	NA	NA	Protective	Not required
SS017	Phase I: aeration curtain & groundwater use restrictions	Yes	Yes	Yes	Protective due to groundwater use restrictions	2008
SS017	Phase II: groundwater extraction system & groundwater use restrictions	No, not capturing plume	Yes	Yes	Protective due to groundwater use restrictions	2008
SS091	Not operational at this time & groundwater use restrictions	NA	NA	NA	Protective due to groundwater use restrictions	2008
OU 5	Aeration curtain, groundwater extraction & groundwater use restrictions	No	Yes	Yes	Protective due to groundwater use restrictions	2008

* Question A: Is the remedy functioning as intended by the decision documents?
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable

Question A. Is the remedy functioning as intended by the decision documents?

It should be noted that the remedies for OU 5 refer to early actions and not final remedies. The NA designation in the above table indicates either that no remedy is required (SD016) or that the remedy is not yet operational (SS091).

Question B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?

The exposure assumptions, toxicity data, and cleanup levels are undergoing evaluation as part of the current RI activities being conducted for OU 5. The RAOs (presented here in Section IV) for early action remedies associated with OU 5 are general and do not define cleanup standards. Therefore, they are still valid. Furthermore, the Utah and Federal drinking water standard for TCE of 5 ug/L, which was used as a design parameter for the aeration curtain, is still valid.

Question C. Has any other information come to light that could call into question the protectiveness of the remedy?

See the following Section for details.

VIII Issues

Based on the information reviewed and interviews and inspections conducted, issues that may affect protectiveness of the selected remedies at OU 5 are listed below:

1. The blowers in the site SS017 Phase I aeration curtain fail approximately every 2 years and the sparge pipes have clogged intermittently since construction. Currently, the aeration curtain is allowing concentrations of TCE greater than 5 ug/L to pass through.
2. The site SS017 Phase I blower building overheats in the summer, causing the system to periodically shut down (OU 5 Steve Knutson interview).
3. The life expectancy of the site SS017 Phase I system is not known. This makes it difficult to determine the cost effectiveness of replacing the blowers with a compressor.

Combine Issues 1, 2 and 3 into a condensed statement relative to the specific equipment.

4. The site SS017 Phase II groundwater extraction system does not appear to be affecting the TARS plume and is predicted to ~~only~~ remove only another 1% of contaminant mass over the next 30 years (MWH 2002a).
5. The 5 to 100 ug/L portion of the TARS plume has passed the location of the site SS017 Phase III groundwater extraction trench and therefore will not be treated by any systems currently designed.
6. The source of the Zone 16 plume (SS091) has not yet been fully identified or addressed.
7. There has been no evaluation of indoor air quality in residences above the plumes.

IX Recommendations and Follow-up Actions for OU 5

The recommendations and follow-up actions for OU 5 are:

1. Replace the blowers with an air compressor at the site SS017 Phase I (aeration curtain), if the system is anticipated to run for the duration of contamination and if determined to be cost-effective.
2. Clean the site SS017 Phase I (aeration curtain) sparge lines and develop a preventive maintenance process to prevent unplanned system shutdowns in the future.
3. Increase ventilation in the site SS017 Phase I (aeration curtain) blower building.
4. Evaluate the life expectancy of the site SS017 Phase I (aeration curtain) system.
5. Shut down the site SS017 Phase II (groundwater extraction) system.
6. Bring site SS017 Phase III (groundwater extraction trench) system on-line as planned.
7. Proceed with permanent remedies as soon as the RI/FS and ROD are complete.
8. Delineate and address the source area for the Zone 16 plume (SS091).
9. Evaluate indoor air quality risks in residences above the contaminated plumes and conduct indoor air testing in high-risk areas.
10. Continue all institutional controls, primarily, groundwater-use restrictions on the shallow aquifer beneath sites SS017 and SS091.

X Protectiveness Statement for OU 5

Due to the restrictions on the use of contaminated groundwater beneath the current plumes, activities at OU 5 are considered to be protective in the short-term. The ~~current~~ RAOs for OU 5 are ~~and~~ not intended to protect overall human health and the environment but are directed toward slowing ~~the~~ migration of contamination until a permanent remedy can be installed. ~~the early actions required to mitigate the plume and not intended to protect overall human health and the environment. The remedial activities associated with the RAOs slow the migration of contamination at OU 5.~~ The site SS017 Phase I (aeration curtain) early action ~~remedy~~ appears to be meeting the RAOs at this time. However, it is not currently remediating the groundwater to below MCLs (as designed was it actually designed to do this? See M. Loucks.). The site SS017 Phase II (groundwater extraction) system does not appear to meet RAOs (mitigate migration of the plume). It appears that the 5 to 100 ug/L portion of the SS017 plume has passed the Phase III (groundwater extraction trench) location and, therefore, will continue to migrate further into the city of Clinton. There is no remedy in place for the contaminant plume associated with SS091. If migration of the contaminant plume is not halted, the plume could travel beyond areas where groundwater-use restrictions apply. An OU 5 RI is in the final stages of completion to be followed by a feasibility study, ROD, and presumably remedial designs to permanently address human health and the environment at OU 5.

XI Next Review

The next review for OU 5 is required by 2008. Not future review is required for Bamberger Pond (SD016) because no further remedial action is planned at this site.

XII References

(To be exported from database)

OU: 5
Comments Prepared By: Jeff Watkins and Oscar Torres

XIII FYR of Sites in OU 5

See attached site summaries.

Comments prepared by: Jeff Watkins

OU 5 SS091 BLDG 1607-EVAP. POND

Site Summary - Hill AFB 2003 Five Year Review

V. Progress Since Last Review	This site had not been established as an IRP site at the time of the last (1998) Five Year Review.
VI. FYR Process	Site review conducted per the process described for the overall 2003 Five Year Review.

VII. Technical Assessment

Question A (Answer)	Not Applicable
Question A (Comment)	No remedial actions are in place at this time. Site is still in the Remedial Investigation stage.
Question B (Answer)	Not Applicable
Question B (Comment)	No remedial actions are in place at this time. Site is still in the Remedial Investigation stage.
Question C (Answer)	Not Applicable
Question C (Comment)	No remedial actions are in place at this time. Site is still in the Remedial Investigation stage.

VIII. Issues	The source area has not yet been fully identified or addressed.
IX. Recommendations	*Continue with groundwater-use restrictions on the shallow aquifer. *Delineate and address source area.
X. Protectiveness	Protective in the short-term
Protectiveness Statement	Due to the restrictions on the use of contaminated groundwater present in the shallow aquifer beneath the current plume, this site is protective in the short-term. However, there is no remedy in place for the contaminant plume associated with this site and it has been shown (MWH 2002b) that numerous contaminants (primarily TCE) are present in the groundwater beneath residential properties in the cities of Sunset and Clinton above their associated MCL. If migration of the plume is not stopped, the plume could travel outside areas with groundwater-use restrictions. However, a remedial investigation is in the final stages of completion to be followed by a feasibility study, ROD, and presumably a remedial design to address human health and the environment.
XI. Next Required FYR	2008

Comments prepared by: Jeff Watkins

OU 5 SS017 US ARMY TOOELE RAIL SHOP

Site Summary - Hill AFB 2003 Five Year Review

I. Introduction

Site SS017, located on the western boundary of Hill AFB, contains a contaminated groundwater plume referred to as the TARS plume. The re-opened Remedial Investigation for OU 5 is scheduled to be complete by mid-summer 2003. Two Early Actions, consisting of an aeration curtain (Phase I) and a groundwater extraction system (Phase II) currently exist on site and a third, a groundwater extraction trench (Phase III), is in the final stages of construction. Restrictions on future use of the shallow contaminated groundwater from this site are in place and former users of this water have been placed on city water.

II. Site Chronology

Please see Table OU 5-2 for a history of events at this site. The table is organized to first describe events which impacted the whole OU, followed by events impacting only specific IRP sites within the OU.

III. Background

The US Army Tooele Rail Shop (also known as the Tooele Army Rail Shop [TARS]) area is located along the northwestern edge of the Base (see Figure OU 5-1) and includes a rail shop, a former Base housing area, and the footprint of a former wastewater treatment system. The area to the east of the rail shop is generally undeveloped within about half a mile. The Base boundary, rail lines, Davis-Weber Canal, Interstate Highway 15, and Main Street in Sunset City are located to the west of the rail shop (see Figure OU 5-1).

Groundwater contamination associated with the Tooele Army Rail Shop (constructed in 1942 and upgraded in 1944 to service and repair railroad engines for the military) is present in the shallow aquifer. The TARS groundwater plume commingles with the Zone 16 (Site SS091) plume on-Base and then separates and extends approximately one mile beyond the boundary of Hill AFB under the communities of Sunset and Clinton. An open area immediately west of the rail shop was formerly used for cleaning large train parts. Trichloroethene (TCE) reportedly was used for this purpose during the period of 1959-1964. Building 1712 was constructed over this area in the late 1980s. Prior to 1979, runoff from a steam cleaning system at the rail shop flowed into a drainage grate which fed an in-ground oil-water separator. Hill AFB drawings indicate the storm drain lines extended directly north from the oil-water separator and the rail shop, parallel to the rail lines, and terminated at a gravel drain/sump approximately 1,000 feet north of building 1701, adjacent to building 1723A. These drain lines likely played a key role in the off-base migration of contaminants. In 1979, the cleaning system was redesigned to collect runoff into a new oil-water separator that discharges water to the Base Industrial Wastewater Treatment Plant.

An Engineering Evaluation and Cost Analysis (EE/CA) was completed for OU 5 (including this site) in 1994 and outlined three phases of early actions to address contaminated groundwater. Phase I (aeration curtain) and Phase II (groundwater extraction system) have been in operation since 1997. Phase III (groundwater extraction trench) was redefined in a 2002 EE/CA Addendum and is currently under construction. See Figure OU 5-1 for the locations of these systems. An RI and draft FS were completed in 1995. However, further groundwater contamination was discovered in 1999 (now known as the Zone 16 Plume, SS091) causing the OU 5 RI to be re-opened. The re-opened RI is scheduled to be complete by mid-summer 2003. No ROD exists for this site, but there is a 1996 Action Memorandum authorizing construction of three phases of early actions.

Groundwater-use restrictions are in place, and enforced by the state, that preclude the use of groundwater from the shallow aquifer beneath OU 5.

Contaminants of Concern

Media	Contaminant(s)	Cleanup Level Required
GW	1,1,1-TRICHLOROETHANE	No number specified, see RAOs
GW	1,1-DICHLOROETHENE	No number specified, see RAOs
GW	CARBON TETRACHLORIDE	No number specified, see RAOs
GW	cis-1,2-DICHLOROETHYLENE	No number specified, see RAOs
GW	PERCHLORATE	No number specified, see RAOs
GW	TETRACHLOROETHYLENE(PCE)	No number specified, see RAOs

GW	TRICHLOROETHYLENE (TCE)	No number specified, see RAOs
GW	VINYL CHLORIDE	No number specified, see RAOs

RAOs

To reduce or eliminate releases and potential releases of contaminated groundwater flow through seeps and springs.

To prevent further groundwater degradation from uncontrolled movement of the existing plume.

To reduce the spread of contamination to currently unaffected residents.

To prevent and minimize the effect of contaminant releases on the welfare of residents living in Sunset and Clinton.

To support and complement the overall remediation strategy considered in the feasibility study for OU 5.

IV. Remedial Actions

No ROD exists for this site. However, there are three early removal actions:

Phase I Aeration Curtain:
The Aeration Curtain consists of an air sparge (AS) system and a soil vapor extraction (SVE) system which consist of two sparge blowers, two SVE blowers, an inlet separator, a heat exchanger, sparge and SVE piping, and a blower building. These systems are connected to a trench approximately 400 feet long, 30 feet deep, and 3 feet wide that runs north to south on the east side of Main St. in Sunset, UT. The aeration curtain was installed to intercept contaminated groundwater traveling west from Hill AFB and treat it in situ by blowing air from the pipes at the bottom of the trench through the contaminated groundwater, stripping TCE in the process. It has been in operation since May 1997.

Phase II Groundwater Extraction System (GES):
The GES consists of five extraction wells, five piezometers, and piping to pump groundwater to a sanitary sewer manhole for treatment by the North Davis County Sewer District (NDCSD). The system is located at 2125 N. 55 W. (approximately one block west of Main Street) in the City of Sunset, UT. The system was installed to provide capture of the >200 ppb TCE portion of the contaminated groundwater plume downgradient of the aeration curtain. It has been in operation since November 1997.

Phase III Groundwater Containment System:
Construction of this system was in the final stages at the end of 2002. The system is located at 550 W and 2250 N in the City of Clinton, UT and is comprised of a groundwater capture trench and a downgradient slurry wall. This system is expected to be operational by spring of 2003.

V. Progress Since Last Review

During the last Five Year Review (FYR) in 1998, no specific recommendations were made for site SS017. However, it was mentioned that a study was being conducted to evaluate conversion of the aeration curtain to a groundwater extraction system. This conversion has not been made and the aeration curtain is still performing to meet RAOs. Since the last FYR, the soil vapor extraction system has been turned off (in September 2000), with concurrence from regulators (OU 5 Oscar Torres interview), because TCE concentrations were not detected in the collected vapor. A Remote Data System (RDS) to monitor the treatment systems was completed in 2002. The location proposed for the Phase III Groundwater Extraction Trench at the time of the last FYR has been changed from the City of Sunset to the City of Clinton (see Figure VI-OU 5-1 for current location). The OU 5 RI has been reopened and is estimated to have a draft complete by mid-summer 2003.

VI. FYR Process

Site review conducted per the process described for the overall 2003 Five Year Review.

VII. Technical Assessment

Question A (Answer)

No

Question A (Comment)

Phase I (aeration curtain): The system still appears to be meeting the RAOs (by controlling the movement of the plume and reducing the spread of contamination). However, the system is not currently functioning as designed (concentrations of TCE greater than 5 ug/L are passing through the curtain) due to blower failures and sparge pipe clogging, which reduce efficiency and, if not rectified, may cause the system to no longer function as intended. Historically, when the aforementioned problems were not occurring, the system functioned at or above its design specifications.

Phase II (groundwater extraction system): This system is not capturing the plume as originally designed and is not functioning as intended.

Question B (Answer)

Yes

Question B (Comment)

The RAOs (presented here in Section III) for these early action remedies are intended to mitigate the plume until long-term remedial actions are implemented and do not define clean-up standards. The RAOs are still valid. The Utah and Federal drinking water standard for TCE of 5 ug/L, which was used as a design parameter for the aeration curtain, is also still valid. The MCLs used to determine contaminants of concern are also still valid. However, when a permanent remedy is selected for this site, the RAOs should specify clean-up standards.

Question C (Answer)

Yes

Question C (Comment)

Phase I (aeration curtain): According to interviews conducted for this review with Oscar Torres, Mark Loucks, Curt Himle, Steve Knutson, and Tyler Esplin, the sparge blowers fail approximately every two years and continually leak oil, and the sparge lines clog intermittently. At the time of inspection, only one blower was operable. These problems will affect the system's efficiency and potentially could jeopardize the protectiveness of the system. The last two quarters of 2002 showed that all of the wells downgradient of the aeration curtain had TCE levels above the MCL of 5 ug/L. Prior to this, since the system started operation, downgradient concentrations were below 5 ug/L.

Phase II (groundwater extraction system): According to interviews and contaminant contour maps, this system is no longer preventing migration of the contaminant plume or removing significant mass. The system will be recommended for shutdown in the upcoming FS because it is not achieving its goal and the predicted TCE mass removal over the next 30 years will only increase by one percent from the mass currently removed.

VIII. Issues

*Efficiency of the Phase I aeration curtain is calculated using concentrations from a set of wells that are not all directly up and downgradient of one another or the aeration curtain. It is not immediately apparent how this combination would effect the efficiency calculation, however, it appears that the calculation does not give a true representation of the aeration curtain efficiency.
*The blowers in the Phase I aeration curtain fail every two years and the sparge pipes have clogged intermittently since construction. Currently, the aeration curtain is allowing concentrations of TCE greater than 5 ug/L to pass through.
*The Phase I blower building overheats in the summer, causing the system to periodically shut down (OU 5 Steve Knutson interview).
*The life expectancy of the phase I system is not known. This makes it hard to determine whether or not it is cost effective to replace the blowers with a compressor.
*The Phase II groundwater extraction system does not appear to be affecting the plume and is predicted to only

remove another one percent of contaminant mass over the next 30 years.
*The 5 to 100 ug/L portion of the plume has passed the location of the Phase III groundwater extraction trench and therefore will not be treated by any systems currently designed.
*There has been no evaluation of indoor air quality in residences along the plume.

IX. Recommendations

Phase I (aeration curtain):
*consider replacing the blowers with an air compressor
*Clean the sparge lines and develop a preventive maintenance process to prevent unplanned system shutdowns
*Increase ventilation in the blower building
*Use only up and downgradient well pairs in the efficiency calculation
*Evaluate the life expectancy of the system

Phase II (groundwater extraction system):
* Shut down system

Phase III (groundwater extraction trench):
*Bring system on-line as planned

Generally:
*Continue with groundwater use restrictions on the shallow aquifer
*Proceed with permanent remedies as soon as the RI/FS and ROD are complete
*Evaluate indoor air quality and potential risks

X. Protectiveness

Protective in the short-term

Protectiveness Statement

Due to the restrictions on the use of contaminated groundwater beneath the current plume, this site is protective in the short-term. Although the Phase I early action remedy appears to be meeting the RAOs at this time, it is not currently remediating the groundwater to below MCLs (as it was designed to do). Additionally, the current RAOs for this site are not intended to protect overall human health and the environment, but only to slow the migration of contamination until long-term remedial actions are constructed. The Phase II groundwater extraction system does not appear to protect human health and the environment or to mitigate migration of the plume. The Phase III system is currently under construction and should help to stop further migration of the portion of the plume that is greater than 100 ug/L. However, it appears that the 5 to 100 ug/L portion of the plume has already passed the Phase III location and, therefore, will continue to migrate further into the City of Clinton.

XI. Next Required FYR

2008

Comments prepared by: Jeff Watkins

OU 5 SD016 BAMBERGER POND

Site Summary - Hill AFB 2003 Five Year Review

I. Introduction

Site SD016 is included in OU 5 and is comprised of Bamberger Pond. This site currently has a No Further Response Action Planned (NFRAP) status (HAFB EMR 2000). Therefore, no remedial action is required at the site. This site is included in the 2003 Five Year Review for completeness to document the site background.

II. Site Chronology

Please see Table OU 5-2 for a history of events at this site. The table is organized to first describe events which impacted the whole OU, followed by events impacting only specific IRP sites within the OU.

III. Background

Bamberger Pond is a stormwater runoff holding system consisting of two separate, unlined basins 50 to 100 feet wide and 600 to 800 feet long that connect with a culvert drain. It was built in 1[illegible]nd is located on the west side of Hill AFB just south of the west gate and west of 6th Street (see Figure OU 5-1[illegible] is still being used to contain stormwater runoff. To the east there is a parking lot for the Building 1299 complex.

Elevated concentrations of arsenic and manganese in groundwater beneath Bamberger Pond were originally thought to be a result of Base activities. However, through extensive investigation and research, it was determined that concentrations were a result of naturally occurring processes associated with the geochemical stability of the aquifer (URS Radian 2000). Therefore, the EPA and the UDEQ concur that there be No Further Response Action Planned (NFRAP) for Bamberger Pond (Site SS016).

Contaminants of Concern

Media	Contaminant(s)	Cleanup Level Required
GW	NA - Site under NFRAP status, elevated concentrations of arsenic and manganese determined to be naturally occuring.	NA

RAOs

Not Applicable. No further remedial action planned.

IV. Remedial Actions

Not Applicable. No remedial action required at this site due to NFRAP status.

V. Progress Since Last Review

This site was mentioned in the 1998 Five Year Review (FYR), however, no specific recommendations were made. Since the 1998 FYR, Bamberger Pond (SD016) was removed from further IRP investigations and accepted by the regulatory agencies as a closed CERCLA site requiring no further action.

VI. FYR Process

Site review conducted per the process described for the overall 2003 Five Year Review

VII. Technical Assessment

Question A (Answer)

Not Applicable

Question A (Comment)

There are no remedies associated with this site because it has been determined that no further action is necessary. The Site has NFRAP status.

Question B (Answer)

Not Applicable

Question B (Comment)

There are no remedies associated with this site because it has been determined that no further action is necessary. The site has NFRAP status.

Question C (Answer)	Not Applicable
Question C (Comment)	There are no remedies associated with this site because it has been determined that no further action is necessary. The site has NFRAP status.

VIII. Issues	None
IX. Recommendations	None
X. Protectiveness	Not Applicable
Protectiveness Statement	Bamberger Pond has NFRAP status. There is no evidence of hazardous substances or petroleum products being released, stored for one year or more, or disposed of in or around Bamberger Pond. Pre-Remedial Investigation and Remedial Investigation data demonstrated that no release of organic compounds occurred in the vicinity of Bamberger Pond. Furthermore, it has been demonstrated that the sporadic[illegible]evated levels of arsenic and manganese in groundwater in the vicinity of Bamberger Pond are a result o[illegible]rally occurring processes associated with the geochemical stability of the aquifer (URS Radian 2000).
XI. Next Required FYR	None - Current FYR is Final

OU: 5

Comments Prepared By: Mark Loucks

Key to changes
Red – MDL's recommended changes
Blue – MDL's comments meant to clarify changes

OU 5

I Introduction

OU 5 is located along the northwestern boundary of Hill AFB. It includes three IRP sites (see Table OU 5-1) that encompass contaminated soil and groundwater on- and off-Base. There is currently no ROD in place for OU 5. Bamberger Pond (SD016) has been designated as a site with no further remedial action planned (HAFB EMR 2000) and has been included here only for completeness and to document site background information. The other two IRP sites that are active are the subject of this FYR and include; the Tooele Army Rail Shop (TARS) plume (IRP site SS017) and the Zone 16 plume (IRP site SS091). The TARS plume consists of contaminated soil on-Base, and contaminated groundwater originating on-Base and continuing west off-base beneath the cities of Sunset and Clinton. This site has two operating early action remedial systems, an air sparge system and a groundwater extraction system. A third early action is under construction that is designed to limit the migration of contaminated groundwater into the city of Clinton. The Zone 16 plume also originates on-Base and in part commingles with the TARS plume and continues off-Base in a separate plume to the north beneath the cities of Sunset and Clinton. The locations of the active IRP sites are shown in Figure OU 5-1 (OU 5 Site Map). It has been determined, at the time of this review, that activities at OU 5 are protective of human health and the environment in the short term.

~~The location of each IRP site is shown in Figure OU 5-1 (OU 5 Site Map). The Tooele Army Rail Shop (TARS) plume (SS017) consists of contaminated groundwater originating on-Base and continuing west beneath the cities of Sunset and Clinton. This site currently has two early action remedial systems operating (one using air sparging and one using groundwater), and one under construction (to utilize groundwater extraction), to address migration of contaminated groundwater. The Zone 16 plume (SS091) also originates on-Base where it commingles with the TARS plume and then continues off-Base in a separate plume to the north of the TARS plume beneath the cities of Sunset and Clinton. Bamberger Pond (SD016) has been designated as a site with no further remedial action planned (HAFB EMR 2000) and has been included here for completeness and to document site background information.~~

Table OU 5-1: OU 5 Site Identification.

Site ID	Site Name
SD016	BAMBERGER POND - Site Closed (NFRAP)
SS017	US ARMY TOOELE RAIL SHOP
SS091	BLDG 1607 - EVAP. POND

II Site Chronology

Please see Table OU 5-2 for a history of events in this OU. The table is organized to first describe events which impacted the OU as a whole, followed by events impacting specific IRP sites within the OU.

OU: 5

Comments Prepared By: Mark Loucks

III Background

OU 5 initially included only the TARS plume ~~area, with its associated off-Base plume,~~ and Bamberger Pond. An RI was ~~and FS were~~ completed in 1995 and the FS was in its draft version in 1999 when additional ~~However, during site inspection~~ investigations performed for the OU 9 North Area Site Investigation, discovered additional TCE contaminated groundwater~~,~~ ~~contaminated primarily with Trichloroethene (TCE),~~ ~~was discovered~~ in the same OU 5 area and was called the Zone 16 plume. ~~This plume was preliminarily delineated in March of 1999 (MWH 2002b) and referred to as the Zone 16 plume (SS091).~~ Its discovery prompted the reopening of the OU 5 RI in 1999.

Bamberger Pond is an unlined storm-water runoff holding system located on the west side of Hill AFB just south of the West Gate and was included in the original IRP program because of near by historic industrial actitivities. ~~It was built in 1941 and is.~~ ~~of south of the TARS area~~. ~~It is still being used to contain storm water runoff.~~ Elevated concentrations of arsenic and manganese in groundwater beneath Bamberger Pond were identified. ~~originally thought to be a result of Base activities~~. However, through extensive investigation and research, it was determined that contaminant concentrations are a result of naturally occurring processes (URS Radian 2000).

The TARS area includes a rail shop, a former Base housing area, and the footprint of a former wastewater treatment system. Groundwater contamination associated with the Tooele Army Rail Shop ~~(constructed in 1942 and upgraded in 1944 to service and repair railroad engines for the military)~~ is present in the shallow aquifer and extends off-Base beneath commercial and residential areas. The groundwater is not used for drinking water, however, there are three known non-culinary users of the groundwater who have been provided with city water by Hill AFB. ~~Historical cleaning of train parts (using TCE) at the rail shop and in the surrounding area is believed to be, in part, responsible for the contamination present in groundwater.~~

The Zone 16 Complex area is located east of the TARS and is currently used for missile testing, research and maintenance, historically it was the former West Fuze Plant which manufactured bombs and other munitions. ~~includes the Building 1607 Complex, which refers to the entire fenced area around this group of buildings including the former flash pond, and is believed to be a primary source area for groundwater contamination at site SS091.~~ Degreasing solvents likely were associated with the activities at these facilities. Shallow groundwater contamination associated with solvent use has migrated into off-Base areas beneath commercial and residential areas.

IV Remedial Actions

Early remedial actions have been implemented at OU 5 to address off-Base groundwater contamination. The RI for OU 5 is not yet complete~~, and formal contaminants of concern (COCs) or specific clean-up levels are not yet identified. However~~, and numerous contaminants have been identified in the groundwater above their associated MCLs and are presented in the individual site summaries (see Section XIII). The early action remedial systems were primarily designed for TCE removal. The following remedial action objectives (RAOs) for OU 5 are ~~pre-ROD,~~ taken from the 1996 Action Memorandum for OU 5 (Radian Int'l 1996a), and apply to ~~any~~ all OU5 early remedial actions performed under the OU5 EEE/CA:

- ~~To reduce or eliminate releases and potential releases of contaminated groundwater flow through seeps and springs~~. MDL comment - we have not done anything at OU5 to mitigate

TCE levels in seeps and springs except pay the water bill for those residence that used apring or shallow well water to water their gardens (they have all been under MCLs)

- To prevent further groundwater degradation from uncontrolled movement of the existing plume.
- To reduce the spread of contamination to currently unaffected residents.
- To prevent and minimize the effect of contaminant releases on the welfare of residents living in Sunset and Clinton.
- To support and complement the overall remediation strategy considered in the feasibility study for OU 5.

Two early action remedial systems have been constructed to mitigate off-Base plume migration at site SS017, including an aeration curtain and a groundwater extraction system. A third early action remedial system (a groundwater extraction trench) for site SS017 ~~was~~ is in the final stages of construction ~~at the end of 2002~~ and is planned to begin operation in the spring of 2003. No remedial actions are in place at site SS091~~, as there are no early actions for this site and the RI is not yet complete~~. ~~No remedial action was required at site SD016 because it was determined that elevated contaminant concentrations were due to naturally occurring processes and the site was placed in NFRAP status~~. MDL comment - this last sentence is redundant with what was said earlier.

V Progress Since Last FYR

Four areas of progress have been made at OU5 since the last FYR and they include:

1. A NFRAP at ~~Since the 1998 FYR,~~ Bamberger Pond (SD016) ~~was removed from further IRP investigations and accepted by the regulatory agencies as a closed CERCLA site requiring no further action~~.
2. The soil vapor extraction system at the Phase I, aeration curtain was taken off-line in September 2000, with concurrence from regulators (OU 5 Oscar Torres Interview)~~, because TCE concentrations were not detected in the collected vapor~~.
3. A Remote Data System (RDS) to ~~monitor the treatment systems~~ was completed and installed in 2002 at the Phase I and Phase II systems
4. The OU 5 RI ~~has been~~ was reopened and ~~is estimated to have a draft document~~ will be completed by ~~mid-summer~~ June 2003.

VI FYR Process

Site review was conducted per the process described for the overall 2003 FYR.

VII Technical Assessment

Results of the technical assessment for each site in OU 5 and for the operable unit as a whole are listed in Table OU 5-3. Details of the technical assessment for each site in OU 5 are provided in the respective site summary (see Section XIII).

Table OU 5-3: Technical Assessment Summary for OU 5.

Site ID	Remedy	Technical Assessment*			Protectiveness	Next Five Year Review
		Question A	Question B	Question C		

SD016	Not required, NFRAP site	NA	NA	NA	Protective	Not required
SS017	Phase I: aeration curtain & groundwater use restrictions	Yes	Yes	Yes	Protective due to groundwater use restrictions	2008
SS017	Phase II: groundwater extraction system & groundwater use restrictions	No, not capturing the 100 ppb contour plume	Yes	Yes	Protective due to groundwater use restrictions	2008
SS017	Phase III: groundwater extraction trench (Not operational at this time) & groundwater use restrictions	NA	NA	NA	Protective due to groundwater use restrictions	2008
SS091	~~Not operational at this time &~~ No remedial actions are in-place at this time & groundwater use restrictions	NA	NA	NA	Protective due to groundwater use restrictions	2008
OU 5	Aeration curtain, groundwater extraction & groundwater use restrictions	No	Yes	Yes	Protective due to groundwater use restrictions	2008

* Question A: Is the remedy functioning as intended by the decision documents?
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable

Question A. Is the remedy functioning as intended by the decision documents?

It should be noted that the remedies for OU 5 refer to early actions not final remedies. The NA designation in the above table indicates either that ~~no~~ remedy is not required (SD016) or that the remedy is not yet operational (Phase III (SS017), or has not yet been selected (SS091).

Question B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?

The exposure assumptions, toxicity data, and cleanup levels are undergoing evaluation as part of the current RI activities being conducted for OU 5. The RAOs (presented here in Section IV) for early action remedies associated with OU 5 are general and do not define clean-up standards. Therefore, they are still valid. Furthermore, the Utah and Federal drinking water standard for TCE of 5 ug/L, which was used as a design parameter for the aeration curtain, is still valid.

Comments Prepared By: Mark Loucks

Question C. Has any other information come to light that could call into question the protectiveness of the remedy?

See the following Section for details.

VIII Issues

Based on the information reviewed and interviews and inspections conducted, issues that may affect protectiveness / effectiveness of the selected remedies at OU 5 are listed below:

1. The blowers ~~in~~ at the site SS017 Phase I aeration curtain fail approximately every 2 years due to high operating pressures and the sparge pipes have clogged intermittently since construction. However, the system has a very high cleanup efficiency (averaging greater than 92%) and is reducing contaminant levels as intended. ~~Currently, the aeration curtain is allowing concentrations of TCE greater than 5 ug/L to pass through.~~ (it should be noted that the objective of this system was to reduce contaminant concentrations i.e. mass removal and containment of the 100 ppb contour. It was known that we wouldn't get to MCLs until up-gradient concentration drop below 500 ppb.)
2. The site SS017 Phase I blower building overheats in the summer, causing the system to periodically shut down (OU 5 Steve Knutson interview).
3. The life expectancy of the site SS017 Phase I system is not known -I disagree with this comment we know that without any source zone source remediation that this system will be operating at least 60 years based on modeling and what appears to be a pulsating source. With his in mind and knowing the difficulty in source zone removal we can predict that this system will be operating a minimum of 30 years into the future. ~~This makes it difficult to determine the cost effectiveness of replacing the blowers with a compressor~~. We need to discuss the possibility of blower replacement with a compressor in relation to this system that will likely be in operation or the cost effectiveness of source zone removal that will effectively reduce.
4. The site SS017 Phase II groundwater extraction system does not meet its RAO of containing the 100 ppb contour. In addition, analysis of future mass removal ~~appears to be affecting the TARS plume and is~~ predicts ~~ed to~~ that the Phase II system will ~~only~~ remove less than another 1% of the OU5 dissolved contaminant mass over the next 30 years (MWH 2002a).
5. The 5 to 100 ug/L portion of the TARS plume has passed the location of the site SS017 Phase III groundwater extraction trench and therefore will not be treated by any systems currently designed. However, site data and modeling indicate that the plume has almost reached stability and it is not anticipated to expand much beyond its current configuration. Once the Phase III System is operational it is anticipated that contaminant concentrations will decrease very quickly. (MDL comment – in light of what we now know about the plume that indicates plume stability I do not see that this is a big issue or an issue at all)
6. ~~The source of the Zone 16 plume (SS091) has not yet been fully identified or addressed~~. MDL comment - Not true the Zone 16 has been defined as fully as is possible. Evidence indicates that this is degrading source.
7. ~~There has been no evaluation of indoor air quality in residences above the plumes~~. MDL comment – Again, not true air samples have been collected at over 48 different residents and schools in the OU5 area during the OU5 RI. Indoor air has been evaluated and we have not seen an indoor air problem. We have detected TCA and chloroform but no TCE.

IX Recommendations and Follow-up Actions for OU 5

The recommendations and follow-up actions for OU 5 are:

1. Evaluate the life expectancy of the site SS017 Phase I (aeration curtain) system and if appropriate replace the blowers with an air compressor at the site SS017 Phase I (aeration curtain), ~~if the system is anticipated to run for the duration of contamination~~
2. Clean the site SS017 Phase I (aeration curtain) sparge lines and develop a preventive maintenance process to prevent unplanned system shutdowns in the future.
3. Increase ventilation in the site SS017 Phase I (aeration curtain) blower building.
4. ~~Evaluate the life expectancy of the site SS017 Phase I (aeration curtain) system.~~
5. Shut down the site SS017 Phase II (groundwater extraction) system.
6. ~~Bring site SS017 Phase III (groundwater extraction trench) system on line as planned~~. MDL comment - This is obvious and is happening so it should not be a recommendation
7. ~~Proceed with permanent remedies as soon as the RI/FS and ROD are complete.~~ See comment above
8. ~~Delineate and address the source area for the Zone 16 plume (SS091).~~ See comment above
9. ~~Evaluate indoor air quality risks in residences above the contaminated plumes and conduct indoor air testing in high risk areas.~~ See comment above
10. Continue all institutional controls, primarily, groundwater-use restrictions on the shallow aquifer beneath sites SS017 and SS091.

X Protectiveness Statement for OU 5

Due to the restrictions on the use of contaminated groundwater beneath the current plumes, activities at OU 5 are considered to be protective in the short-term. The current RAOs for OU 5 are directed toward the early actions required to mitigate the plume and not intended to protect overall human health and the environment. The remedial activities associated with the RAOs slow the migration of contamination at OU 5. The site SS017 Phase I (aeration curtain) early action remedy appears to be meeting the RAOs at this time. ~~However, it is not currently remediating the groundwater to below MCLs (as designed).~~ MDL comment – URS should be aware that the goal of the system was not to cleanup to MCLs. This is an EE/CA action whose goal was to remove the high concentration mass (i.e. greater than 100 ppb) and keep additional mass from entering the city of Clinton. when this system was built we knew that it did not span the width of the 5 ug/l contour it was not intended for that. If we look at the effectiveness of the Phase I system (i.e. 92-95% mass reduction) this is a very effective system that **is performing as designed.** URS needs to capture this in your evaluation. The site SS017 Phase II (groundwater extraction) system does not appear to meet RAOs ~~(mitigate migration of the plume).~~ Again URS should be aware that the RAO for this system was not to mitigate migration but to capture the 100 ppb contour and remove mass (it currently doesn't do either) ~~It appears that the 5 to 100 ug/L portion of the SS017 plume has passed the Phase III (groundwater extraction trench) location and, therefore, will continue to migrate further into the city of Clinton.~~ See comment above and be aware that the goal of the Phase III system is containment to kept additional contamination from entering Clinton (i.e. limit contaminant migration). There is no remedy in place for the contaminant plume associated with SS091. ~~If migration of the contaminant plume is not halted,~~

~~the plume could travel beyond areas where groundwater use restrictions apply.~~ MDL- Comment these two plumes are shown to be relatively stable and /or receeding so we do not expect them to migrate much further and consequently they will not reach areas outside the restricted zones as they are currently proposed. An OU 5 RI is in the final stages of completion to be followed by a feasibility study, ROD, and presumably remedial designs to permanently address human health and the environment at OU 5.

XI Next Review

The next review for OU 5 is required by 2008. Not future review is required for Bamberger Pond (SD016) because no further remedial action is planned at this site.

XII References

(To be exported from database)

XIII FYR of Sites in OU 5

See attached site summaries.

OU: 6
Comments Prepared By: Oscar Torres

----- Forwarded by B Hall/SaltLakeCity/URSCorp on 03/05/03 04:01 PM -----

Watkins Jeffrey W Civ OO-ALC/EMR
<Jeffrey.Watkins@HILL.af.mil>

03/05/03 03:16 PM

To:"'B_Hall@urscorp.com'" <B_Hall@urscorp.com>
cc:
Subject: FW: Preliminary OU6 Summary - message #2

B
Oscar's comments are given below.
Jeff

1. OU6 Month 08, Year 2002, COMMENTS, second sentence, page 6 of 7:
a. Delete the month "May" and insert the months November and December after the August.
b. Change TCE level from 0.07 to 0.7 ug/L

2. OU6 Fig_1: In the EM Library IRP documents, there was a drawing in the OU6 Craigdale O&M manual showing extraction wells connected to the treatment system.
Thank you,
Oscar

OU: 6
Comments Prepared By: Jeff Watkins

OU 6 Review Comments
Jeff Watkins
March 3/03

I Introduction, paragraph 1: Strike the last sentence about protectiveness. See Section X. Remove Table xxx.

III Background: Mention the Craigdale extraction well field and the link with the Cooley system. Include the contribution to GW flows of the aging Davis-Weber canal, the catastrophic failure near OU 6 in 1998, and the resulting relining of the canal.

V Progress Since Last FYR: Explain that the Cooley A/S was shut down because the concentration of TCE in the influent from the garage spring has dropped below 5 ppb and the volume of groundwater flows has decreased very significantly (due to on-base system and canal relining). Oscar and Jeff have data for support. Explain that the Craigdale A/S has been bypassed because the influent concentration of TCE is below the discharge limit now that the drainage canal has been lined.

VII Technical Assessment: OK to include Protectiveness Statement for each site in table.

VIII Issues
Paragraph 1: State when the first PSVR will be completed. Will a brief discussion of PSVPs and PSVRs be included in the main FDYR body? If not, include a brief explanation here.
Paragraph 4: Strike the last 3 sentences giving detailed O&M information and state that well rehab will/has resolve(d) the issue. Expand recommendation #6 slightly to incorporate rehab details, if necessary.

IX Recommendations:
Paragraph 2: There is an apparent disconnect between the recommendation to accelerate the PSVR analysis ASAP and that given in the Site Summary stating the PSVR should be completed as scheduled. Use of the phrase "as soon as possible" implies an urgency associated with risk, what? Please resolve.

X. Protectiveness Statement: Same apparent disconnect in 3rd sentence on PSVR schedule as in Section IX. Provide general statements of "apparent protectiveness" of the sites and/or selected remedy. We agreed that URS would examine overall site data w/o rigorous statistical analyses, knowing the detailed analyses will be done in the PSVR, but we should be able to make a general statements about it. For example, "Following a review of monitoring data for the last X years, the plume appears stable."

I think the regulators and some members of the public will want statements of apparent protectiveness. Somewhere we should preface the statement with a comment that relates the very short length of time of treatment so far. The regulators will understand but we need to ensure the public also understands.

OU: 6
Comments Prepared By: Steve Hicken

Comments on 5 year review
Steve Hicken
3 march 2003

Section I Comments:

1) General: I would restrict your introduction to a description of OU 6. Leave protectiveness statements out. I think more site detail could be added to the introduction. Pg 1, 1st paragraph: I would remove the last sentence. Protectiveness comments should be included under section X.

2) OU 6 site map referenced: This map is ideal for showing and identifying the on and off base extraction wells, connecting lines, treatment facilities and discharge points. I would include them. Where the off-base discharge line trace ends at the top of the page, I suggest putting an arrow with 'Discharge to Weber River'. I also question the elbow in the gw contours at U6-406 (pond) and U6-303 (garage spring). I think a more accurate map would be generated if you would leave off the spring U6-303 concentrations in your contour generating package.

3) Pg 1, 2nd paragraph, 4th sentence: Air stripping is not being used for any portion of the off-base plume. The pond has achieved cleanup objectives and is under a monitoring program. Treatment for groundwater extracted from the six extraction wells has been terminated. Water is discharged untreated to the storm sewer because influent concentrations have dropped significantly. On-base groundwater continues to be extracted, treated with air stripping and discharged to a re-infiltration drain field.

4) Pg 1, 2nd paragraph, ref to Bldg 1946 evap pond: Suggest you write the sentence as follows 'The Building 1946 Evaporation Pond (SD40B) received wash water from a propellant testing laboratory. It was designated as a site with no further remedial action planned (OU 6 ROD) and has been……

5) Pg 1, Table xxx OU 6 Site Identification: I would suggest removing the protectiveness statement table to the section it is discussed in (sec X).

Section II Comments:
1) General: I was a little confused by the different chronology tables and I am familiar with the site. So my end conclusion is that it wouldn't be very friendly to someone who wasn't familiar. I would suggest trying to combine them all under one general OU 6 table. Maybe some consolidation would be in order. Hit the truly important points. Then just identify in event or comments or even another column heading if an event refers to a specific site and not to the overall OU. I think it might flow a little more smoothly with this approach.

2) Chronology Tables: See individual sheets for specific comments on events.

OU: 6
Comments Prepared By: Steve Hicken

Section III Comments:
1) Pg 1, 1st paragraph, last sentence: This statement needs a little further clarification. How about this as an addition. "Groundwater in the shallow aquifer is currently not used as a source of drinking water, but off-base it has historically been used for irrigation of lawns, gardens and as water for pets and livestock. In instances where contaminated groundwater was used for these purposes, alternative clean sources have been supplied to residents." Or something like this to give the correct understanding that exposure pathways have been addressed.

2) Pg 2, partial paragraph top of page: I think some additional verbiage will help put the OU 6 sources, which were small events, into perspective, when compared with the large disposals at the documented trenches, pits and landfills at other operable units. Suggest the following insert after your sentence that starts out with "Historically, hazardous wastes generated by the industrial operations….."
Insert suggestion: The sources of the OU 6 groundwater contamination have never been documented, as this area did not have historic disposal pits, ponds or waste landfills. The best estimate at this time is that the contamination was introduced to the soils from infrequent, small volume disposals in floor drains, from leaking UST's or merely from wastes being dumped in the sandy areas between buildings. The relatively small mass of contamination in the groundwater and soils would be consistent with these scenarios."

Section IV Comments:
1) Pg 2, 1st paragraph, 2nd sentence: suggest making the following change "…and 1,1-DCE in on-base subsurface soil."

2) Pg 2, last paragraph: Reference map for locations of extraction wells, treatment systems etc. You should also clarify that water rights restrictions apply for areas both on and off-base, and that access restrictions to protect workers from contacting contaminated soils only applies to the on-base source area of the east plume (OT026).

Section V Comments:
1) Pg 2: I would include that subsequent sampling at the pond have shown that concentrations continue to remain below the 5 ppb level.

2) You need to include the shut down of the off-base air stripper and talk about discharge now going directly to the storm sewer and ultimately the Weber River. The change took place in November of 2002. Influent concentrations in the off-base system have dropped significantly over the years. From 1998 to 2003 they have declined from 55.3 ppb to 14.3 ppb of TCE. Also might be of interest to note somewhere that discharge concentrations at our compliance point in the storm drain have always been non-detect since direct untreated discharge started.

3) I would think there should be some discussion somewhere as to the general trend in gw concentrations across the plume. Some wells have remained in the same range while others have shown a significant decline as illustrated by the withdrawl of the 100 ppb contour from the off-base area. I don't think a statistical analysis needs to be performed,

but at least take a qualitative look at what has happened since 1998. Also there were sentry wells installed in the Farr subdivision that were intended to alert us if plume expansion was happening. These are U6-030, 026 and 025. Just a cursory look at these wells indicates to me that the plume is stable and not expanding.

Section VII Comments:
1) Table xxx: For your answer to Question A for OT026 I think you might be able to say yes with some qualifying statement that further evaluation will be done when the PSVR is complete.

2) There is an issue with Question B and C for OT026 that you are probably not aware of. When the RI was originally done air sampling was performed in a number of homes above the plume. TCE was detected in several residences, but at levels that were concluded not to be a risk at that time. Since then, with our problems in Roy and as emphasis on vapor intrusion has increased, EMR has worked with the EPA and State to establish an action level for TCE in indoor air at .43 ppbv. At several of the air results from the original RI were above that level. So the answer to B may be no and the answer to C may be yes with the statement that air sampling needs to be done to evaluate current exposure risk in light of the new action level agreed upon. This should be put in your recommendations section.

3) I am not sure why you bring up protectiveness before your discussion of it in Section X.

Section VIII Comments:
1) I am not sure these all these issues affect the protectiveness of the remedy. It seems to me the protectiveness issue is primarily one of exposure. Expansion would potentially expose more people to contamination, but if expansion were happening the sentry wells would show increasing concentrations. Most of your issues seem to deal with optimizing groundwater capture.

2) Item 2 is not so much an issue of protectiveness as concentrations have fluctuated a little, but generally have stayed in the same range. However, it is an issue with regards to language in the ROD. Since our current conceptual model shows a connection to the main plume, how long might we anticipate or expect it would take for concentrations to decline. Perhaps if we developed an estimate it may serve as a rational to continue monitoring with no additional action until the next 5 year review.

3) I would include the air exposure issue. This is an issue that could certainly affect protectiveness.

Section X Comments:
1) Your statement is not consistent with your statement in the Site Summary sheet for OT026 under protectiveness and protectiveness statement. There you state that the remedy currently protects human health and the environment. I liked the way it is

worded there. That message to me is totally different than the one in Section X. I would take the language directly from the Site Summary sheet and use it in Section X.

Site Summary Sheets Comments:
General: I think your style of writing and the message they communicate in these summary sheets is far better than what I have read in the main 5 year summary report.

Site ST022, RAO's: There are no seeps, springs, or a Cooley Pond associated with this site. They are with OT026.

Site OT026, Background: Your last sentence implies contaminated shallow groundwater is still being used to irrigate lawns, gardens, pets and livestock. See Section III comment 1.

Site OT026, Background, Contaminants of Concern: Might be useful to include a column of max concentrations of these contaminants. I would use current values as available.

Site OT026, Remedial Actions, off-base groundwater remediation: I would include the fact that the discharge to the storm sewer ultimately goes to the Weber River. Also that to this point since the air stripper has been shut down, all compliance sampling in the storm sewer has been non detect.

Site OT026, Technical Assessment, Questions: Please state the questions here. See the comments generated for the report section, as to changes that may need to be made to the answers for questions B, and C relative to air sampling.

OU: 7

Comments Prepared by: Hill EMR Combined

Operable Unit 7

I Introduction

OU 7 is a soils-only operable unit with five IRP sites ~~are included in OU 7~~. Site identification numbers and site names are indicated in Table OU 7-1. The only connection among the sites other than geographical location on the Base is the connection between the chromium spill site (Site SS027) and the Sill property in Layton (Site SS028). Fill excavated from a utility trench in Building 225 was placed at two locations on the Sill property. This fill material was later found to be contaminated with chromium. A removal action then ensued to remove the contaminated fill for proper disposal in a RCRA landfill.

The chromium spill site is a result ~~from~~ of activities in the former Metal Plating Shop Area. The contamination underlies Building 225 (Site SS027) and it is the only site containing contamination above both the background levels and health risk standards. Two contaminants of concern exist at this site, hexavalent chromium and cadmium. The other four sites have been closed through either separate decision documents (Sites SS028 and OT029) or through the ROD (Sites ST031 and SS032).

The existing floor slab overlying the former Metal Plating Shop Area in Building 225 protects human health of the area personnel by preventing exposure to contaminated soil. The ROD specifies enacting institutional controls, conducting an inspection and maintenance program, and conducting soil moisture measurements and groundwater quality monitoring for this area.

Table OU 7-1: OU 7 Site Identification.

Site ID	Site Name
SS027	BUILDING 225 CHROMIUM SPILL
ST031	BUILDING 220 UNDERGROUND TANKS
SS032	BUILDING 225 PCB
SS028	SILL PROPERTY, LAYTON
OT029	BUILDING 204 BERYLLIUM UNDERGROUND WASTE TANK

II Site Chronology

Please see Table OU 7-2 for a history of events in this OU. The table is organized first to describe events that impacted the OU as a whole. Events impacting only specific IRP sites within the OU are listed separately.

III Background

The former Metal Plating Shop was located along the east side of Building 225 and was in operation from the 1940s through 1972. Contents of the plating solution tanks containing acids, bases, metal salts, and other chemicals frequently were discharged into a floor drain system that was connected to the industrial waste pipeline. Over time, the plating solutions corroded the drains and piping and the discharged liquids leaked into the subsurface soil.

The closed sites included in OU 7 have various and generally unrelated histories. Refer to individual site summaries, shown in Section XIII, for background information.

IV Remedial Actions

The selected remedy at Site SS027 consists of applying institutional controls, conducting an inspection and maintenance program for the floor slab in the area of the former Metal Plating Shop, and conducting soil moisture content and groundwater quality monitoring. Institutional controls consist of a continuing order from the Base commander (HAFB 1998) to restrict worker access, deed restrictions, and warning signs (ROD 1995). The inspection and maintenance program consists of an annual inspection of the floor slab delineated by three areas of attainment intended to ensure that cracks or fractures that could provide a means of transporting fluids to the sub-floor soil or expose workers to contaminated soil are repaired. The areas of attainment were delineated based on contaminant concentrations detected in the RI phase. The performance monitoring includes semi-annual monitoring of soil moisture content to detect leaks beneath the slab at six monitoring locations and groundwater quality at three wells (one upgradient, one within the source area, and one downgradient) (Remedial Action Project Close-Out Report for OU 7 1998).

V Progress Since Last FYR

No actions were identified for this OU in the 1998 FYR. Since 1998, institutional controls, the inspection and maintenance program, and the performance monitoring have continued per the schedule set forth in the Final Remedial Design/Remedial Action Work Plan for Operable Unit 7 (MW 1996).

VI FYR Process

Site review was conducted per the process described in this report for the overall 2003 FYR.

VII Technical Assessment

Results of the technical assessment for each site in OU 7 are listed in Table OU 7-3. The conclusion of this review is that Site SS027 is not protective of human health and the environment due to chromium concentrations in excess of MCLs in the groundwater underlying the site. These concentrations exceeded the MCL in 1996, shortly after the ROD was completed, and have not returned to sub-MCL levels since that time. Evidence also exists that migration of contaminants is occurring due to the elevated concentrations of chromium in a downgradient location when compared to the upgradient well. Additional details of the technical assessment for each site in OU 7 are provided in the respective site summary (see Section XIII).

Table OU 7-3: Technical Assessment Summary for OU 7.

Site ID	Remedy	Technical Assessment*			Protectiveness	Next Five Year Review
		Question A	Question B	Question C		
SS027	Floor Slab	No	No	Yes	Not Protective	2008
ST031	Not required, site closed	NA	NA	NA	Protective	Not required
SS032	Not required, site closed	NA	NA	NA	Protective	Not required
SS028	Not required, site closed	NA	NA	NA	Protective	Not required
OT029	Not required, site closed	NA	NA	NA	Protective	Not required
OU 7	Floor Slab	No	No	Yes	Not Protective	2008

* Question A: Is the remedy functioning as intended by the decision documents?
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable

VIII Issues

All issues recommended in this section pertain to Building 225 Chromium Spill (Site SS027) only. Additional details regarding these recommendations are available from the SS027 Site Summary found in Section XIII.

Institutional Controls

- Warning signs within Building 225, SS027, are not in compliance with ROD intent. Per the ROD, the selected remedy at OU 7 includes: "Posting warning signs regarding the presence of contaminated soils that could represent a threat to human health." The signs currently posted say, "Caution: Do Not Disturb Floor, Contact EMR, Phone 78790". The current signs do not inform area personnel of the contaminated soils in the areas of attainment underlying the floor slab or of a threat to human health.

Inspection and Maintenance Program

- Defects that affect infiltration rates recommended for repair in the 2001 annual report (URS 2002) have not been repaired at the time of this review.
- The tape delineating the areas of attainment is in disrepair (torn, peeling, etc.).

Performance Monitoring

- Hexavalent chromium concentrations above total chromium MCLs have been measured in the groundwater underlying the floor slab since 1996.
- Downgradient concentrations of hexavalent chromium are above the upgradient concentrations suggesting a release of contaminants to the aquifer at Building 225.
- The annual reports show three areas of attainment based on subsurface contaminant concentrations. One of these areas, the middle chromium plating area, does not contain any locations for monitoring soil moisture.

- Soil moisture monitoring objectives and process are not clear. Action levels for a soil moisture increase are not clearly identified nor is an action plan in place if an action level is reached. Data comparison is completed at one interval (7-8 feet bgs) only and no rationale for reviewing only that depth is given. Historically, logging has not been performed during the same months of the year.
- No soil moisture data are available in ERPIMS to facilitate a thorough performance review for the floor slab remedial action.

General

- PSVP recommendations have not been incorporated fully into the LTM and O&M contracts to ensure monitoring and reporting is comprehensive.
- Hexavalent chromium reference dose level has been reduced since the ROD was written, indicating that hexavalent chromium is a more toxic metal than what was evaluated in the ROD.

IX Recommendations and Follow-up Actions for OU 7

All recommendations presented in this section pertain to Building 225 Chromium Spill (Site SS027) only. Additional details regarding these recommendations are available from the SS027 Site Summary found in Section XIII.

Institutional Controls

- Change the warning sign verbiage to provide warning of presence of contaminated soils that could pose a hazard if exposed.

Inspection and Maintenance Program

- Remedy defects in floor slab as soon as they are identified to ensure minimal infiltration. Floor slab cracks are scheduled for repair during 2003.
- Replace tape, which outlines the areas of attainment, with paint or another method of delineation. Marking tape will be replaced during 2003.

Performance Monitoring

- Review historical soil moisture data in an effort to ascertain the cause of the migration of hexavalent chromium above MCLs in the groundwater underlying the areas of attainment and the elevated concentrations of hexavalent chromium downgradient of the source area. The cause of these problems should be identified and resolved.
- Determine if a soil moisture probe is required in the middle chromium plating area of attainment.
- Establish an appropriate action level for an increase in soil moisture content based on soil moisture results.
- Determine what actions should be taken if an increase in soil moisture content occurs at a particular depth.
- Evaluate soil moisture logs at all intervals, not just 7-8 feet bgs.
- Schedule soil moisture data collection in the same months of each year to ensure comparable results.
- Incorporate historical data from the annual reports and current neutron logging data at all intervals into ERPIMS to ensure data availability for future comparisons.

Comments Prepared by: Hill EMR Combined

General

- Review the PSVP and ensure either the LTM or O&M contractor is addressing all aspects of monitoring and reporting.
- Re-evaluate risk analysis due to change in hexavalent chromium reference dose levels.

X Protectiveness Statement for OU 7

Four of the five sites included in OU 7 are closed and a protectiveness evaluation is not applicable. However, the fifth site, Building 225 Chromium Spill, is not protective. There are no current health risks at this site because the areas of contamination are beneath the concrete floor slab, which prevents the completion of the exposure pathway from occurring. However, due to chromium concentration in excess of MCLs in the groundwater underlying the source area and evidence of downgradient contaminant migration, this remedy is not protective of the environment.

XI Next Review

The next FYR for OU 7 is required by 2008. No future review is required for Building 220 Underground Tanks (Site ST031), Building 225 PCB (Site SS032), Sill Property, Layton (Site SS028), or the Building 204 Beryllium Underground Waste Tank (Site OT029).

XII References

(To be exported from database)

XIII FYR of Sites in OU 7

See attached site summaries.

OU: 8
Comments Prepared By: Jeff Watkins and Robert Petrie

Watkins Jeffrey W Civ OO-ALC/EMR
<Jeffrey.Watkins@HILL.af.mil>

04/23/03 11:21 AM

To:'"B_Hall@URSCorp.com"' <B_Hall@urscorp.com>
cc:
Subject: RE: OU 8 JWW comments rec'd/ clarification on detail?

B
I made "suggestions" for your consideration. If you think the suggestions devalue the summary and that they should be left in place, please do so.

For URS, I have compiled all the EMR opinions about figures and given it to my management to make a final decision on content. We will also review the "tone" of recommendations and PSs and make a determination of their form. We want to do this before you prepare the draft report for delivery to the regulators and possibly the RAB.
Stay tuned!
Jeff

-----Original Message-----
From: B_Hall@URSCorp.com [mailto:B_Hall@URSCorp.com]
Sent: Wednesday, April 23, 2003 9:06 AM
To: Watkins Jeffrey W Civ OO-ALC/EMR
Cc: Jeremy_Cox@URSCorp.com
Subject: FYR: OU 8 JWW comments rec'd/ clarification on detail?

Jeff-
Rec'd. Thanx.

You've recommended removing alot of the detail in this OU Summary... and I know the focus is on brevity and having detail in the Site Summaries. Just wanted to remind you that for OU8 there is only one site (OT033) so there is no accompanying Site Summary. Any detail needs to show up in the OU Summary. We can certainly edit down based on your recommendations - just wanted to make sure you want to cut it down that much since the information will not show up anywhere else?

This is the case for several of the OUs (8, 10, 11, 12) so those OU Summs tend to have greater detail than the others. B.

B.

Watkins Jeffrey W

Civ OO-ALC/EMR To:
"'B_Hall@urscorp.com'" <B_Hall@urscorp.com>,
<Jeffrey.Watkins@H
"'Stacey_Arens@urscorp.com'" <Stacey_Arens@urscorp.com>,
ILL.af.mil> "'jeremy_Cox@urscorp.com'"
<jeremy_Cox@urscorp.com>
cc:

04/23/03 07:51 AM Subject: FW: OU-8 FYR
comments from Robert Petrie

My suggestions are in black strikeout or aqua JWW.
Jeff

-----Original Message-----
From: B_Hall@URSCorp.com [mailto:B_Hall@URSCorp.com]
Sent: Tuesday, April 22, 2003 10:31 AM
To: Watkins Jeffrey W Civ OO-ALC/EMR
Cc: Petrie Robert Civ OO-ALC/EMR; Stacey_Arens (E-mail);
Jeremy_Cox@URSCorp.com
Subject: Re: OU-8 FYR comments from Robert Petrie

Rec'd. Thanx Rob.

Jeff-
Will there be add'l comments to come for OU8? If so, we'll hold off
processing until we have them all. Thanx. B.
****
Barbara L. Hall, PhD
Sr. Environmental Engineer
URS Corporation
756 E Winchester St, Suite 400
Salt Lake City UT 84107
ph: 801-904-4016
fax: 801-904-4100
email: b_hall@urscorp.com

Change is always different. -- Jonathan Young

OU: 8
Comments Prepared By: Jeff Watkins and Robert Petrie

Petrie Robert Civ

OO-ALC/EMR To:
B_Hall@urscorp.com,
"Stacey_Arens (E-mail)"
<Robert.Petrie@HI <Stacey_Arens@urscorp.com>

LL.af.mil> cc: Watkins Jeffrey W
Civ OO-ALC/EMR

<Jeffrey.Watkins@HILL.af.mil>, Petrie Robert Civ OO-ALC/EMR
04/22/03 09:44 AM <Robert.Petrie@HILL.af.mil>

Subject: OU-8 FYR comments
from Robert Petrie

All,
Please find attached my comments for OU-8 portion of the Five Year Review. In the Word Doc, I have used the 'strike and replace' feature to outline my recommended edits. In blue is the recommended changes, red is the text to be removed and in blue italics are notes and information and should not be incorporated into the document. Most of the italicized comments are found in the later part of the document. I have revised the OU-8 Figure in Adobe to reflect the change in status of the isolated lobe in
the West ramp area of the Base. I have also edited the adobe doc for the OU-8 chronology.

Please call (801 775-6896) or email me if you have any questions regarding the changes I have recommended.
Regards
Rob P.

<<OU 8 Chron.pdf>> <<OU 8 Fig 1.pdf>> <<OU 8 FYR comments.doc>>
(See attached file: OU 8 Chron.pdf)(See attached file: OU 8 Fig 1.pdf)(See attached file: OU 8 FYR comments.doc)

OU: 8

Comments Prepared By: Rob Petrie and Jeff Watkins

Operable Unit 8

I Introduction

OU 8 is a groundwater-only Operable Unit and contains one site, OT033, ~~which is~~ the Layton TCE plume (see Figure OU 8-1). Chlorinated compounds, primarily TCE comprise the on-Base plume, while both TCE and 1,2-DCA have migrated off-Base ~~northwest from on-Base source areas and~~ to the south and southwest ~~off-Base~~. ~~One chlorinated compound,~~ 1,2-DCA~~,~~ ~~which~~ is ~~only~~ minimally retarded ~~compared~~ relative to groundwater flow ~~rates~~velocities, and has migrated up to 10,000 feet from the source areas off-Base. The potential source areas that have impacted groundwater at OU 8 either previously or currently include: the Sodium Hydroxide Tank Site (ST004 in OU 3), the IWTP Sludge Drying Beds (WP006 in OU 3), the former Berman Pond (WP005 in OU 3) and Refueling Vehicle Maintenance Facility (RVMF) (ST018 in OU 3), Building 220 (ST031 in OU 7) and 225 (SS027 & SS032 in OU 7), Pond 1 (SD034 in OU 9), Layton Area, UST sites 260 (ST074) and 280 (ST035), and potentially Buildings 43 and 454 (OT097 in OU 11) (MW 2001).

Table OU 8-1: OU 8 Site Identification.

Site ID	Site Name
OT033	LAYTON TCE PLUME

II Site Chronology

See Table OU 8-2 for a history of events in this OU. The table is organized to describe events that impacted the OU as a whole, followed by events impacting specific IRP sites within the OU.

III Background

~~VOCs are the primary contaminants detected in OU 8 groundwater.~~ The VOCs most frequently detected above their respective MCLs in OU 8 groundwater include, TCE, 1,2-DCA, 1,1-DCE, 1,1,1-TCA, chlorobenzene, and PCE. In addition, gasoline and diesel range organic compounds and related compounds (benzene, toluene, ethylbenzene, and naphthalene) have been detected in concentrations exceeding their respective MCLs near on-Base UST sites. Inorganic contaminants in groundwater detected above their respective MCLs include hexavalent chromium, nickel, and lead in the vicinity of Building 225 (OU 7) and Hill AFB IWTP (MW 2001).

Several remedial actions or corrective measures have been implemented within the OU 8 area for ~~OU 8~~both groundwater and ~~the four~~ source areas overlying OU 8. ~~These~~ R~~r~~emedial actions include hydraulic containment of contaminated OU 8 groundwater at the southern Base boundary as a part of an interim remedial action (IRA), implementation of the OU 3 and OU 7 RODs, implementation of interim remedial measures at the Sodium Hydroxide Tank Site (ST004), and implementation of corrective actions at UST sites ST035 (Building 280) and ST074 (Building 260) (MW 2001).

The areal extent of TCE and 1,2-DCA plumes are shown in Figure OU 8-1. ~~There are separate TCE and DCA plumes shown on Figure OU 8-1.~~ The off-Base TCE plume ~~is~~ splits into separate ~~two portions: an~~ eastern and western ~~leg~~legs. Off-Base TCE concentrations are highest in the area ~~immediately~~ extending south ~~of~~ from the OU 8 IRA hydraulic containment system, and the distal portions of both east and west legs ~~of the off-Base contaminant plume~~. ~~The highest off-Base TCE concentration of 465 ug/L was reported at a depth of 110 feet located immediately~~

~~south of the IRA hydraulic containment system. Chemical partitioning calculations estimate the total mass of TCE within the OU 8 plume is approximately 10,500 pounds, with approximately 2,900 pounds in the aqueous phase (i.e., dissolved). The estimated volume of groundwater contaminated with TCE at OU 8 is approximately 4 billion gallons (MW 2001).~~

The 1,2-DCA plume has migrated approximately ~~one-half mile~~3000 feet past the furthest extent of the off-Base TCE ~~-~~plume.~~ The highest 1,2-DCA concentration, 697 ug/L was reported in the the distal end of the western leg in U8-096. The with a maximum depth 1,2-DCA has been reported is of 184 feet bgs detected in a U8-124 well located southwest of I-15near the toe of the plume. The estimated total mass of 1,2-DCA within the OU 8 plume is approximately 2,800 pounds with approximately 2,100 pounds in the aqueous phase (dissolved). The estimated volume of groundwater contaminated with 1,2-DCA at OU 8 is approximately 2.8 billion gallons (MW 2001).~~

There is chemical and geochemical evidence to suggest that biodegradation of TCE and 1,2-DCA is occurring off Base; however, while TCE concentrations on-Base have attenuated over time there is no evidence to ~~date, the data~~ indicate that biodegradation is contributing to this process~~not occurring on Base~~ beneath the industrial area. There is evidence to suggest that abiotic degradation of 1,1,1-TCA may be occurring on Base. Lead, nickel, and cadmium are readily sorbed to soils or precipitated as carbonates, such that natural attenuation processes may be sufficient to mitigate their transport. Reduction of hexavalent chromium to immobile trivalent forms occurs in subsurface environments and may be sufficient to mitigate its transport ~~as well~~ (MW 2001).

The Remedial Investigation and the Feasibility Study for OU 8 were completed in December 2001and March 2003, respectively. The FS contains both on-Base and off-Base remedial alternatives, however the FS does not ~~make~~ outline the ~~a~~ preferred remedial alternative ~~selection~~ for either ~~section of the plume~~on- or off-Base. The preferred remedial alternative will be outlined in the Proposed Plan scheduled for general release June 18, 2003. The on-Base alternatives include no further action, limited action, MNA, and two pump and treat options. The off-Base alternatives include no action, limited action, MNA, and three pump and treat options.

IV Remedial Actions

The OU 8 IRA addresses contaminated groundwater along the southern boundary of Hill AFB. The interim remedy selected for OU 8 is designed to prevent further groundwater transport of contamina~~n~~tion to off-Base areas, thereby controlling the volume and areal extent of contamination and reducing future potential off-Base risk and cleanup costs. The interim remedy selected for OU 8 was designed to contain the migration of contaminants at the southern boundary of Hill AFB by removing groundwater ~~with~~ using a series of vertical extraction wells. Since the objective of the IRA is containment, cleanup levels were not established.

The OU 8 IRA hydraulic containment system ~~was~~ has been operational since~~on~~ 18 May 1998. ~~and consists of a series of~~E~~e~~ight ~~vertical~~ extraction wells pump groundwater on a semicontinuous basis discharging to the sanitary sewer for treatment at North Davis County Sewer District (NDCSD), ~~conveyance lines of double-walled HDPE piping, and discharge points to the sanitary sewer system through two individual sanitary sewer manholes.~~ Because the system transects southgate drive the conveyance and instrumentation are operated independently as separate East and West systems.~~The extraction wells are divided into two separate systems that operate independently, the East System and the West System, one on each side of the South Gate Drive~~

(see insert on Figure OU 8-1). The East system consists of three extraction wells, and the West system consists of five extraction wells. ~~The depths of the extraction wells vary from 110 to 160 feet bgs with screened intervals varying from 60 to 100 feet in length.~~

V Progress Since Last FYR

No recommendations were made in the 1998 FYR for OU 8. Since 1998 however, the IRA hydraulic containment system continued operation without major changes as the CERCLA process continues. Other progress includes finalization of the RI and the FS for OU 8 which were completed in December 2001 and March 2003, respectively. The Proposed Plan and ROD are scheduled for completion in June and November 2003, respectively.

VI FYR Process

Site review was conducted per the process described in this report for the overall 2003 FYR.

VII Technical Assessment

Question A. Is the remedy functioning as intended by the decision documents?

Yes. The principal goal of the IRA is to prevent further groundwater transport of contaminant to off-Base areas, not to restore the contaminated aquifer to drinking water standards (ROD for IRA 1997). Based on potentiometric surface maps, the extraction wells are capturing groundwater in the OU 8 plume at the Base boundary.

A final remedy has not been selected and a final ROD has not been implemented at the time of this review. This question should be addressed again ~~Therefore, after~~following implementation of the final remedy.~~, which is likely to include the IRA among other actions, this question should be addressed again~~.

Question B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?

No. The Utah and Federal Standard for Drinking Water for arsenic at the time the Interim ROD was written was 50 ug/L. This value is currently valid; however, the arsenic standard of 10 ug/L will be effective on 1/26/2006. This decrease should be taken into consideration when writing the final ROD.

The Utah and Federal Standard for Drinking Water for hexavalent and total chromium was 50 ug/L at the time the Interim ROD was written. Since an MCL for hexavalent chromium in groundwater is not published, the MCL for total chromium in groundwater is used for both hexavalent and total chromium. The MCL for total chromium in groundwater is 100 ug/L. The value of 100 ug/L for hexavalent and total chromium should be used when the final ROD is written.

Question C. Has any other information come to light that could call into question the protectiveness of the remedy?

The hydraulic containment system's intent was not protectiveness. Therefore, this question is not applicable.

OU: 8

Comments Prepared By: Rob Petrie and Jeff Watkins

VIII Issues

1.) ~~One remedial alternative discussed in the FS (MW 2003) is MNA for the off-Base plume. Per the RI (MW 2001), "Although there is evidence of TCE biodegradation, natural attenuation alone may not be sufficient for TCE remediation off-Base under present conditions." Consequently, information to date does not indicate MNA is a feasible alternative.~~ *Note. While the FS outlines MNA as all or part of the remedy in Alternatives 3–6 off-Base, the proposed plan was revised in March 2003 to only include MNA alternative (#3) and was removed from alternatives 4-6. Monitoring will still be a component on those alternatives but will not include the additional sampling required to satisfy MNA requirements. While MNA is one of the alternatives considered, it is not Hill AFB preferred alternative for the off-Base plume, the preferred alternative is an engineered strategy (#5) consisting of two pumping systems*

~~2~~1.) Table 3-1 of the Interim ROD identifies 10 different contaminants. The RI has 5 contaminants detected above their respective MCLs that are not identified in the Interim ROD. These contaminants are toluene, ethylbenzene, naphthalene, nickel, and lead. Also, arsenic is not mentioned in the RI as a contaminant, but it is listed in the Interim ROD.

~~3~~2.) U8-201, U8-207, and U8-208 (the East system) have very low TCE concentrations (i.e., less than 17 ug/L since April 1999 and U8-201 has not been above 5 ug/L, the MDL, since April 1999). It may be possible to turn off wells within the East system while still meeting the IRA objective of containing groundwater with contaminant concentrations above MCLs.

~~4~~3.) Calculations in Appendix L of the 2002 O&M Plan (URS 2002), ~~generated by Montgomery Watson in 1998,~~ illustrate that U8-203 can be shut down for a maximum of 38 days while still maintaining (or regaining) capture of the migrating contaminants during the well's shutdown period. This duration was then translated into the maximum allowable system shutdown period. This system shutdown duration may not be appropriate since U8-203 yields substantially more volume than other wells and it is screened in a higher hydraulically conductive zone than other wells in the system.

Further, due to well fouling issues and pump mechanical problems, individual wells within the IRA system have been inoperable for consecutive months (based on a review of 2 years of monthly and annual reports). No guidance is given in the O&M Plan for the maximum downtime for individual wells within the IRA prior to loss of hydraulic containment (URS 2002).

~~5~~4.) During the interviews with personnel from the O&M contractor, several operational issues were identified. JWW: I recommend not discussing mundane O&M issues unless they have a direct bearing on system efficacy as related to protectiveness.
Some of the points outlined below do gel with my current understanding of the IRA….I spoke with Sage Evans 4/24/03 and he is in concurrence with my reservations. We should talk about this over the phone or in person if there is some miscommunication between myself and members of the O&M team.

A.) It was reported that some of the pumps in the wells are oversized ~~and others are undersized~~. Pump sizing in current O&M plan is based on projections of modeled flows and from pump tests performed prior to construction. Except for U8-203, all projections have over estimated actual ground water production rates. Since the flows are less than projected, current pump sizing specified in current version of O&M manual is in excess of requirements.

B.) Spare pumps require cleaning and maintenance~~ and were not operational at the time of the interview~~. These pumps were operational when they were removed from the well
~~C.) Spare pumps are not the same size as the pumps in the wells and therefore cannot sustain optimal long-term operations.~~
~~D~~C.) The design and location of the pressure transmitter enclosures allows excessive moisture into the enclosure and inflates operational costs.

~~6~~5.) Air sampling has been performed in a number of homes above the plume. Due to recent emphasis on vapor intrusion, EMR has worked with the EPA and Utah State to establish an action level for TCE in indoor air at 0.43 ppbv, which may be different than the TCE action level at the time of the OU 8 indoor air testing.

~~7~~6.) Biofouling has been a problem in the past causing prolonged downtime of several pumps. However over the past 3 years, the cleaning strategies to manage this issue have been refined to a point where in 2003 the operator has defined flow rate goal for each well. The performance of the extraction wells is being tracked monthly. Based on the rate of decline in production the operator can predict in advance when a well will require maintenance.

~~8.) Time-series data have not been reviewed to determine the effect the IRA system has had on the areal extent of the plume.~~ *Note, the investigation team collects individual well data to evaluate this*

~~9.) It was identified in the interview with Rob Petrie of EMR (28 January 2003) that one of the field drains daylights for approximately 5 feet. The concentrations of COCs in this water is unknown.~~ *This U3-610 and the concs at last sampling were 5 and 6 ppb for DCA and TCE, respectively*

IX Recommendations and Follow-up Actions for OU 8

~~1.) Evaluation of additional information is needed prior to determining whether MNA could be a technically supported preferred alternative for either lobe (east or west) of the off-Base plume.~~

~~2~~1.) Clarify appropriate CoCs in the final ROD.

~~3~~2.) Investigate the following options: *Yes to all four below*

A.) Reduce the frequency of sampling for the East system wells due to their historical contaminant concentration stability and low contaminant levels to ensure a cost effective sampling plan,

B.) Reduce the MDL with the laboratory to a reporting limit less than 5 ug/L for better quantification of contaminant concentration to support taking wells off-line,

C.) Take some or all of the East System wells off-line (U8-201, U8-207, U8-208) based statistically-proven concentrations below MCLs and modeling to ensure capture of the 5ug/L contour is not compromised, and

D.) Change the discharge point of the East System from the sanitary sewer to the storm drain due to the low concentrations being captured by this section of the system.

~~4~~3.) Calculate maximum shutdown durations for each well within the IRA system to ensure future capture of the entire plume transect. Compare the maximum well shutdown durations for each well to determine the maximum system shutdown duration. *Yes*

~~5~~4.) Address operational issues:

A.) ~~Review pump sizing.~~Current and future pump purchases are based on actual flows and not modeled projections. During the next O&M plan revision; the new pump sizes will replace the existing specifications. Note that existing pumps will continue to be used until they require replacement. The capital costs have already been sunk in these pumps and using them has no detrimental effect on the long-term operation of the system.

B.) Clean and maintain spare pumps.

~~C.) Purchase spare pumps that are the correct size.~~

~~D~~C.) Complete a cost-benefit analysis for replacement or re-engineering of the current pressure transmitter enclosures.

~~6~~5.) Review previous indoor air results to ensure future residents' health based on the new criteria of 0.43 ppbv of TCE. *Yes*

~~7~~6.) Follow-up on the preventative maintenance plan already implemented to combat the fouling issue at the site and review pump downtime durations and frequency of required cleaning to ensure current schedule is adequate. *Yes……but I believe we are already doing this.*

~~8.) Evaluate time-series data to determine the effect the IRA system has had on the areal extent of the plume. This evaluation will help to understand the performance and protectiveness of the IRA system.~~

~~9.) Determine if the water from the field drain is above MCLs and if so, eliminate this exposure route by preventing exposure pathway completion.~~

X Protectiveness Statement for OU 8

The hydraulic containment system, implemented as an IRA, is preventing the groundwater from migrating off-Base, thereby controlling the volume and areal extent of contamination and reducing future potential off-Base risk and cleanup costs. The remedy is performing as intended by the Interim ROD.

Protectiveness of this OU cannot be determined or evaluated until a final remedy is selected, implemented, and performance data are reviewed. The FS for this site was finalized in March 2003. A Proposed Plan and a ROD are expected within calendar year 2003.

XI Next Review

The next FYR for OU 8 is required by 2008.

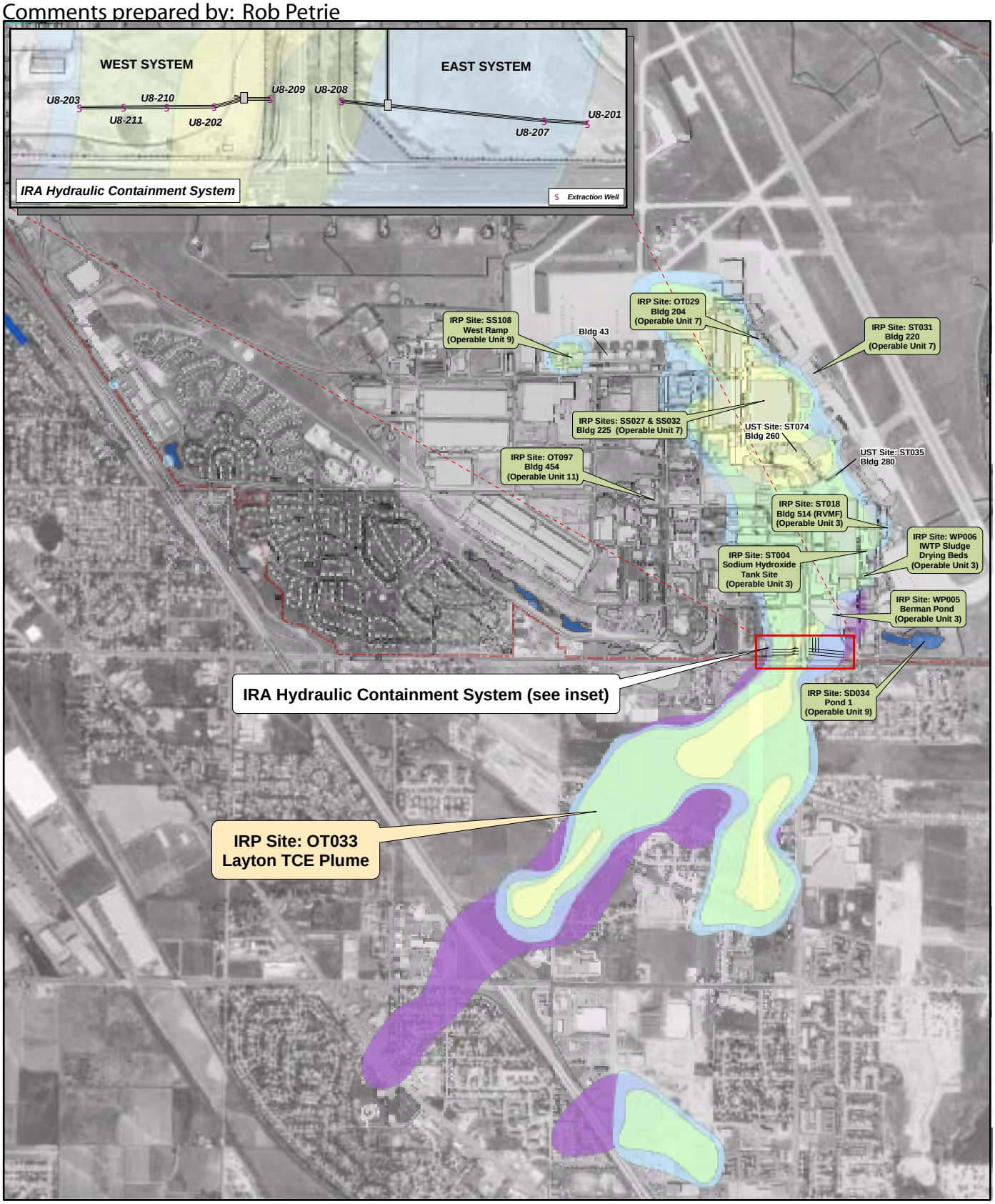
XII References

(To be exported from database)

XIII FYR of Sites in OU 8

See attached site summaries.

Comments prepared by: Rob Petrie



G:\Projects\HillAFB\Base\5YearReview\Maps\OU8_REV040403.mxd

TCE Isoconcentrations

- 5-10 µg/L
- 10-100 µg/L
- 100-1,000 µg/L
- 1,2 DCA Plume (> 5 µg/L)

Maximum TCE and 1,2-DCA concentrations from 1999 to 2002 extracted from the Hill AFB database

PRELIMINARY

800 0 800 1,600 Feet

FIGURE OU 8 -1
Operable Unit 8 (OU 8)

2003 CERCLA Five Year Review
Hill Air Force Base, Utah

URS

Table OU 8 -2: Site Chronology - Hill AFB 2003 Five Year Review

MONTH	YEAR	EVENT	COMMENTS	REFERENCE
OT0 33	**LAYTON TCE PLUME**			
	1993	OU 8 Created	OU 8 was created in 1993, and consisted of contaminated groundwater previously considered part of OU 3 and OU 7.	Remedial Investigation Report for Operable Unit 8
05	1997	Interim Record of Decision	An interim ROD for an Interim Remedial Action at OU 8 was finalized in May 1997.	Remedial Investigation Report for Operable Unit 8
10	1997	Hydraulic containment system constructed	The hydraulic containment system was constructed from the 20 October 1997 and completed 1 May 1998. The system consists of eight extraction	Construction Completion Report for Operable Unit 8 Interim Remedial Action Hydraulic Containment System
10	1997		wells and twelve piezometers.	
05	1998	Final Inspection of the Interim Remedial Action	Final inspection of the OU 8 IRA Hydraulic Containment System was conducted on 4 May 1998. A final facility inspection by the EPA and UDEQ was conducted on 20 July 1998. O&M system startup was on 18 May 1998.	Final Interim Remedial Action Report for Operable Unit 8
05	1998	The West System was operational		Remedial Investigation Report for Operable Unit 8

Comments prepared by: Rob Petrie

Table OU 8 -2: Site Chronology - Hill AFB 2003 Five Year Review

MONTH	YEAR	EVENT	COMMENTS	REFERENCE
04	1999	The East System was placed on-line after modifications	The East System was shut down on May 21, 1998 after only four days of operation due to flooding of the electrical pullbox that resulted in electrical component damage. After several design changes were implemented, the East System was restarted in April 1999.	Remedial Investigation Report for Operable Unit 8
12	2001	Remedial Investigation	Remedial Investigation finalized.	Remedial Investigation Report for Operable Unit 8
03	2003	Feasibility Study (FS)	Feasibility Study finalized.	Feasibility Study Report for OU 8

OU: 9
Comments Prepared By: Shannon Smith, 02/27/03 12:00 PM

Jeremy --

Here are my comments on the OU9 FYR documentation.

General Comments:

1. Site SD040 -- Refer to this as the Pond 7 Area and not DRMO/Pond 7 Area in all documents and the figure. The reason we don't want to reference the DRMO in the name is because they have a RCRA Part B permit and don't want to raise any red flags with the UDEQ.

2. General Comment regarding OT106 Deferred Sites. Once a complete site characterization is completed, the site will be either removed from the inventory list if the samples are below RBSLs or further invested under a new site ID if samples are above RBSLs.

3. The name of the map is the "Restricted Use Access Map"

Specific Comments:

1. Site Chronology Pond 3:
1992: Check the reference. Should be OU3 ROD and not the OU9 CSM
1999: Detailed topographic survey. Correct spelling.

2. Site Chronology Pond 1:
1999: Detailed topographic survey. Correct spelling.

3. Site Chronology 800/900 warehouse area:
01/2002 Comments: "UST program." Expand on this.

4. Site Summary Pond 1
IV. Remedial Actions. Second sentence. Remove the word "of".

5. Site Summary Pond 7
III. Background. Reword to read. The Pond 7 investigation area is located on the western edge of the Base, south of the West Gate and the DRMO. The DRMO is a military salvage yard .....

6. Site Summary 800/900 warehouse Area
III. Background. Third sentence. Reword to read. The OU8 RI concluded that the contamination at this site is not hydraulically connected to the OU8 groundwater plume.

Also, I have provided the documents to Sheri Rolfsness for her review and comment on the sites she is more familiar with.

Shannon

-----Original Message-----
From: Jeremy_Cox@URSCorp.com [mailto:Jeremy_Cox@URSCorp.com]
Sent: Wednesday, February 26, 2003 1:18 PM

OU: 9
Comments Prepared By: Shannon Smith, 02/27/03 12:00 PM

To: Shannon.Smith@hill.af.mil; Jeffrey.Watkins@hill.af.mil; B_Hall@URSCorp.com; Autumn_Hu@URSCorp.com
Subject: OU 9 Summary for HAFB FYR

Shannon and Jeff,

Autumn Hu has completed her FYR summary of OU 9 and we've finished our internal reviews. I've attached the OU Summary (OU 9 030225.doc) for your review. The individual Site Summaries have been attached as .pdf files. I've also included an Excel spreadsheet of the deferred sites and an OU chronology as a .pdf. A figure for the OU (also a .pdf) will be attached to a separate e-mail. Please review these documents and return your comments to me as soon as it is conveniently possible. Thanks.

Jeremy B. Cox
Environmental Engineer
URS Corporation
756 East Winchester Street, Suite 400
Salt Lake City, UT 84107
(801) 904-4065
e-mail: jeremy_cox@urscorp.com

OU: 9
Comments Prepared By: Jeff Watkins

Watkins Jeffrey W Civ OO-ALC/EMR
<Jeffrey.Watkins@HILL.af.mil>

03/11/03 03:19 PM

To:"'B_hall@urscorp.com'" <B_hall@urscorp.com>
cc:
Subject: OU 9 Comments

B
The draft report for OU 9 looks OK. For site summary OT106, section VI, strike the comment about protectiveness and reword the text. The figure is OK. For other site summaries, is the recommendation "Evaluate protectiveness during the next FYR" necessary? I don't see it as a recommendation. Pond 1 site summary SD034, Background, may be wordy.

More to follow
Jeff

OU-9
Comments Prepared By: Sheri Rolfsness, Shannon Smith, 03/03/03 01:39 PM

Jeremy --

Sheri had no additional comments.

Shannon
-----Original Message-----
From: Rolfsness Sheri Civ OO-ALC/EMR
Sent: Monday, March 03, 2003 12:56 PM
To: Smith Shannon Civ OO-ALC/EMR
Subject: RE: OU 9 Summary for HAFB FYR

shannon,
I reviewed and had no comments...

sheri

-----Original Message-----
From: Smith Shannon Civ OO-ALC/EMR
Sent: Thursday, February 27, 2003 11:31 AM
To: Rolfsness Sheri Civ OO-ALC/EMR
Subject: FW: OU 9 Summary for HAFB FYR

Sheri --

Please feel free to review your sites and provide comments. Thanks

Shannon
-----Original Message-----
From: Jeremy_Cox@URSCorp.com [mailto:Jeremy_Cox@URSCorp.com]
Sent: Wednesday, February 26, 2003 1:18 PM
To: Shannon.Smith@hill.af.mil; Jeffrey.Watkins@hill.af.mil; B_Hall@URSCorp.com; Autumn_Hu@URSCorp.com
Subject: OU 9 Summary for HAFB FYR

Shannon and Jeff,

Autumn Hu has completed her FYR summary of OU 9 and we've finished our internal reviews. I've attached the OU Summary (OU 9 030225.doc) for your review. The individual Site Summaries have been attached as .pdf files. I've also included an Excel spreadsheet of the deferred sites and an OU chronology as a .pdf. A figure for the OU (also a .pdf) will be attached to a separate e-mail. Please review these documents and return your comments to me as soon as it is conveniently possible. Thanks.

Jeremy B. Cox
Environmental Engineer
URS Corporation
756 East Winchester Street, Suite 400
Salt Lake City, UT 84107

OU: 10
Comments Prepared By: Jeff Watkins, 03/18/03 06:46 AM

Jeremy

The OU 10 Summary looks OK.

Jeff

-----Original Message-----

From: Jeremy_Cox@URSCorp.com [mailto:Jeremy_Cox@URSCorp.com]

Sent: Wednesday, March 05, 2003 10:47 AM

To: Shannon.Smith@hill.af.mil; Jeffrey.Watkins@hill.af.mil

Cc: B_Hall@URSCorp.com

Subject: OU 10 Summary

Shannon and Jeff,

Here is our latest draft of the OU 10 Summary, attached as a Word document. The OU Chronology is attached as a .pdf. I'll include the draft figure in a separate e-mail. Please send us your comments as soon as it is conveniently possible. Thanks.

Jeremy B. Cox

Environmental Engineer

URS Corporation

756 East Winchester Street, Suite 400

Salt Lake City, UT 84107

(801) 904-4065

e-mail: jeremy_cox@urscorp.com

OU: 10
Comments Prepared By: Shannon Smith, 03/05/03 02:19 PM

Jeremy --

Comments on OU 10 FYR documents.<?xml:namespace prefix = o ns = "urn:schemas-microsoft-com:office:office" />

Site Chronology:

1995 SI OU9 SI approach was designed to focus ..... (Add OU9 to paragraph)

Site Summary

Section III Background, Para 6.

The land use in the cities of Sunset and Clearfield, where potential contamination has occurred, is residential and commercial.

Figure:

We would prefer you not contour the plume as this point, especially the off-base portion, since this is based solely on CPT data which is considered screening level data. Once we have installed a network of MWs, we can start to delineate concentrations within the plume. I attached an example of a "plume" map we have created for this site.

Shannon

-----Original Message-----
From: Jeremy_Cox@URSCorp.com [mailto:Jeremy_Cox@URSCorp.com]
Sent: Wednesday, March 05, 2003 10:47 AM
To: Shannon.Smith@hill.af.mil; Jeffrey.Watkins@hill.af.mil
Cc: B_Hall@URSCorp.com
Subject: OU 10 Summary

Shannon and Jeff,

Here is our latest draft of the OU 10 Summary, attached as a Word document. The OU Chronology is attached as a .pdf. I'll include the draft figure in a separate e-mail. Please send us your comments as soon as it is conveniently possible. Thanks.

Jeremy B. Cox
Environmental Engineer
URS Corporation
756 East Winchester Street, Suite 400
Salt Lake City, UT 84107
(801) 904-406e-mail: jeremy_cox@urscorp.com

OU: 10
Comments Prepared By: Shannon Smith, 03/05/03 02:19 PM

1200 plume Dec 19 02.pdf

OU: 11
Comments Prepared By: Shannon Smith and Jeff Watkins

----- Forwarded by B Hall/SaltLakeCity/URSCorp on 02/20/03 03:27 PM -----

Watkins Jeffrey W Civ OO-ALC/EMR <Jeffrey.Watkins@HILL.af.mil>

02/20/03 02:58 PM

To:'"B_Hall@urscorp.com"' <B_Hall@URSCorp.com>
cc:
Subject: FW: OU11 Summary

Again
> -----Original Message-----
> From: Smith Shannon Civ OO-ALC/EMR
> Sent: Wednesday, February 19, 2003 1:19 PM
> To: Watkins Jeffrey W Civ OO-ALC/EMR
> Cc: Rolfsness Sheri Civ OO-ALC/EMR
> Subject: RE: OU11 Summary
>
> Jeff -- I had just a few comments on the OU11 summary.
>
> Site summary -
>
> The reference "Analytical Data Report for Operable Unit 5, 01 May 2000
> Through 26 March 2001" is actually the ADR for OUs 5 and 9. Change title
> in text.
>
> The underground storage tanks passed tightness tests performed in 1991,
> 1992, 1993, and 1994, 2000 and 2001 suggesting that the tanks were
> structurally intact.
>
> General Comment: The UST information included in the site summary is
> incomplete. If a discussion of the UST portion needs to be included in
> the summary (I'm not sure if it does since it is not a CERCLA cleanup),
> then everything needs to be included in the discussion including the
> installation of the SVE system. A decision needs to be made if the UST
> info (two UST sites in the area, one closed, one cleanup is underway)
> should be included at all.
>
>
> Shannon
>
>
> -----Original Message-----
> From: Watkins Jeffrey W Civ OO-ALC/EMR
> Sent: Wednesday, February 19, 2003 10:04 AM
> To: Smith Shannon Civ OO-ALC/EMR
> Subject: FW: OU11 Summary
> Importance: High
>
>
> Hi Shannon
> Sheri recommended that you review the attachments also because of your

> involvement in the issues. Focus on brevity, clarity, and readability
> also. Would appreciate comments asap.
> Many thanks!
> Jeff
>
> -----Original Message-----
> From: B_Hall@URSCorp.com [mailto:B_Hall@URSCorp.com]
> Sent: Tuesday, February 18, 2003 4:58 PM
> To: jeffrey.watkins@hill.af.mil
> Cc: Jeremy_Cox@URSCorp.com; Paul_Bitter@URSCorp.com
> Subject: FYR: OU11 Summary
>
>
> Jeff-
> Here are .pdf files for the Prelim OU11 Summary and the accompanying
> figure. The figure is NOT in final form, but should be adequate for your
> review of the content of the OU11 Summary. (This is one of those feature
> issues that will take some "doing" to get into a form that's consistent in
> detail with those for more documented OUs - old demolished buildings.)
>
> This is NOT the format that will be used in the DRAFT report for the OU
> Summaries. I thought it was more important to get this Prelim. to you
> this
> week than to spend time on format right now. I hope to have the OU6 (more
> complex) Summary to you before the end of the week and that one will
> illustrate the format we intend to use for the OU Summaries.
>
> We'll accommodate any comments you generate as soon as you can get them
> back to us. Happy reading. B.
> (See attached file: OU11 Summ.pdf)(See attached file: OU11 Chron .pdf)(See
> attached file: ou11 figure.pdf)
> **********
> Barbara L. Hall, PhD
> Sr. Environmental Engineer
> URS Corporation
> 756 E Winchester St, Suite 400
> Salt Lake City UT 84107
> ph: 801-904-4016
> fax: 801-904-4100
> email: b_hall@urscorp.com
>
> Change is always different. -- Jonathan Young << File: OU11 Summ.pdf >>
> << File: OU11 Chron .pdf >> << File: ou11 figure.pdf >>

OU: 11
Comments Prepared By: Jeff Watkins

OU 11 Preliminary Review Comments
Jeff Watkins
February 19/03

Site Summary
I. Introduction: OK. Figure 1 should show the general location of the 3 plumes mentioned.

II. Site Chronology: OK.

III. Background: Too wordy in first 3 paragraphs. Suggest removal of text already given in the Site Chronology regarding physical facilities, etc. Resolve number of fuel tanks (2 vs 3). Paragraphs 4 through end are good because they reflect the need for remedial inquiry. Briefly define known plume characteristics relative to direction, off-base boundaries, etc.

CoCs: OK, but should mention major contaminants found so far.

RAOs: OK

IV. Remedial Actions: OK

V. Progress Since Last Review: Suggest removal of last two sentences, first paragraph. Second paragraph is good.

VI. FYR Process: OK

VII. Technical Assessment: OK

VIII. Issues: Good

IX. Recommendations: Good.

X. Protectiveness: Good. Suggest removal of the last two sentences in the Protectiveness Statement and placement in Section VIII, Issues. May include an estimate (year) of when a ROD and actual cleanup may begin, if required.

XI: Next FYR: OK

Figure
1. Suggest showing the known general extent of the plume(s)
2. Suggest expanding the Index Map slightly more to show the location relative to the base boundary.
3. Suggest removal of most of the monitoring points around the immediate site to "unclutter" visual impact, especially with regard to the plumes. Make a general reference

OU: 11
Comments Prepared By: Jeff Watkins

to MPs and their associated documents in the text (in Background?), and perhaps more in the Chronology.

Site Chronology
Excellent.

OU: 11
Comments Prepared By: Sheri Rolfsness and Jeff Watkins

-----Original Message-----
From: Rolfsness Sheri Civ OO-ALC/EMR
Sent: Wednesday, February 19, 2003 9:50 AM
To: Watkins Jeffrey W Civ OO-ALC/EMR
Cc: Smith Shannon Civ OO-ALC/EMR
Subject: RE: OU11 Summary

Jeff,

I have a few comments on the OU11 Summary and the chronology. Because some of the documents and history discussed in this summary pertain to work conducted under the UST program, and I have not been involved in that, recommend Shannon Smith be provided an opportunity to review this summary as well.

OU11 Site Summary:

- The schedule for completing the RI has been adjusted to Aug 2004. Several places in the document mention "spring 2004" for the RI, and that needs to be updated to "summer 2004" or "late 2004," wherever an RI completion date is mentioned.
- Section III, Background, first paragraph identifies a reference document I am not familiar with, and I suspect may not be correct. (ADR for OU5 May 00 - Mar 01) Request URS verify this reference and correct it if necessary; I'm not aware of any OU5 document that discusses building 454.
- Section IX, Recommendations, should be revised. The first recommendation needs to be clear as to what is to be characterized - at this site the dissolved groundwater plumes. As written, a lay reader might assume characterization of soils or other media. The reference to "shallow and deep zones" would likely be unclear to someone unfamiliar with the site, as these "zones" are not mentioned anywhere else in the summary. I would revise the recommendation to say simply "Complete groundwater characterization for contaminants of concern, and develop RI and FS reports." (or something similar)
- The second recommendation (same section) is inappropriate because it assumes that cleanup is required, that contaminants are migrating, and suggests an urgency to implement a remedy when we have not completed the RI and do not know those things to be true. My recommendation would be "Select and implement a remedy, if required, in accordance with CERCLA criteria."

OU11 Site Chronology:

- OU11, 2002-My name is used twice without any indication of my qualifications. A RAB member or citizen would have no idea whether URS interviewed the gas station manager, or someone who happened to walk by on the way to Burger King. I recommend that anytime a personal communication is referenced at any OU, the individual named should be identified as the OU Project Manager, Environmental Engineer, Geologist or whatever. (I'll settle for OU11 Project Engineer, unless you think Queen of the [OU11] Empire would work-that has a nice ring)
- Regarding what I said in that paragraph, several things need to be clarified for publication. Recommend revising to read as follows: "At one point, the golf course, 800&900 warehouse buildings, and Building 454 were all a part of OU11. After further delineation of the contamination, the

golf course and the 800&900 warehouse buildings were placed back into OU9 because they had low levels of TCE contamination and will likely have similar remedies. The contaminants, contaminant levels, and potential remedies for Building 454 are different and more complex than the other two sites, so it remained in OU11. A letter was sent to regulators on 30 Sep 2002 proposing this realignment between OUs 11 and 9. Verbal concurrence was received from regulators in a subsequent meeting.

OU11 Figure;

- The summary does not discuss individual sampling points, and there have been many more sampling points installed since this figure was published. I think the figure would be cleaner if the sample points and/or their labels were removed. The discussion centers on tanks and facilities, which would show up more clearly if this were done.

I hope that helps; you know where to find me if you have any questions!

Sheri Rolfsness, P.E.
OO-ALC/EMR
7274 Wardleigh Rd
Hill AFB UT 84056-5137
DSN 775-6922 (Commercial 801-775-6922)

-----Original Message-----
From: Watkins Jeffrey W Civ OO-ALC/EMR
Sent: Wednesday, February 19, 2003 8:06 AM
To: Rolfsness Sheri Civ OO-ALC/EMR
Subject: FW: OU11 Summary

Sheri
Please review in terms of the FYR: content, readability, etc., and send comments asap, if possible. The goal of the FYR is brevity and clarity.
Many thanks!
Jeff

-----Original Message-----
From: B_Hall@URSCorp.com [mailto:B_Hall@URSCorp.com]
Sent: Tuesday, February 18, 2003 4:58 PM
To: jeffrey.watkins@hill.af.mil
Cc: Jeremy_Cox@URSCorp.com; Paul_Bitter@URSCorp.com
Subject: FYR: OU11 Summary

Jeff-
Here are .pdf files for the Prelim OU11 Summary and the accompanying figure. The figure is NOT in final form, but should be adequate for your review of the content of the OU11 Summary. (This is one of those feature issues that will take some "doing" to get into a form that's consistent in detail with those for more documented OUs - old demolished buildings.)

This is NOT the format that will be used in the DRAFT report for the OU Summaries. I thought it was more important to get this Prelim. to you this week than to spend time on format right now. I hope to have the OU6 (more

complex) Summary to you before the end of the week and that one will illustrate the format we intend to use for the OU Summaries.

We'll accommodate any comments you generate as soon as you can get them back to us. [...] B.
(See attached file: OU11 Summ.pdf)(See attached file: OU11 Chron .pdf)(See attached file: ou11 figure.pdf)
****
Barbara L. Hall, PhD
Sr. Environmental Engineer
URS Corporation
756 E Winchester St, Suite 400
Salt Lake City UT 84107
ph: 801-904-4016
fax: 801-904-4100
email: b_hall@urscorp.com

Change is always different. -- Jonathan Young

OU: 11
Comments Prepared By: Sheri Rolfsness, 04/01/03 02:42 PM

Please site the following on the plume map per Sheri Rolfsness of EMR.

"Operable Unit 11 Analytical Data Report May 1, 2001 - January 31 2002 and additional Remedial Investigation data collected through October 2002"

Thanks.

P.S. I have added this report in the DB as a reference...

Stacey Arens
Environmental Engineer
URS Corporation
stacey_arens@urscorp.com
Office: 801-904-4060

OU: 12
Comments Prepared By: Jeff Watkins

Jeremy

Section III, paragraph 1: Reword the second sentence to eliminate the redundancy.

Jeff

-----Original Message-----

From: Jeremy_Cox@URSCorp.com [mailto:Jeremy_Cox@URSCorp.com]

Sent: Friday, March 07, 2003 5:09 PM

To: jeffrey.watkins@hill.af.mil; mark.loucks@hill.af.mil; david.w.mills@hill.af.mil

Cc: B_Hall@URSCorp.com

Subject: FYR OU 12 Summary for your review

Jeff,

Here is our draft summary and chronology of OU 12. The draft figure will follow in a separate e-mail. I'm sending this e-mail to Dave Mills and Mark Loucks, but if there is anyone else who needs to review the OU 12 summary, please forward this message to them. Thanks.

Jeremy B. Cox

Environmental Engineer

URS Corporation

756 East Winchester Street, Suite 400

Salt Lake City, UT 84107

(801) 904-4065

e-mail: jeremy_cox@urscorp.com

OU: 12
Comments Prepared By: Jeff Watkins and Mark Loucks, 03/18/03 07:05 AM

Jeremy
See Mark's comments.
Jeff

-----Original Message-----
From: Loucks Mark D Civ OO-ALC/EMR
Sent: Tuesday, March 11, 2003 2:41 PM
To: Watkins Jeffrey W Civ OO-ALC/EMR
Subject: Comments to OU12 5-Year review writeup

Jeff, The only comment that I have is that they need a bettter figure. Figure one is poor. I've attached a possible alternative. If they would like to use it and need the natvie microstation format let me know.

MDL

<<1_12propwells0103wplume.pdf>>

1_12propwells0103wplume.pdf

OU: 12
Comments Prepared By: Mark Loucks

Loucks Mark D Civ OO-ALC/EMR
<Mark.Loucks@HILL.af.mil>

03/25/03 03:34 PM

To:'"B_Hall@URSCorp.com"' <B_Hall@URSCorp.com>,
Watkins Jeffrey W Civ OO-ALC/EMR <Jeffrey.Watkins@HILL.af.mil>
cc:
Subject: RE: FW: Comments to OU12 5-Year review writeup

What I wanted to point out with the attached map is that there is a more up-to date plume map than what was generated in June of last year that you included in this one i'm making sure that Mark Holt has the up-to-date version that will have the simplicity that you are looking for.

Thanks MDL

-----Original Message-----
From: B_Hall@URSCorp.com [mailto:B_Hall@URSCorp.com]
Sent: Tuesday, March 25, 2003 2:28 PM
To: Mark.Loucks@hill.af.mil; jeffrey.watkins@hill.af.mil
Cc: Tammi_Messersmith@URSCorp.com; Jeremy_Cox@URSCorp.com
Subject: Re: FW: Comments to OU12 5-Year review writeup

Mark/Jeff-
Just trying to understand the nature of your comments, Mark, on the OU 12 figure.....

Are there specific features in the figure you provided that you're interested in seeing on the FYR OU12 figure? For consistency, we need to start w/ the GIS generated figure and go from there - and decide at that point what to pull off of the native file for the figure you provided. The figure you attached contains a lot of detail on the off-Base areas (buildings, street names) and all of the wells are labeled. Is that what you were hoping to see? Recall that this will be an 8-1/2 X 11 figure (not 11 X 17) so detail will be lost (especially proposed vs. existing MWs). Tell us the features you'd like to see, and we'll get them on the figure. Or was there something more general that lead to your assessment of the figure as "poor"?

Also, we need to confirm that we illustrate the most current plume. The source for the plume we'll be illustrating is the data set from MWH 6/2002 ("Draft Conceptual Model for Operable Units 5 and 12"). Correct?

Thanx. B.
****
Barbara L. Hall, PhD
Sr. Environmental Engineer
URS Corporation
756 E Winchester St, Suite 400
Salt Lake City UT 84107
ph: 801-904-4016
fax: 801-904-4100
email: b_hall@urscorp.corp

Appendix B

Community Input for the Hill AFB 2003 Five-Year Review

Community Interviews

A number of interviews were conducted with community members as part of the Five-Year Review process. Interviewees were asked questions regarding the cleanup program at Hill AFB.

The process

Hill AFB public involvement staff members conducted interviews with community members for the Five-Year Review. These interviews varied in length from 20 minutes to two hours. Questions were based on, but not limited to, those found in the Environmental Protection Agency's Five-Year Review guidance. No recording or transcript of the interviews was made. The attached summaries are based upon handwritten notes taken during the interview. Upon request, interviewees were permitted to review and edit the summaries to ensure their comments were adequately recorded.

Attached is the list of proposed interviewees. Some were either unwilling to be interviewed or were unavailable for interview during the interview timeframe. Summaries of the interviews conducted follow.

Results summary

In general, most of those interviewed were pleased with the progress of Hill's cleanup program. They indicated satisfaction with the Air Force's investigation and clean-up of the various sites and that the time taken to implement remedies at sites was appropriate. Most agreed with the remedies that were selected, and in general, say the communities are not adversely affected by investigation and cleanup operations.

There was one notable exception. Mr. Brent Poll, a resident of South Weber representing the South Weber Landfill Coalition, was extremely critical of the base's handling of the investigation and cleanup of contamination from Operable Unit 1. He said he believes the Air Force is purposely understating the risk posed by the contamination and the remedial response is not only insufficient, but irresponsible. He said he is concerned that South Weber city leaders are making poor decisions based on bad information received from the Air Force. He also expressed concern about using natural attenuation as a remedy for contamination at OU1. He said the monitoring network and frequency of monitoring is inadequate to determine whether or not natural attenuation is occurring.

Major issues

- **Property values.** Some interviewees expressed concern that their property has been devalued as a result of cleanup operations and the contamination. Others, however, say they have not seen a reduction in property values.
- **Property usage.** Some interviewees criticized the Air Force and local city governments for not doing more to inform people that a particular piece of property might be near contamination. Some want to completely stop development in areas of contamination.
- **Communication.** Most interviewees said they thought the Air Force was doing a good job of keeping people informed. They said newsletters, city council visits,

InfoFairs and other outreach efforts were effective and appropriate. One of the interviewees said the Air Force was not doing enough and said the information presented was self-serving, misleading and inaccurate.

- **Appropriateness of remedies.** Mr. Poll, in particular, was critical of the remedy at OU1. He said natural attenuation was neither effective nor appropriate. Dr. John Carter, Mr. Poll's technical advisor, said he believed the Air Force and the EPA selected the remedy at OU1 prior to any public input. He said he believes the Air Force and the EPA manipulated data to support the application of the pre-selected remedy. Other interviewees, however, said they believed the remedies that have been put in place around the base are appropriate and show a responsible use of taxpayer dollars. Roy residents were happy with the Air Force's response to finding chemical vapors in basements. They were pleased the Air Force took immediate action to remove the vapors from their homes.

Based on the community interviews, the overall evaluation of the cleanup effort was positive. This result echoes what has been observed in other contexts, including InfoFairs, city council meetings and a comprehensive community survey conducted in 2000. While no one is happy about contamination in the community, most are pleased with the Air Force's efforts to acknowledge its existence, quickly assess its risks and respond in an appropriate and timely manner.

Interviewee List

Name	Affiliation	Comment
Brent Poll	South Weber Landfill Coalition	Interviewed
Dr. John Carter	South Weber Landfill Coalition	Interviewed
Scott Paxman	Weber Basin Water District	Interviewed
Lynn Moulding	Riverdale RAB representative	Interviewed
Gregory Fisher	Clinton RAB representative	Declined
Jerry Everett	Layton RAB representative	Contacted-No response
Chris Davis	Roy City Manager	Interviewed
Jim Harris	Weber State University	Interviewed
Merlin Mitchell	Former Clinton RAB representative	Contacted-No response
Ron Chandler	South Weber City Manager	Contacted-No response
Jeff Burton	Roy resident	Interviewed
Faye Field	Roy resident	Interviewed
Scott Ware	Roy resident	Unavailable
Leigh Glaves	Roy resident	Unavailable
Martin	Sunset resident	Unavailable
Al Herring	Sierra Club	Interviewed

FIVE-YEAR REVIEW COMMUNITY INTERVIEW

Mr. Brent Poll, South Weber Landfill Coalition (SWLC)
Dr. John Carter, Technical Advisor to SWLC

Interview by: Dave Harris

Also present: Dave Allison, Utah Department of Environmental Quality

Date: March 10, 2003
Time: 1 p.m.
Location: Poll home

1. **What is your overall impression of the cleanup effort?**

   Mr. Poll says Hill's cleanup effort is flawed because it bases cleanup decisions on incomplete or incorrect data. He disagrees with using natural attenuation as a cleanup alternative in a populated area. He claims reports and studies have been falsified to support a pre-determined conclusion. He says Hill's cleanup efforts are either inept or fraudulent. He said evidence exists that proves the Record of Decision (ROD) at Operable Unit 1 (OU1) is wrong.

   Dr. Carter said there is not an adequate monitoring network to justify the conclusions made in the ROD at OU1. He said the conclusions are not based on hard data, but on theory. He says the data are uncertain. He said he believes the Utah Department of Environmental Quality and the Environmental Protection Agency are "in bed" with the Air Force and conclusions were reached long before the documents and decisions were finalized.

2. **What effects have site operations had on the surrounding community?**

   Mr. Poll said that developers and banks do not want to touch sites with pollution. He said Hill AFB reports say it is safe, but you can not say it is safe. People want to be far away from the pollution.

3. **Are you aware of any community concerns regarding the cleanup or its operation and administration?**

   Mr. Poll said the South Weber City Council is torn. He said they want to tell people they are safe, but they really do not know if people are safe or not. They face pressures from many sides – developers, citizens, bankers, etc. People want to hear they are safe. He said land-use restrictions are the answer until we have more answers as to how safe it really is. He said land-use restrictions are the only way to be protective.

He said the cleanup standards are bogus because it is impossible to say what is safe. The people rely on the standards, but they are worthless.

4. **Are you aware of any events, incidents, or activities at the cleanup sites, such as vandalism, trespassing or emergency responses from local authorities**?

   Mr. Poll said a lot of people want to walk along the canal. He says the base should say something about the risk, but they do not. A lot of people walk up on the hillside near the contaminated springs. The fences are not adequate to keep people out.

5. **Do you feel well informed about the cleanup's activities and progress?**

   Mr. Poll said he is well informed.

6. **Do you have any comments, suggestions or recommendations regarding the cleanup's management or operation?**

   Mr. Poll said he has pictures that show the Air Force's premise is wrong. He believes the Air Force believed it was so powerful it could get away with it. He said the Air Force has perpetrated fraud on the people.

   Mr. Carter said the frequency of monitoring in South Weber is inadequate to monitor natural attenuation. He said the Air Force needs a more real-time way to track contamination migration. He said more indoor air sampling data points are required in South Weber.

   Mr. Carter said the Air Force should put more monitoring wells on the northeast side of the landfills. He said it would provide valuable data and would not be very expensive.

Five Year Review Community Interview

Scott Paxman, Weber Basin Water Conservancy District

Interviewed by: David Harris

Date: March 10, 2003
Time: 3:00 p.m.
Location: Weber Basin Water Conservancy District Offices

1. **What are the main issues Weber Basin Water Conservancy District (Weber Basin) sees regarding the cleanup systems in place?**

   Paxman said Weber Basin is primarily concerned with protecting drinking water supplies – its numerous wells drawing water from deep-water aquifers and the Weber River.

2. **What wells are of concern?**

   Paxman said there is a well near Hill's South Gate (Laytona Well) and a couple of wells in Clearfield near the Operable Unit 10 (OU10) plume. He said neither well has shown evidence of contamination, but these are wells they like to keep an eye on.

3. **Are Hill's systems protecting the water supply adequately?**

   Paxman said in his opinion, Hill was doing an excellent job at putting in treatment systems that are effective. He said Hill AFB's staff is always up-front about what they are doing and does a good job at keeping the Restoration Advisory Board up-to-date.

4. **What does Weber Basin see that Hill could do to better protect the water supplies?**

   Mr. Paxman did not know of anything more Hill could do to protect water supplies. He mentioned the incident with South Weber Supply Well #2 (which occurred in the late 1990s) and that the Air Force put in a number of wells and showed clearly where the contamination was, and more importantly, where it was not. He said it was excellent information to provide to concerned customers who would call.

5. **Does Weber Basin foresee the contamination from Hill AFB threatening water supplies in the future?**

   Mr. Paxman said he did not see a foreseeable threat to the drinking water supply from Hill AFB contamination. He did say Weber Basin is planning to build a new treatment

plant on the northwest side of the base. This plant would treat both groundwater and surface water (from the Davis-Weber Canal) for use as drinking water. He said if volatile organic chemicals were present in canal water, Weber Basin would need to know so they could ensure the water was receiving proper treatment.

6. **Has anyone from the pubic expressed concern to Weber Basin concerning the safety of the water supply and Hill AFB contamination?**

   Aside from the calls surrounding the South Weber Well #2 incident, Mr. Paxman said he gets few, if any, phone calls from the public.

Five Year Review Community Interview

Lynn Moulding, Riverdale City/Community RAB Representative

Interviewed by: David Harris

Date: March 24, 2003
Time: 1:00 p.m.
Location: Riverdale City Offices

1. **What is your overall impression of the cleanup effort?**

   Mr. Moulding said the cleanup effort has been good. He credited that to the close contact and cooperation between the city, the residents and the Air Force. It was helpful that the time to investigate and put a cleanup system in place was relatively short, he said.

2. **What effects have site operations had on the surrounding community?**

   Mr. Moulding said the cleanup system has had very little impact on the community. Initially there were concerns about how long it would take to get the cleanup system in place. He said after the cleanup system was put in place, there were few, if any, complaints.

3. **Are you aware of any community concerns regarding the cleanup or its operation and administration?**

   Mr. Moulding said there have been very few complaints registered by the community. Most complaints received in context of the contamination have been directed more at the city than the Air Force, he said.

4. **Are you aware of any events, incidents, or activities at the cleanup sites, such as vandalism, trespassing or emergency responses from local authorities?**

   Mr. Moulding said there has been no vandalism or any other problems in Riverdale.

5. **Do you feel well informed about the cleanup's activities and progress?**

   Mr. Moulding said, for the most part, the Air Force has kept him informed. He said someone did approach him a few months ago regarding discharging into the city sewer lines, but no one ever followed up on that request.

6. **Do you have any comments, suggestions or recommendations regarding the cleanup's management or operation.**

   Mr. Moulding had no comments or suggestions.

Five Year Review Community Interview

Chris Davis, Roy City Manager

Interviewed by: David Harris

Date: April 22, 2003
Time: 8:30 a.m.
Location: Roy City Offices

1. **What is your overall impression of the cleanup effort?**

   Mr. Davis said that he sees a very concerted effort. He said it is very positive to see an open process coming from the federal government. He said he believes the word is getting out to people and the Air Force is being proactive.

2. **What effects have site operations had on the surrounding community?**

   He said he has heard no complaints from the community about anything that is going on. He said some people expressed concern when they first learned of the contamination, but he credits the Air Force's proactive response to the lack of general fear and anger in the community.

3. **Are you aware of any community concerns regarding the cleanup or its operation and administration?**

   He said he and the city appreciate the Air Force's handling of the process. He said the frequent meetings are helpful. He said the mayor is particularly interested in what is going on, since he is near the contamination, as are two planning commission members. He said he has not heard anything but positive comments from them.

4. **Are you aware of any events, incidents, or activities at the cleanup sites, such as vandalism, trespassing or emergency responses from local authorities?**

   He said no vandalism or problems have been reported.

5. **Do you feel well informed about the cleanup's activities and progress?**

   He said he feels well informed about the cleanup. He thinks the level of information is good and that the city council is hearing what they need to hear to make informed

decisions. He offered the use of the city's newsletter for any updates that need to go out to the residents.

6. **Do you have any comments, suggestions or recommendations regarding the cleanup's management or operation.**

   He offered no suggestions, other than for the Air Force to keep doing what it has been doing.

7. **Other issues:**

   One issue raised regarded the city's efforts to inform residents of the contamination in Roy, especially in notifying developers of contamination. Mr. Davis said there is no need for a formal process to inform developers of the contamination because there is little if any developable property in the plume or in the projected path of the plume. Any undeveloped property in the path of the plume has already started the development phase and the developers are aware of the contamination.

FIVE-YEAR REVIEW COMMUNITY INTERVIEW

Jim Harris, Weber State University

Interview by: Barbara Fisher and Carly Brown

Date: March 28, 2003
Time: 1 p.m.
Location: Weber State University

1. **What are the main issues Weber State University sees regarding the cleanup systems in place?**

   Mr. Harris said WSU is concerned about future development on the Davis campus. The university's long-range plan calls for adding 11 or 12 more buildings on the campus, one every few years depending on enrollment demands/funding. This campus could eventually be larger than the main campus in Ogden if enrollment predictions hold up. The first building on the campus is currently under construction and will have 31 classrooms and 3 auditoriums that will hold 100 people each. Approximately 3,500 to 4,000 students can attend classes in the four colleges that will work out of the first building on the campus. The facility will be open 6:30 a.m.-10 p.m., and classes will start in August.

2. **What effects have Hill AFB's operations had on Weber State University?**

   Mr. Harris said there were no significant effects on Weber State University's plans/designs at the new campus. He said in some places where Hill AFB monitoring wells are located, piping had to be extended to avoid or go around the monitoring wells, but no fixes were required in the design. Mr. Harris said he was comfortable with the Hill AFB environmental staff's level of participation in WSU's planning for the new campus and said the base staff worked closely with Mike Perez early on in the process. He said Robert Petrie of the Hill AFB environmental staff was really helpful during the process.

3. **Are you aware of any community concerns regarding the new Weber State University campus and the Hill AFB groundwater contamination?**

   Mr. Harris said he had received calls from a couple of residents, one of whom had questions about what TCE is. He said he felt comfortable answering the questions because he was familiar with TCE. Mr. Harris is also a member of the Hill AFB RAB.

   Mr. Harris said he has spoken with neighbors about the new campus, especially those to the south, and they were concerned about dust and noise during construction. There are

approximately 150 houses in the neighborhood. Mr. Harris said the university held a public meeting with these residents last fall (2002) and there were questions raised about the groundwater contamination (How deep is the contamination? How far does the contamination go?)

Mr. Harris said he also received a call from an individual who claims the rights to the groundwater that flows through the decades-old field drains located on the WSU property. The individual was concerned about interruption of the groundwater flow to her property where the water surfaces. The individual was aware that the water was for irrigation purposes only and it had been tested and was not contaminated.

4. **Are you aware of any events, incidents or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details?**

   Mr. Harris said he was a little concerned about possible vandalism on the campus property. He said he saw people out racing around in a car on the property. He said the university has installed gates, but anyone racing like that on the property could hit the monitoring wells too.

5. **Do you feel well informed about Hill AFB's environmental activities and progress?**

   Mr. Harris said he does feel well informed about Hill AFB's environmental activities and progress.

6. **Do you have any comments, suggestions or recommendations regarding the OU-8 site's management or operation?**

   Mr. Harris said the OU-8 project appears pretty well in hand. He did ask why the Operations and Maintenance (O&M) costs are so high for the project. He said he deals with O&M all the time. He said the cost of a technician to monitor 18 wells was high.

7. **Did the groundwater contamination on the site of the new campus cause you to make modifications to plans, have construction delays, budget concerns, etc.?**

   Mr. Harris said the groundwater contamination did slow the university down a little bit in its construction project. There were dewatering issues because groundwater was encountered. Also because of concern about the contamination in the groundwater, the groundwater was tested. Mr. Harris also said 12-15 feet below the natural grade on the property a solvent odor could be smelled. Because of this, the water and air in this location was sampled. Nothing was found of concern in either instance.

8. **Do you foresee any impact to the Weber State facility in Layton with the Air Force's proposed direction for clean up?**

   Mr. Harris said he thinks this is a pretty good plan and it was good to hear about it. He said he would like more information about Pond 2 and whether the pond collected any contaminated run-off and has this run-off been eliminated.

   Mr. Harris said he thinks everybody is going about (the clean-up) as logically as they can.

FIVE-YEAR REVIEW COMMUNITY INTERVIEW

Mr. And Mrs. Jeff Burton, Roy residents
Ms. Faye Field, Roy resident

Interview by: Barbara Fisher and Carly Brown

Date: April 16, 2003
Time: 6:30 p.m.
Location: Roy City Public Works Department

1. **Do you feel the Air Force has been responsible enough in getting out the word on the contamination and its health risks and taking appropriate action? Why or why not?**

   Ms. Field said she feels the Air Force has been responsible. She said that once the Hill AFB environmental staff realized there was a problem, they worked to fix it and she has a good relationship with the people doing the sampling and other work in her home.

   Mr. Burton said the Hill AFB response has been good. He said he only asked twice to have his air tested. He said he is very happy with the technical people and they have been very responsive. He said he was a "little disappointed" about the notification process to residents. He said he was concerned that only those in the "hot spot" area were being contacted and that residents living north of him are unaware they live over a plume of contaminated groundwater. He also said he is unhappy that the Roy City Council decided not to require new housing developments in the plume area to have passive remediation systems. He said that while the council did decide to put a notification on the city's plat map, most homebuyers would likely not notice this. He said passive remediation systems could be installed in all new homes at no cost to the builder or homebuyers because the Air Force would pay for the work

   How does getting this word out today compare vs. a year ago?

   Mr. Burton said word of mouth is how most people are getting their information now. He said he has not seen any new information lately. He said people in the area know more about the contamination than they did a year ago and that is probably due to the media.

2. **Do you feel well informed about Hill AFB's environmental activities and progress?**

   Ms. Field said she feels well informed. She has lived in her home 76 years and said she understands that the vapors in her home are due to the contamination and the level of the water table where she lives.

   Mr. Burton said Hill is doing a splendid job. He said he calls Hill project managers and gets answers to questions he has. He also said letters he has received and InfoFairs he has attended have been very informative and have helped others in the area understand what is going on.

3. **Are you aware of any community concerns regarding the contamination?**

   Mr. Burton said he worries when the Environmental Protection Agency (EPA) states that the levels of Trichloroethene (TCE) in homes in the area are not a health risk. He said he knows the levels of TCE in the vapors and water in Roy are not high enough to be considered a health risk to a healthy individual, but wants to know if the EPA has looked at the effects on the elderly, children and those who are hypersensitive to the contaminants. He also questions the statement that TCE is not a known carcinogen in humans and he said the statement "there is no significant health risk" is misleading.

4. **Do you feel the vapor mitigation system is a sufficient remedy for the problem?**

   Ms. Field said she has been healthy all her life. She said her home is different from other homes in Roy in that it has a basement and a crawl space, and because of this, two remediation systems have been installed in her home. She said the systems seem to work as they should.

   Mr. Burton said he is happy with the continuing process. He said he was unhappy when the Air Force just wanted to seal or caulk the cracks in his basement because the caulk has a shelf life. He said he is happier with the standard remediation system now in his home. He recommends that someone with a scientific background be part of the decision making process on where to place the remediation system in a home. He said someone other than the contractor in charge of installing the system should come in and make the recommendation on where to put the system and to not just put it where the homeowner would like it.

   Have you heard any feedback from others in the community?

   Ms. Field said that some in her community had expressed some curiosity about the system. A prospective buyer called Mr. Burton to ask questions about the remediation system in his home. The buyer was interested in the home next to Mr. Burton. The buyer did try to move forward with the purchase of the home but was not able to for unknown reasons.

5. **Why did you decide to put the system in your home and are you satisfied with the work?**

   Ms. Field said she decided to put the systems in her home due to Hill AFB's recommendation. She is satisfied with Hill's recommendations because they are doing something about the problem and they told her it would help the problem.

   Mr. Burton said he researched the options for remediation of the vapors and believes dilution of the air in his basement is the best solution. He said he likes the vapor mitigation system because it has been used to treat Radon. He suggested that standards be

established for the remediation system, including setting specifications on the slope angle of the system's pipes to prevent condensation buildup.

6. **Do you foresee any problems with the system in the future?**

   Mr. Burton said he thought the system and remediation was an acceptable approach. He said that if he did have a problem there was a number he could call. In his past experiences, someone is there by the next day. He said also has Hill AFB project managers' phone numbers.

   Has the presence of the system caused you to make any lifestyle changes?

   Mr. Burton said the system makes him feel better and said he thinks it is actually safer. He said he feels that his home value has gone up with the system in place because without the system it would be more dangerous.

7. **Are you comfortable with the quarterly air sampling regiment?**

   Ms. Field said that she was fine with the quarterly sampling.

   Mr. Burton said he is comfortable with the quarterly sampling, but that the ideal sampling time to show the highest TCE concentrations would be when the ground is frozen and homes are all sealed up. He said he would like to see a published schedule for the quarterly sampling so he would not dilute the air in his basement before sampling occurs. He said he would also like the flexibility of calling and requesting sampling in his home. He said he is also concerned about the tri-level nature of his home and would like another air sampling canister placed on his second level, near the garage to ensure the remediation system is working effectively in all areas of his home.

8. **Do you have any comments, suggestions, etc?**

   Ms. Field said that she just wants Hill AFB to continue to clean up the contamination. She said that now that Hill has found a system that works to keep up the good work.

   Mr. Burton said the evolution from caulking basements to installing the remediation system has made him realize that Hill is trying to do what is best and gives him great confidence in the work being done. He said he would like to be notified of future city council presentations by Hill AFB so he can attend.

Five-Year Review Community Interview

Al Herring, Sierra Club RAB Representative

Interviewed by: David Harris

Date: April 2, 2003
Time: 1 p.m.
Location: Herring home

1. **What is your overall impression of the cleanup effort?**

   Mr. Herring said he believed the cleanup effort was effective and appropriate. He said as a taxpayer, he feels good about it. He said, from his perspective, he believes the base is taking appropriate actions to clean up the sites. He said the cleanup proposed for Operable Unit 8 (OU8) seems appropriate.

2. **What effects have site operations had on the surrounding community?**

   Where he lives, which is outside the contaminated area, there is no direct impact on his community. However, he says the base seems to have accommodated the people's concerns. He said the base has done a good job of communicating with people doing construction and drilling wells.

3. **Are you aware of any community concerns regarding the cleanup or its operation and administration?**

   He said he is surprised and disappointed that the Sierra Club has not taken more of an interest in the cleanup. However, he acknowledged that the issues surrounding the cleanup are not "Sierra Club-type" issues. He has not heard any negative comments from the public.

4. **Are you aware of any events, incidents, or activities at the cleanup sites, such as vandalism, trespassing or emergency responses from local authorities?**

   No.

5. **Do you feel well informed about the cleanup's activities and progress?**

   He said he is comfortable with the information he is receiving. As a member of the RAB, he said he feels like he gets good information. He said he feels privileged to be a part of

the RAB. He appreciates the Air Force's quick and open response to his concerns and questions.

6. **Do you have any comments, suggestions or recommendations regarding the cleanup's management or operation.**

   Mr. Herring did not have any specific suggestions.

Appendix C

Documents Reviewed and Personal Communications for the Hill AFB 2003 Five-Year Review

Documents Reviewed for Hill AFB 2003 Five-Year Review

100 Percent Technical Specifications - SVE System Remedial Design Operable Unit 3, Montgomery Watson, September 1996.

2001 Cost & Performance Report, Operable Unit 1, Hill AFB, UT, URS, 11 February 2002.

2001 Cost and Performance Report Operable Unit 2, URS, March 2002.

2001 Operation and Maintenance Report Building 225 Floor Slab Operable Unit 7 Hill Air Force Base, Utah, URS, March 2002.

2001 Operation and Maintenance Reports OU 3 Sodium Hydroxide Tank Site Cap and Berman Pond Cap, OU 4 Landfill 1 Cap and Soil Vapor Extraction Drain System, and OU 7 Building 225 Floor Slab, Hill Air Force Base, Utah, URS, March 2002.

AATDF Surfactant/Foam Process for Aquifer Remediation, Rice University, November 1997.

Action Memorandum Operable Unit 5, Hill AFB, Radian International, March 1996.

Action Memorandum Operable Unit 6, Radian, December 1996.

Addendum to Remedial Investigation Report for Operable Unit 4, Volume 12 Appendices A, B, C, D, E, and F (Vol 2 of 8), U.S. Geological Survey, April 1993.

Annual Report for Landfill 1 Cap Operable Unit 4, Montgomery Watson, November 1999.

Annual Report for Operable Unit 3 Sodium Hydroxide Tank Site and Berman Pond, Montgomery Watson, December 1999.

Annual Report for Operable Unit 4 - 1997, Montgomery Watson, November 1997.

Annual Report for Operable Unit 7, Montgomery Watson, December 1998.

Annual Report for Operable Unit 7 Building 225 Floor Slab, Montgomery Watson, November 1999.

Bamberger Pond NFRAP Action Memorandum, Hill AFB EMR, June 2000.

Baseline Risk Assessment for Operable Unit 2 Sites WP07, SS21 Volume 1 Report, Radian, March 1992.

Baseline Risk Assessment Operable Unit 5 Sites SS17, SD16 Executive Summary, Radian, February 1995.

Building 205 Record Drawing, Installation of Lines and Tanks for Industrial Waste, Buildings 225 and 205, Sheet 1., Hill Air Force Base Civil Engineering, December 1957.

Building 454 Investigation Tech Memo Operable Unit 9 Final, Montgomery Watson, November 2000.
Building 786 No Further Response Action Planned Decision Document, IRP Site SS092, Final Report, CH2M Hill, September 2002.

Comprehensive Event Report, Hill AFB EMR, November 2000.

Comprehensive Remedial Investigative Report for Operable Unit 1 (IRP Site LF01, LF03, WP02, FT09, OT14, FT81, and WP80) Volume 1, Montgomery Watson, December 1995.

Construction Completion Report for Operable Unit 8 Interim Remedial Action Hydraulic Containment System, Montgomery Watson, January 1999.

Contract F42650-98-D-0067, Delivery Order 0020, Cost Reimbursable Project Number 1. - Draft Operable Unit 4 Sewer Connection Soil Sampling Letter Report, CH2M Hill, 2 April 2003.

Decision Document for IRP Site SD40A Category III NFRAP Pond 6, Hill AFB EMR, March 1998.

Decision Document for Perimeter Road, Site SS21, Hill AFB EMR, June 1991.

Decision Document for Site OT20- Spoils Area, Hill AFB EMR, June 1992.

Draft 2002 Cost and Performance Report, Operable Unit 2, Hill Air Force Base, Utah, URS Corporation, March 2003.

Draft Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling, Montgomery Watson Harza, October 2002.

Draft Conceptual Model for Operable Unit 5, May 2001, Montgomery Watson, May 2001.

Draft Final Feasibility Study, Operable Unit 5, Radian International, May 1996.

Draft Final South Area of Operable Unit 9 Site Inspection - Final Comprehensive Data Evaluation, CH2M Hill, October 1997.

Draft Remedial Action Report Operable Unit 2 North Interceptor Trench, Spring U2-326 Interceptor Trench, Containment Wall, and Air Stripper Treatment Plant, CH2M Hill, March 2000.

Draft Subsurface Investigation Report and Corrective Action Plan for Building 454, LUST Site EIHG, Dames and Moore, January 1996.

Draft Treatment System Operation Report, OU 5 Phase I Aeration Curtain, January - December 2002, URS, 24 December 2002.

Engineering Evaluation and Cost Assessment (EE/CA) Addendum For Operable Unit 5, Montgomery Watson Harza, January 2002.

Engineering Evaluation/Cost Analysis for the OU9 Pond 1 Removal Action, Final Report, CH2M Hill, April 2002.

Engineering Evaluation/Cost Analysis Operable Unit 5, Radian, December 1994.

Feasibility Study for Operable Unit 3 (IRP Sites ST04, WP05, WP06, ST18, SD23, SD34), Montgomery Watson, March 1995.

Feasibility Study Report for OU 8, Montgomery Watson Harza, March 2003.

Federal Facilities Agreement Under CERCLA Section 120, EPA Region VIII, April 1991.

Federal Register Vol. 52, No. 140, Environmental Protection Agency, 22 July 1997.

Final 2000 Cost and Performance Report, Operable Unit 2, Hill Air Force Base, Utah, URS, 15 February 2001.

Final Analytical Data Report (ADR) For Operable Unit 9 Investigation Areas 1 May Through 10 October 2000, Montgomery Watson, February 2001.

Final Conceptual Model for Operable Unit 5, Oct. 2001, Montgomery Watson Harza, October 2001.

Final Conceptual Model for Operable Units 5 and 12, Montgomery Watson Harza, September 2002.

Final Contaminant Transport Model Report for Operable Unit 5, Montgomery Watson Harza, February 2002.

Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas, Montgomery Watson, October 2000.

Final Decision Document for Fire Training Area 1, U.S. Air Force Installation Restoration Program, Hill Air Force Base, Utah, July 1989, Science Applications International Corporation, July 1989.

Final Decision Document for IRP Site OT 029 Category III NFRAP Building 204 Beryllium Underground Waste Tank, Hill AFB EMR, March 1998.

Final Decision Document for Site OT14 - Golf Course, Hill Air Force Base, Utah, Hill AFB EMR, May 1991.

Final Decision Document for Site SS28, Sill Property, Hill AFB EMR, June 1991.

Final Dense Nonaqueous Phase Liquid (DNAPL) Source Delineation Report Operable Unit 2, URS Corporation, September 1999.

Final Draft Abatement and Initial Site Characterization Report Building 454, Site EIHG, Dames and Moore, October 1994.

Final Fate and Analysis of Arsenic and Manganese in the Vicinity of Bamberger Pond, URS, June 2000.

Final Feasibility Study Report for Operable Unit 1 (IRP Sites LF01, LF03, WP02, FT09, OT14, FT81, and WP80), Hill Air Force Base, Utah, Radian International, January 1998.

Final Interim Remedial Action Hydraulic Containment System Operations and Maintenance Plan Operable Unit 8, Hill AFB Volume I of III, Montgomery Watson Harza, April 2002.

Final Interim Remedial Action Report for Operable Unit 8, Montgomery Watson, September 1998.

Final Operable Unit 1 Phase I Remedial Action Groundwater Extraction System Operation and Maintenance Plan, CH2M Hill, August 2002.

Final Operable Unit 2 Panel 1 and 5 Surfactant Enhanced Aquifer Remediation (SEAR) Report, URS Corporation, February 2002.

Final Operable Units 5 and 12 Active Soil-Gas Survey Source Area Investigation Report, Montgomery Watson Harza, June 2002.

Final Operable Units 5 and 12 Historic Site and Source Area Review, March 2002, Montgomery Watson Harza, March 2002.

Final Operation and Maintenance Manual, Aeration Curtain, OU 5, Radian International, October 1998.

Final Record of Decision and Responsiveness Summary for Operable Unit 2, CH2M Hill, September 1996.

Final Remedial Action Project Report For Operable Unit 2 Spring U2-304 Seep Intercept System, Montgomery Watson, July 2000.

Final Remedial Action Report Pond 10 Pumping Facility Construction at OU 1, Radian, August 2000.

Final Remedial Investigation/Feasibility Study Work Plan for Operable Units 5 and 9 Investigation Area, Montgomery Watson, May 2002.

Final South Area Of Operable Unit 9 Site Inspection, Final Comprehensive Data Evaluation, Volume 1, CH2M Hill, February 2001.

Final Summary Report for Chromium Cleanup at Two Sites in Layton, Utah, James M. Montgomery Consulting Engineers Inc., 1 February 1991.

Focused Feasibility Study for Operable Unit 2, Hill AFB EMR, February 1991.

Geotechnical Report OU 4 Proposed Extraction Trenches Long-Term Impact Review, URS, January 2001.

Guidance for Remedial Actions for Superfund Sites with PCB Contamination, Environmental Protection Agency, August 1990.

Hill AFB Environmental Restoration Management Action Plan - 2001, Montgomery Watson Harza, September 2002.

Hill AFB Five-Year Review, September 1998, Hill AFB EMR, September 1998.

http://www.epa.gov/OGWDW/mcl.html, Environmental Protection Agency, February 2001.

Innovative Subsurface Remediation: Field Testing of Physical, Chemical, and Characterization Technologies. American Chemical Society Symposium Series 725, American Chemical Society, January 1999.

Intent to Shut Down and Bypass Treatment Equipment at Operable Unit 6 Off-Base Systems, Hill AFB EMR, 7 January 2002.

Interim PCB Contaminated Soil Removal Report for Electrical Substation No. 2, Radian, June 1999.

Interim Remedial Action Field Work Data Summary and Remedial Design Technical Memorandum Operable Unit 8, Montgomery Watson, March 1996.

Memorandum, Comparison of Standards and Cleanup Levels at Hill AFB, URS, 16 December 2002.

Minutes, First RAB Meeting, January 12, 1998, Hill AFB EMR, January 1995.

Monthly OU 1 Operations Summary Reports (Jan - Dec), URS, January 2002.

National Primary Drinking Water Standards, Environmental Protection Agency, December 1999.

North Area Preliminary Assessment Report, June 1995, Final, Montgomery Watson, June 1995.

OO-ALC-HAFB Supplement I, AFI 32-7020, 29 April 1998, Hill AFB, 29 April 1998.

Operable Unit 1 Fire Training Area 2 No Further Response Action Planned (NFRAP) Decision Document, IRP Site FT081, State of Utah, Department of Environmental Quality,

Leaking Underground Storage Tank Site EIIK, Hill Air Force Base, Utah, August 2001, CH2M Hill, August 2001.

Operable Unit 2 Source Removal System and Industrial Waste Treatment Plan Modifications Construction Report, Radian, January 1994.

Operable Unit 4 Performance Standard Verification Plan, CH2M Hill, November 2001.

Operable Unit 6 Cooley's Pond Treatment System Monthly Operation Summary, January - August 2002, URS, 31 August 2002.

Operable Unit 6 Off-Base (Craigdale) Pump-and-Treat System Monthly Operation Summary, January - August 2002, URS, 31 August 2002.

Operable Unit 9 Calendar Year 2001 Deferred Sites Inventory Report, Hill Air Force Base, Utah. Draft, CH2M Hill, August 2002.

Operation and Maintenance Manual On-Base Pump and Treat System, Operable Unit 6, Final Revision 1, URS, July 2002.

OU 1 Source Zone Delineation Progress Report, Intera, 26 September 2002.

OU 10 RI/FS, Operable Unit 10 Analytical Data Report, May 1, 2001 - January 31, 2002, CH2M Hill, July 2002.

OU 12 Base Boundary Hydraulic Containment System Work Plan, Montgomery Watson Harza, June 2002.

OU10 Remedial Investigation/Feasibility Study Operable Unit 10 Analytical Data Report, May 1 2001 - January 31 2002, CH2M Hill, July 2002.

OU11 Remedial Investigation/Feasibility Study, Operable Unit 11 Analytical Data Report, May 1 2001 - January 31 2002, CH2M Hill, November 2002.

OU6 LTM-O&M Data.xls, URS, 17 December 2002.

PCB Spill Sampling and Cleanup in Building 225, Hill Air Force Base, Utah, Hill AFB EMR, November 1989.

Performance Standard Verification Plan For Phase III EE/CA, Operable Unit 5, Montgomery Watson Harza, October 2001.

Performance Standard Verification Plan Operable Unit 1, CH2M Hill, April 2001.

Performance Standard Verification Plan Operable Unit 2, CH2M Hill, November 2001.

Performance Standard Verification Plan Operable Unit 3, CH2M Hill, November 2001.

Performance Standard Verification Plan Operable Unit 6, URS, November 2001.

Preliminary Assessment/Site Investigation, Building 1946 Evaporation Pond, ERM-Rocky Mountain, Inc., January 1993.

Proposed 1st Round Cone Penetration Testing Locations for the 800 / 900 Area, Operable Unit 11, CH2M Hill, 12 February 2002.

Proposed Explanation of Significant Differences for Operable Unit 4 Landfill Contents Remedy, USEPA Region VIII, March 1995.

Proposed Plan for Operable Unit 4 (IRP Sites LF11, LF12, OT20, OT41, OT42), Montgomery Watson, September 1993.

Record of Decision and Responsiveness Summary for Operable Unit 4 (IRP Sites LF11, LF12, OT20, OT41, OT42), Hill AFB EMR, June 1994.

Record of Decision for an Interim Remedial Action at Operable Unit 8, Hill AFB, May 1997.

Record of Decision for Interim Action at Operable Unit 2, HAFB EMR, December 1990.

Record of Decision for Interim Action at Operable Unit 2, Final, HAFB EMR, August 1991.

Record of Decision for Interim Action at Operable Unit 3 Site ST04, Hill AFB EMR, September 1992.

Record of Decision for Operable Unit 3, Hill AFB EMR, September 1995.

Record of Decision for Operable Unit 7, Hill AFB EMR, September 1995.

Record of Decision Operable Unit 1 IRP Sites LF01, WP02, LF03, FT09, FT81, and WP80, Hill AFB EMR, September 1998.

Record of Decision Operable Unit 6 Sites ST022, OT026, SD40B, Radian, August 1997.

Remedial Action Project Close-Out Report for Operable Unit 3, Montgomery Watson, April 1999.

Remedial Action Project Close-Out Report for Operable Unit 7, Montgomery Watson, August 1998.

Remedial Action Report for the Landfill 1 Cap Site (IRP Site LF11), Hill AFB EMR, August 1997.

Remedial Action Report Phase II Remedial Action Horizontal Drain Upgrades Operable Unit 4, CH2M Hill, January 1998.

Remedial Design / Remedial Action Work Plan and Design Analysis Report, Operable Unit 6, Final, Radian, March 1998.

Remedial Design Report and Work Plan for Operable Unit 3, Montgomery Watson, February 1997.

Remedial Design Report and Work Plan Operable Unit 1, CH2M Hill, February 2000.

Remedial Design Report and Work Plan Phase III Groundwater Extraction Trench System Operable Unit 4, CH2M Hill, January 1999.

Remedial Design Report and Work Plan Schedule A and B Construction Operable Unit 2, CH2M Hill, December 1997.

Remedial Design Work Plan for Operable Unit 4 (IRP Sites LF11, LF12, OT20, OT41, OT42), Hill AFB EMR, February 1995.

Remedial Design/Remedial Action Work Plan for Operable Unit 7, Montgomery Watson, August 1996.

Remedial Investigation Report for Operable Unit 2 Sites WP07, SS21 Volume 1 Report and Appendices A & B, Radian, July 1992.

Remedial Investigation Report for Operable Unit 3 (IRP Sites ST04, WP05, WP06, ST18, SD23, OT33, SD34, and SD46), Draft Final, James M. Montgomery Consulting Engineers, April 1992.

Remedial Investigation Report for Operable Unit 4 Volume 2 Baseline Risk Assessment, James M. Montgomery Consulting Engineers, November 1991.

Remedial Investigation Report for Operable Unit 8, Montgomery Watson Harza, December 2001.

Remedial Investigation Report Operable Unit 5 Sites SS17, SD16 Volume 1 - Text, Radian, May 1995.

Remedial Investigation Report Operable Unit 6 Sites ST22, OT26 Volume 1 Text, Radian, July 1995.

Remedial Investigation Report Operable Unit 6 Sites ST22, OT26 Volume 2 Appendices, Radian, July 1995.

Remedial Investigation/ Feasibility Study Report for Operable Unit 7 (IRP Sites SS27, ST31, & SS32) Volume II (Appendices A-L), Montgomery Watson, February 1995.

Remedial Investigation/Feasibility Study Report for Operable Unit 7 (IRP Sites SS27, ST31, & SS32) Volume I (Text), Montgomery Watson, February 1995.

Report Repository Operation and Performance Reports Interim Remedial Action Hydraulic Containment System Operable Unit 8, April 2000-March 2001, Hill AFB, Utah, Hill AFB, January 2001.

Revised Final - Site Inspection Report of Operable Unit 9 North Area, Montgomery Watson, July 2000.

Risk-Based Concentration Table, EPA Region III, October 9, 2002, EPA Region III, 9 October 2002.

Site Characterization Report for a Portion of Building 225 and Site Investigation of Fill Soils at Base Supply Well 6, James M. Montgomery, Consulting Engineers, December 1991.

Site Conceptual Model Review OU 4, Jacobs Sverdrup/Intera Inc., December 2002.

Statement of Concurrence With No Further Response Action Planned (NFRAP), Building 514

Refueling Vehicle Maintenance Facility (RVMF), Installation Restoration Program
(IRP) Site ST018, URS Greiner, Inc., May 2001.

Subsurface Investigation Report for Underground Storage Tank Site 454, CH2M Hill, February 2001.
Synopsis of Regulatory Review for OU6 Craigdale Discharge, Hill AFB EMR, 8 October 2002.

System Evaluation Report SRS Commissioning, Startup, and Initial Operation Interim Remedial Action, 2, Radian, February 1995.

Technical Memorandum Baseline Risk Assessment for Operable Unit 4, James M. Montgomery Consulting Engineers, April 1990.

Technical Memorandum Second Draft Vol 1 Report Site Characteristics Summary Report, First Phase of Remedial Investigation, Operable Unit 4, Landfills 1 and 2, U.S. Geological Survey, January 1990.

Treatment System Operation Report Interim Remedial Action Hydraulic Containment System Operable Unit 8, Hill AFB, Utah, URS, June 2002.

Treatment System Operation Report Operable Unit 6 Cooley's Pond Pump-and-Treat System, Hill Air Force Base, Utah, January - December 2002, URS, February 2003.

Treatment System Operation Report Operable Unit 6 Craigdale Pump-and-Treat System, Hill Air Force Base, Utah, January - December 2002, URS, February 2003.

Treatment System Operation Report Operable Unit 6 On-Base Pump-and-Treat System, Hill Air Force Base, Utah, January - December 2002, URS, January 2003.

Treatment System Operation Report, Craigdale Pump-and-Treat System, Operable Unit 6, URS, March 2002.

Treatment System Operation Report, On-Base Pump and Treat System, Operable Unit 6, URS, 18 February 2002.

U.S. Air Force Installation Restoration Program Remedial Investigation/Feasibilty Study Hill AFB, Utah, Decision Paper Site SD046 - Storm Pond 2 No Further Response Action Planned, Hill AFB EMR, 30 June 1992.

UCS O&M and Performance Verification Plan Operable Unit 2, Radian International, July 1997.

Utah Rule R309-200, Monitoring and Water Quality: Drinking Water Standards, State of Utah, July 2002.

Vol. 1 Report Remedial Investigation Report for Operable Unit 4, U.S. Geological Survey, June 1992.

Vol. 1 Report Remedial Investigation Report for Operable Unit 4, First Draft, U.S. Geological Survey, September 1991.

Work Plan for South Area of Operable Unit 9 Site Inspection Volume 1: Report and Appendices A-D, CH2M Hill, December 1995.

Personal Communication Between URS Evaluation Team and the following for Hill AFB 2003 Five-Year Review

Elliott, B., Historical PM, Hill AFB EMR, 02 January 2003.

Esplin, T., Engineer for O&M Contractor, URS, 06 February 2003.

Esplin, T., Site Engineer for OU 6, URS Corp., 27 January 2003.

Evans, S., Hydrologist, URS, 08 January 2003.

Holt, M., ERPIMS Database Manager, Hill AFB EMR, 31 December 2002.

Knutson, S., O&M Contractor (URS), URS, 12 February 2003.

Loucks, M., Historical PM, Hill AFB EMR, 11 February 2003.

Loucks, M., Project Manager, Hill AFB EMR, 18 March 2003.

Mills, D., Project Manager, EMR, 05 March 2003.

Renn, H., O&M Project Manager, URS Corp, 24 February 2003.

Rolfsness, S., OU 11 Project Manager, Hill AFB EMR, 31 December 2002.

Rolfsness, S., OU 11 Project Manager, Hill AFB, EMR, 02 January 2003.

Smith, S., OU 9 Project Manager, Hill AFB, EMR, 13 February 2003.

Torres, O., O&M Project Manager, Hill AFB, EMR, 28 January 2003.

Torres, O., O&M Project Manager, Hill AFB EMR, 03 January 2003.

Torres, O., O&M Project Manager, Hill AFB EMR, 30 January 2003.

Torres, O., Project Manager, Hill AFB EMR, 06 February 2003.

Vicelja, J., Consulting Engineer, P.E., Joseph Vicelja Consulting Engineering, 07 February 2003.

Watkins, J., EM Operations Program Manager, Hill AFB EMR, 24 October 2002.

Watkins, J., EM Operations Program Manager, Hill AFB EMR, 13 March 2003.

Appendix D

Inspection Checklist and Sample Site Interview Questionnaire

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name:	**Date of inspection:**
Location and Region:	**EPA ID:**
Agency, office, or company leading the five-year review:	**Weather/temperature:**
Remedy Includes: (Check all that apply) Landfill cover/containment Access controls Institutional controls Groundwater pump and treatment Surface water collection and treatment Other_____ Monitored natural attenuation Groundwater containment Vertical barrier walls	
Attachments: Inspection team roster attached Site map attached	
II. INTERVIEWS (Check all that apply)	
1. **O&M site manager** _____ _____ _____ Name Title Date Interviewed at site at office by phone Phone no. _____ Problems, suggestions; Report attached _____	
2. **O&M staff** _____ _____ _____ Name Title Date Interviewed at site at office by phone Phone no. _____ Problems, suggestions; Report attached _____	

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; Report attached _____
_____

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1.	**O&M Documents**			
	O&M manual	Readily available	Up to date	N/A
	As-built drawings	Readily available	Up to date	N/A
	Maintenance logs	Readily available	Up to date	N/A
	Remarks_____			
2.	**Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
	Contingency plan/emergency response plan	Readily available	Up to date	N/A
	Remarks_____			
3.	**O&M and OSHA Training Records**	Readily available	Up to date	N/A
	Remarks_____			
4.	**Permits and Service Agreements**			
	Air discharge permit	Readily available	Up to date	N/A
	Effluent discharge	Readily available	Up to date	N/A
	Waste disposal, POTW	Readily available	Up to date	N/A
	Other permits_____	Readily available	Up to date	N/A
	Remarks_____			
5.	**Gas Generation Records**	Readily available	Up to date	N/A
	Remarks_____			
6.	**Settlement Monument Records**	Readily available	Up to date	N/A
	Remarks_____			
7.	**Groundwater Monitoring Records**	Readily available	Up to date	N/A
	Remarks_____			
8.	**Leachate Extraction Records**	Readily available	Up to date	N/A
	Remarks_____			
9.	**Discharge Compliance Records**			
	Air	Readily available	Up to date	N/A
	Water (effluent)	Readily available	Up to date	N/A
	Remarks_____			
10.	**Daily Access/Security Logs**	Readily available	Up to date	N/A
	Remarks_____			

IV. O&M COSTS

1. **O&M Organization**

State in-house — Contractor for State
PRP in-house — Contractor for PRP
Federal Facility in-house — Contractor for Federal Facility
Other_____

2. **O&M Cost Records**

Readily available — Up to date
Funding mechanism/agreement in place
Original O&M cost estimate_____ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ Breakdown attached
Date Date Total cost
From_____ To_____ _____ Breakdown attached
Date Date Total cost
From_____ To_____ _____ Breakdown attached
Date Date Total cost
From_____ To_____ _____ Breakdown attached
Date Date Total cost
From_____ To_____ _____ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS — Applicable — N/A

A. Fencing

1. **Fencing damaged** — Location shown on site map — Gates secured — N/A

Remarks_____

B. Other Access Restrictions

1. **Signs and other security measures** — Location shown on site map — N/A

Remarks_____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	Yes	No	N/A
Site conditions imply ICs not being fully enforced	Yes	No	N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date	Yes	No	N/A
Reports are verified by the lead agency	Yes	No	N/A
Specific requirements in deed or decision documents have been met	Yes	No	N/A
Violations have been reported	Yes	No	N/A

Other problems or suggestions: Report attached
_____
_____
_____
_____

2. **Adequacy** ICs are adequate ICs are inadequate N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** Location shown on site map No vandalism evident
Remarks_____
_____

2. **Land use changes on site** N/A
Remarks_____
_____

3. **Land use changes off site** N/A
Remarks_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads Applicable N/A

1. **Roads damaged** Location shown on site map Roads adequate N/A
Remarks_____
_____

B. Other Site Conditions

Remarks_____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS Applicable N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Cracks** Location shown on site map Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____

3. **Erosion** Location shown on site map Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Holes** Location shown on site map Holes not evident
   Areal extent_____ Depth_____
   Remarks_____

5. **Vegetative Cover** Grass Cover properly established No signs of stress
   Trees/Shrubs (indicate size and locations on a diagram)
   Remarks_____

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
   Remarks_____

7. **Bulges** Location shown on site map Bulges not evident
   Areal extent_____ Height_____
   Remarks_____

8. **Wet Areas/Water Damage** Wet areas/water damage not evident
   - Wet areas — Location shown on site map — Areal extent_____
   - Ponding — Location shown on site map — Areal extent_____
   - Seeps — Location shown on site map — Areal extent_____
   - Soft subgrade — Location shown on site map — Areal extent_____

   Remarks_____

9. **Slope Instability** Slides — Location shown on site map — No evidence of slope instability
   Areal extent_____
   Remarks_____

B. Benches Applicable N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** Location shown on site map N/A or okay
   Remarks_____

2. **Bench Breached** Location shown on site map N/A or okay
   Remarks_____

3. **Bench Overtopped** Location shown on site map N/A or okay
   Remarks_____

C. Letdown Channels Applicable N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** Location shown on site map No evidence of settlement
   Areal extent_____ Depth_____
   Remarks_____

2. **Material Degradation** Location shown on site map No evidence of degradation
   Material type_____ Areal extent_____
   Remarks_____

3. **Erosion** Location shown on site map No evidence of erosion
   Areal extent_____ Depth_____
   Remarks_____

4. **Undercutting** Location shown on site map No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ No obstructions
Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations Applicable N/A

1. **Gas Vents** Active Passive
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance
N/A
Remarks_____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks_____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks_____

5. **Settlement Monuments** Located Routinely surveyed N/A
Remarks_____

E. Gas Collection and Treatment	Applicable	N/A
1. **Gas Treatment Facilities** Flaring / Thermal destruction / Collection for reuse Good condition / Needs Maintenance Remarks_____		
2. **Gas Collection Wells, Manifolds and Piping** Good condition / Needs Maintenance Remarks_____		
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition / Needs Maintenance / N/A Remarks_____		
F. Cover Drainage Layer	Applicable	N/A
1. **Outlet Pipes Inspected** Remarks_____	Functioning	N/A
2. **Outlet Rock Inspected** Remarks_____	Functioning	N/A
G. Detention/Sedimentation Ponds	Applicable	N/A
1. **Siltation** Areal extent_____ Depth_____ N/A Siltation not evident Remarks_____		
2. **Erosion** Areal extent_____ Depth_____ Erosion not evident Remarks_____		
3. **Outlet Works** Remarks_____	Functioning	N/A
4. **Dam** Remarks_____	Functioning	N/A

H. Retaining Walls Applicable N/A

1. **Deformations** Location shown on site map Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** Location shown on site map Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge Applicable N/A

1. **Siltation** Location shown on site map Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** Location shown on site map N/A
   Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** Location shown on site map Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** Functioning N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS Applicable N/A

1. **Settlement** Location shown on site map Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   Performance not monitored
   Frequency_____ Evidence of breaching
   Head differential_____
   Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES	Applicable	N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	Applicable	N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition All required wells properly operating Needs Maintenance N/A
   Remarks_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks_____

B. Surface Water Collection Structures, Pumps, and Pipelines	Applicable	N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition Needs Maintenance
   Remarks_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks_____

C. Treatment System Applicable N/A

1. **Treatment Train** (Check components that apply)
   Metals removal Oil/water separation Bioremediation
   Air stripping Carbon adsorbers
   Filters_____
   Additive (*e.g.*, chelation agent, flocculent)_____
   Others_____
   Good condition Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually_____
   Quantity of surface water treated annually_____
   Remarks_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A Good condition Needs Maintenance
   Remarks_____

3. **Tanks, Vaults, Storage Vessels**
   N/A Good condition Proper secondary containment Needs Maintenance
   Remarks_____

4. **Discharge Structure and Appurtenances**
   N/A Good condition Needs Maintenance
   Remarks_____

5. **Treatment Building(s)**
   N/A Good condition (esp. roof and doorways) Needs repair
   Chemicals and equipment properly stored
   Remarks_____

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks_____

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

OU 7 EMR Date: Time:

PERFORMANCE, OPERATION AND MAINTENANCE PROBLEMS (**EMR**)

1. What do the monitoring data show?
2. How successfully is the remedy performing (progress toward RAOs, PRGs, etc.)?
3. Are there any trends that show contaminant levels are decreasing?
4. What is the operational uptime and removal efficiency goal for the system?
5. What has the actual operational uptime and removal efficiency goal been for the past 1 year, 2 years, etc.? What data is this based on?
6. Is there a continuous on-site O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.
7. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.
8. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details.
9. Have there been any typical/recurring performance problems with the system?
10. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
11. Is the sampling plan adequate to determine effective treatment, capture, etc.? What information is your determination based on?
12. Has there been unexpected contamination found outside the capture zone or any indication of an unknown source?
13. What is the overall goal of this remediation project?
14. Is the remedy functioning as expected (i.e. is the capture zone containing the plume)?
15. Do you have any comments, suggestions, or recommendations regarding the project?
16. What is your overall impression of the project (general sentiment)?
17. In the 2001 Report, URS suggested that nine defects be sealed and one warning sign be replaced. Was this completed and if not, why? Increased frequency of neutron logging to ensure infiltration rates are okay?
18. In the 2001 Report – How are the areas of attainment delineated?
19. No soil moisture data points for one area of attainment…Is this okay? What was the basis for the soil moisture data points?
20. Is there a pass/fail criterion for increased moisture data in the probe locations? If yes, do you know what is the basis / rationale for this criteria?

21. Moisture logs for April 2001 were at 23% and January 1997 data was 10% for 27-29 feet bgs. Is this acceptable? Increased contaminant mobilization? Are all levels/depths reported and reviewed for moisture increases?

22. At what intervals in the monitoring point locations are the soil moisture measured/logged (i.e., every 2 feet)?

23. Why is the soil moisture only reported for 7-8 feet bgs? (highest conc. Generally occurred in the uppermost layer found at approx. 10 feet bgs).

24. The major components of selected remedy per the ROD at OU 7 include:

    - Posting warning signs regarding presence of contaminated soils that could represent a threat to human health.

    The current signs read "Caution: Do not disturb floor. Contact EMR, Phone 7-8790"

    Do you think this sign verbiage fulfills the intent of the ROD? Why?

25. Per the PSVP, graphics will be prepared of the concentration at each monitoring well (T-228-001, U7-008, and U7-012) and reported in the annual report. Is this being done?

26. The PSVP states that the Site conceptual model for OU 7 is being reviewed on an annual basis. Is this being done?

27. Review graphs with EMR re: RAO #3.

Appendix E

Changes in Chemical-Specific Clean-up Levels

Comparison of Standards and Cleanup Goals - Hill AFB, FYR 2003 (Evaluated December 2002)

Italicized values are risk based.

Change in MCL or toxicity factor
- More stringent
- Less stringent
- Other

CSF - Cancer slope factor, CSF(i) for inhalation, CSF(o) for oral
DW - Drinking water
EE/CA - Engineering Evaluation / Cost Analysis
FYR - Five Year Review
GW - Groundwater
HEAST - Health Effects Assessment Summary Tables
IRIS - Integrated Risk Information System
MCL - Maximum Contaminant Level
NCEA - National Center of Environmental Assessment
RAO - Remedial Action Objective
RBC - Risk-based Concentration
RfD - Reference Dose, RfD(i) for inhalation, RfD(o) for oral
RI/FS - Remedial Investigation / Feasibility Study
ROD - Record of Decision
STSC - Superfund Technical Support Center
SW - Surface water

(a) UT drinking water standard only indicates chromium
(b) Arsenic standard of 10 ug/L (ppb) will be effective in 1/26/2006.
(c) EPA Region 3 and 9 RBCs are based on risk factors in HEAST, IRIS, NCEA, or other EPA sources.
(d) MCL for chloroform is for trihalomethanes.
(e) OU3 CoCs are based on their potential to leach to groundwater and results in groundwater contaminant concentrations in excess of MCLs, except for PCB-1254 which was based on health risk.

		OU1			
Contaminants	MCLs Federal 40 CFR part 141 (10/10/02) Utah R309-103 (7/1/02) ug/L (ppb)	GW, SW Cleanup Level Based on: MCL and Risk ug/L	Soil Cleanup Level Based on: GW Protection mg/kg	GW Protection Level Used as Basis for Soil Cleanup Level ug/L	Comments
1,1,1-Trichloroethane (1,1,1-TCA)	200	200	10	200	
1,1,2-Trichloroethane (1,1,2-TCA)	5				
1,1-Dichloroethane (1,1-DCA)	NA	*790*	*13*	*630*	1,1-DCA toxicity factors on Region 3 RBC Table have not changed since 4/1998 (after ROD).
1,1-Dichloroethene (1,1-DCE)	7	7	0.03	7	
1,2,4-Trichlorobenzene (1,2,4-TCB)	70	70	17	70	
1,2-Dichlorobenzene	600	600	60	600	
1,2-Dichloroethane (1,2-DCA)	5		0.1	5	
cis 1,2-Dichloroethene (cis 1,2-DCE)	70	70	1.1	70	
trans 1,2-Dichloroethene (trans 1,2-DCE)	100				
1,4-Dichlorobenzene	75	75	5.8	75	
2,3,7,8-Tetrachlorodibenzo-p-Dioxin (2,3,7,8-TCDD)	0.00003		0.004	0.00003	
2,4-Dimethylphenol	NA	*600*	*8*	*300*	2,4-Dimethylphenol toxicity factors on Region 3 RBC Table have not changed since 4/1998 (after ROD).
4-Methylphenol (p-cresol)	NA	*750*	*3.7*	*750*	p-cresol toxicity factors on Region 3 RBC Table have not changed since 4/1998 (after ROD).
Arsenic	50 (b)	50			Arsenic cleanup level currently valid. However arsenic standard of 10 ug/L (ppb) will be effective in 1/26/2006.
Barium	2000	1000			Barium cleanup level is lower than MCL.
Benzene	5	5	0.12	5	
Benzo(a)pyrene	0.2		21	0.2	
Beta-BHC	NA				
Bis(2-ethylhexyl)phthalate	6				
Boron	NA				
Cadmium	5				
Chlorobenzene	100	100	2.4	100	
Chloroform	100 (d)				
Chromium (total)	100 (a)				
Chromium (VI)	NA (a)				
Ethylbenzene	700		11	700	
Fluoride	4000	2400			Fluoride cleanup level is lower than MCL.
Gamma-BHC (lindane)	0.2				
Heptachlor epoxide	0.2				
Methylene Chloride	NA				
Methyl Ethyl Ketone	NA				
Naphthalene	NA	*1200*	*22.5*	*60*	Naphthalene RfD(o) decreased from 0.04 to 0.02 mg/kg/d (more stringent), RfD(i) now available: 9.0E-4 mg/kg/d. EPA Region 3 RBC Table 10/2002.
Nickel	NA				
PCB	0.5		10.1	0.5	
Pentachlorophenol	1		0.26	1	
Selenium	50				
1,1,2,2-Tetrachloroethane	NA				
Tetrachloroethylene (Perchloroethylene, PCE)	5	5	0.52	5	
Toluene	1000	1000	43	1000	
Trichloroethene (TCE)	5	5	0.17	5	
Vinyl Chloride	2		0.03	2	
xylenes (total)	10,000		1000	10000	
References for Cleanup Levels and Risk Factors		OU1 ROD 1998, Tables 7-1, 7-2. OU1 RI 1995, Appendix A Tables 4-2, 5-3. EPA Region 3 RBC Table 10/2002.			

Comparison of Standards and Cleanup Goals - Hill AFB, FYR 2003 (Evaluated December 2002)

	OU2			OU3				OU4		
Contaminants	GW, SW Cleanup Level Based on: MCL and Risk ug/L	Soil Cleanup Level Based on: Risk mg/kg	Comments	Soil Cleanup Level (Berman Pond) Based on: GW Protection (e) mg/kg	Soil Cleanup Level (RVMF) Based on: GW Protection mg/kg	GW Protection Level (Utah MCL, December 1994) Used as Basis for Soil Cleanup Level ug/L	Comments	GW, SW Cleanup Level Based on: MCL and Risk ug/L	Air Cleanup Level Based on: Risk ug/m^3	Comments
1,1,1-Trichloroethane (1,1,1-TCA)	200			4		200				
1,1,2-Trichloroethane (1,1,2-TCA)				0.04		5				
1,1-Dichloroethane (1,1-DCA)										
1,1-Dichloroethene (1,1-DCE)					0.08	7	1,1-DCE MCL that soil cleanup level is based on is still valid.	7		
1,2,4-Trichlorobenzene (1,2,4-TCB)										
1,2-Dichlorobenzene				20		600				
1,2-Dichloroethane (1,2-DCA)				0.03		5		5		
cis 1,2-Dichloroethene (cis 1,2-DCE)	70			0.7		70		70		
trans 1,2-Dichloroethene (trans 1,2-DCE)								100		
1,4-Dichlorobenzene				2.8		75				
2,3,7,8-Tetrachlorodibenzo-p-Dioxin (2,3,7,8-TCDD)										
2,4-Dimethylphenol										
4-Methylphenol (p-cresol)										
Arsenic				4.1		50	Arsenic cleanup level currently valid. However arsenic standard of 10 ug/L (ppb) will be effective in 1/26/2006.	50		Arsenic cleanup level currently valid. However arsenic standard of 10 ug/L (ppb) will be effective in 1/26/2006.
Barium								2,000		
Benzene				0.05		5		5		
Benzo(a)pyrene				0.07		0.2				
Beta-BHC	*0.01*		Beta-BHC CSF(i) increased from 1.86E-3 to 1.80E+0, 1000x more stringent (EPA Region 3 RBC Table 10/2002).							
Bis(2-ethylhexyl)phthalate				6		6				
Boron								*2,700*		Boron RfD(i) now available (EPA Region 3 RBC table 10/2002).
Cadmium				16		5				
Chlorobenzene				0.95		100				
Chloroform								100		
Chromium (total)										
Chromium (VI)										
Ethylbenzene										
Fluoride										
Gamma-BHC (lindane)	0.2									
Heptachlor epoxide				0.04		0.2				
Methylene Chloride	*6*		Methylene chloride CSF(i) increased from 1.65E-6 to 1.65E-3 (1000x more stringent). EPA Region 3 RBC Table 10/2002.	*0.02*			Methylene chloride CSF(i) increased from 1.65E-6 to 1.65E-3 (1000x more stringent). EPA Region 3 RBC Table 10/2002.			
Methyl Ethyl Ketone								*830*		MEK RfD(o) and RfD(i) remain the same (EPA Region 3 RBC Table 10/2002).
Naphthalene										
Nickel								*100*		Nickel RfD(o) remain the same, RfD(i) still not available. (EPA Region 3 RBC Table 10/2002)
PCB				*0.06*			PCB CSF(o) decreased from 7.7 to 2.0 1/mg/kg/d (less stringent), CSF(i) now available: 2.0 1/mg/kg/d. EPA Region 3 RBC Table 10/2002.			
Pentachlorophenol										
Selenium								50		
1,1,2,2-Tetrachloroethane				*0.001*			No MCL for 1,1,2,2-Tetrachloroethane is available, ROD did not list CSF for comparison. However, there was a change for this compound in the EPA Region 3 RBC Table in Oct 1998.			
Tetrachloroethylene (Perchloroethylene, PCE)	5	*12.31*	PCE CSF(i) listed in ROD was 2.03E-072 /mg/kg/d (5.8E-073 1/mg/m^3, possible typo), RBC Table listed 1.0E-2 (more stringent). OU2 ROD, EPA Region 3 RBC Table 10/2002.					5		
Toluene	1000							1,000		
Trichloroethene (TCE)	5	*58.21*	TCE inhalation and oral CSFs are more stringent. CSF(i) increased from 1.7E-6 to 4.0E-1 1/mg/kg/d; CSF(o) increased from 1.1E-2 to 4.0E-1 1/mg/kg/d. EPA Region 3 RBC Table 10/2002.	0.07		5		5	*5*	TCE CSF(i) increased from 1.7E-2 to 4.0E-1 1/mg/kg/d (23x more stringent)
Vinyl Chloride				0.02		2				
xylenes (total)								10,000		
References for Cleanup Levels and Risk Factors	OU2 ROD 1996, Tables 4-4, 7-1. EPA Region 3 RBC Table 10/2002.			OU3 ROD 1995, Tables 3-5, 4-4, 4-5. Utah MCLs: UT R309-101 to R309-104 1/1/95. EPA Region 3 RBC Table 10/2002.				OU4 ROD 1994, Tables 3-4, 3-5, 5-1. EPA Region 3 RBC Table 10/2002.		

Comparison of Standards and Cleanup Goals - Hill AFB, FYR 2003 (Evaluated December 2002)

	OU5		OU6			OU7		OU8	
Contaminants	GW, SW Cleanup Level	Comments	GW, SW Cleanup Level Based on: MCL ug/L	Soil Cleanup Level Based on: Risk mg/kg	Comments	Soil Cleanup Level Based on: Risk mg/kg	Comments	GW Cleanup Level Based on: MCL ug/L	Comments
1,1,1-Trichloroethane (1,1,1-TCA)								200	
1,1,2-Trichloroethane (1,1,2-TCA)									
1,1-Dichloroethane (1,1-DCA)									
1,1-Dichloroethene (1,1-DCE)				*0.026*	1,1-DCE has been reclassified as non-cancerous (EPA Region 3 RBC table 10/2002).			7	
1,2,4-Trichlorobenzene (1,2,4-TCB)									
1,2-Dichlorobenzene									
1,2-Dichloroethane (1,2-DCA)								5	
cis 1,2-Dichloroethene (cis 1,2-DCE)									
trans 1,2-Dichloroethene (trans 1,2-DCE)									
1,4-Dichlorobenzene									
2,3,7,8-Tetrachlorodibenzo-p-Dioxin (2,3,7,8-TCDD)									
2,4-Dimethylphenol									
4-Methylphenol (p-cresol)									
Arsenic								50	Arsenic cleanup level currently valid. However arsenic standard of 10 ug/L (ppb) will be effective in 1/26/2006.
Barium									
Benzene								5	
Benzo(a)pyrene									
Beta-BHC									
Bis(2-ethylhexyl)phthalate									
Boron									
Cadmium						*7.57*	Cadmium toxicity factors remain the same (EPA Region 3 RBC Table 10/2002).		
Chlorobenzene								100	
Chloroform									
Chromium (total)								50	Chromium cleanup level is lower than MCL.
Chromium (VI)						*1.16*	Chromium(VI) RfD(i) decreased from 5E-3 to 3E-5 (100x more stringent) at OU7 (EPA Region 3 RBC Table 10/2002).	50	Chromium (VI) cleanup level is lower than MCL.
Ethylbenzene									
Fluoride									
Gamma-BHC (lindane)									
Heptachlor epoxide									
Methylene Chloride									
Methyl Ethyl Ketone									
Naphthalene									
Nickel									
PCB									
Pentachlorophenol									
Selenium									
1,1,2,2-Tetrachloroethane									
Tetrachloroethylene (Perchloroethylene, PCE)								5	
Toluene									
Trichloroethene (TCE)	x	RAO required aerial decrease of TCE plume. No numerical remedial goal was set, only discharge compliance was specified.	5					5	
Vinyl Chloride									
xylenes (total)									
References for Cleanup Levels and Risk Factors	OU5 EE/CA 1994		OU6 ROD 1997, pgs 4-10, 7-1. Tables 4-2. EPA Region 3 RBC Table 10/2002.			OU7 ROD 1995, Table 5-1. OU7 RI/FS 1995, Tables 6-8 to 6-19, 6-30. EPA Region 3 RBC Table 10/2002.		OU8 ROD 1997 (Interim), Table 3-1.	

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103

SUBJECT: Risk-Based Concentration Table

FROM: Jennifer Hubbard, Toxicologist
Technical Support Section (3HS41)

TO: RBC Table Users

DATE: October 9, 2002

Attached is the EPA Region III Risk-Based Concentration (RBC) Table, which we prepare and post periodically for all interested parties. The Table's current web address is http://www.epa.gov/reg3hwmd/risk/index.htm

For questions about the Table, please consult this memo, especially the Special Notes and Frequently Asked Questions. You can also consult the RBC Table companion documents that are posted on the website. If you don't find the answer there, and your question is about risk assessment or the science behind the RBCs, you can reach me at hubbard.jennifer@epa.gov or 215-814-3328. For technical difficulties in reading, displaying, or downloading the table from the web, please contact piernock.andrea@epa.gov

CONTENTS, USES, AND LIMITATIONS OF THE RBC TABLE

The RBC Table contains Reference Doses (RfDs) and Cancer Slope Factors (CSFs) for 400-500 chemicals. These toxicity factors have been combined with "standard" exposure scenarios to calculate RBCs--chemical concentrations corresponding to fixed levels of risk (i.e., a Hazard Quotient (HQ) of 1, or lifetime cancer risk of 1E-6, whichever occurs at a lower concentration) in water, air, fish tissue, and soil.

The Region III toxicologists use RBCs to screen sites not yet on the NPL, respond rapidly to citizen inquiries, and spot-check formal baseline risk assessments. The primary use of RBCs is for chemical screening during baseline risk assessment (see EPA Regional Guidance EPA/903/R-93-001, "Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening"). The exposure equations come from EPA's Risk Assessment Guidance for Superfund (RAGS), while the exposure factors are those recommended in RAGS or supplemental guidance from the Superfund program. The attached technical background document provides specific equations and assumptions. Simply put, RBCs are like risk assessments run in reverse. For a single contaminant in a single medium, under standard default exposure assumptions, the RBC corresponds to the target risk or hazard quotient.

RBCs also have several important limitations. Specifically excluded from consideration are (1) transfers from soil to air, (2) cumulative risk from multiple contaminants or media, and (3) dermal risk. Additionally, the risks for inhalation of vapors from water are based on a very simple model, whereas detailed risk assessments may use more detailed showering models. Many RBCs are also based on adult risks. For more information about children's risks, see the Technical Background Document and Frequently Asked Question #12. Furthermore, the toxicity information in the Table has been assembled by hand and (despite extensive checking and years of use) may contain errors. It's advisable to cross-check before relying on any RfDs or CSFs in the Table. If you note any errors, please let us know.

It is important to note that, at this time, the Table uses inhalation RfDs and CSFs rather than RfCs (Reference Concentrations) and inhalation unit cancer risks. This is because the latter factors incorporate exposure assumptions and therefore can only be used for one exposure scenario. Because risk assessors need to evaluate risks for many types of scenarios, the factors have been converted to the more traditional RfDs and CSFs. Unless otherwise indicated in the toxicity-factor source, the assumption is that RfCs and unit risks should be adjusted by a 70-kilogram body weight and a 20 m^3/day inhalation rate to generate the RfDs and CSFs. For adults, the use of an inhalation RfD vs. an RfC does not typically change the risk estimate significantly.

Many users want to know if the RBCs can be used as valid no-action levels or cleanup levels, especially for soils. The answer is a bit complex. First, it is important to realize that the RBC Table does not constitute regulation or guidance, and should not be viewed as a substitute for a site-specific risk assessment. For sites where:

1. A single medium is contaminated;

2. A single contaminant contributes nearly all the health risk;

3. Volatilization, dermal contact, and other pathways not included in the RBCs are not expected to be significant;

4. The exposure scenarios and assumptions used in the RBC table are appropriate for the site;

5. The fixed risk levels used in the RBC table are appropriate for the site; and

6. Risk to ecological receptors is not expected to be significant;

the RBCs would probably be protective as no-action levels or cleanup goals. However, to the extent that a site deviates from this description, as most do, the RBCs would not necessarily be appropriate.

To summarize, the Table should generally not be used to set cleanup or no-action levels at CERCLA sites or RCRA Corrective Action sites, to substitute for EPA guidance for preparing

baseline risk assessments, or to determine if a waste is hazardous under RCRA.

SPECIAL NOTES

The RBC Table was originally developed by Roy L. Smith, Ph.D., for use by risk assessors in the Region III Superfund program. Dr. Smith is no longer with Region III, and the Table continues to evolve. You may notice some modifications of formatting and conventions used in the Table.

For instance, besides formatting, the following changes are noteworthy:

As usual, updated toxicity factors have been used wherever available. However, because IRIS and provisional values are updated more frequently than the RBC Table, RBC Table users are ultimately responsible for obtaining the most up-to-date values. The RBC Table is provided as a convenience, but toxicity factors are compiled from the original sources and it is those original sources that should serve as the definitive reference.

Certain outdated and withdrawn numbers have been removed from the Table.

Changes to the table since the last semi-annual version have been marked with asterisks (**). Changes may involve a corrected CAS number or a correction in the VOC status, a change in the SSL, or changes of RfDs and CSFs.

RBCs are not rounded to 1E6 ppm, as they were in some earlier versions of the Table. For certain low-toxicity chemicals, the RBCs exceed possible concentrations at the target risks. In such cases, Dr. Smith rounded these numbers to the highest possible concentration, or 1E6 ppm. This type of truncation has been discontinued so that Table users can adjust the RBCs to a different target risk whenever necessary. For example, when screening chemicals at a target HQ of 0.1, noncarcinogenic RBCs may simply be divided by 10. Such scaling is not possible when RBCs are rounded. Users who are interested in truncation can also consult the Soil Screening Guidance for a discussion of "Csat," the saturation concentration.

This Table was originally compiled to assist Superfund risk assessors in screening hazardous waste sites. The large number of chemicals made the Table unwieldy and difficult to keep current. Many of the chemicals did not typically (or even occasionally) appear at Superfund sites. Starting with the April 1998 version of the Table, the 600+ chemicals were reduced to some 400-500 chemicals by eliminating many of those atypical chemicals. Through time, the Table may continue to grow or decrease in size.

At Region III Superfund sites, noncancer RBCs are typically adjusted downward to correspond to a target HQ of 0.1 rather than 1. (This is done to ensure that chemicals with additive effects are not prematurely eliminated during screening. Note that the RBCs displayed on the table are shown at an HQ of 1; to arrive at the RBC at 0.1, data users

must do the conversion themselves.) However, some chemicals have RBCs at HQs of 0.1 that are lower than their RBCs at 1E-6 cancer risk. In other words, the screening RBC would change from carcinogenic to noncarcinogenic. A feature of this Table is that these chemicals are now flagged with a "!" symbol. Therefore, assessors screening with adjusted RBCs will be alerted to this situation. See the companion attachment to the RBC Table, "Alternate RBCs," for alternate values for "!" RBCs.

Earlier versions of this Table included a substitution of inhalation toxicity factors for oral factors whenever oral factors were unavailable (this applied only to groundwater and air, but not soil or fish). This practice was discontinued in order to minimize the uncertainty associated with such a conversion. The discontinuation of this practice did not significantly decrease the number of available RBCs.

The criterion for "VOC status" is in accordance with RAGS Part B: chemicals with Henry's Law constants greater than 1E-5 and molecular weight less than 200 are now marked as VOCs. This increases consistency with the national guidance and with other EPA regions that use risk-based screening numbers.

Earlier versions of this Table included soil screening levels (SSLs), when those values were available in draft form. Since the finalization of the SSL Guidance, risk assessors are urged to consult the final SSL Guidance directly. However, for generic use in Region III, the table now contains soil-to-groundwater SSLs in accordance with the new guidance. For more information, see the Region III memo on SSLs, or consult the national SSL guidance directly (Soil Screening Guidance: User's Guide, April 1996, Publication 9355.4-23; and Soil Screening Guidance: Technical Background Document, May 1996; EPA/540/R-95/128).

You may notice there are now two rows for uranium, one reflecting the IRIS (EPA consensus) value and the other reflecting a more recent, but provisional value. Region III has shown both on this table, rather than choosing one over the other, to give Table users as much information as possible.

Vinyl chloride is handled differently from most other chemicals because of the unique aspects of its slope factor derivation. Readers are referred to the memo, "Derivation of Vinyl Chloride RBCs," which is a companion document to this RBC Table.

FREQUENTLY ASKED QUESTIONS

To help you better understand the RBC Table, here are answers to our most often-asked questions:

1. How can the age-adjusted inhalation factor (11.66) be less than the inhalation rate for either a child (12) or an adult (20)?

Age-adjusted factors are not intake rates, but rather partial calculations which have different units from intake rates. (Therefore, they are not directly comparable.) The fact that these partial calculations have values similar to intake rates is really coincidental, an artifact of the similar magnitude of years of exposure and time-averaged body weight.

2. For manganese, IRIS shows an oral RfD of 0.14 mg/kg/day, but the RBC Table uses 2E-2 mg/kg/day. Why?

The IRIS RfD includes manganese from all sources, including diet. The explanatory text in IRIS recommends using a modifying factor of 3 when calculating risks associated with non-food sources, and the Table follows this recommendation. IRIS also recommends subtracting dietary exposure (default assumption in this case 5 mg). Thus, the IRIS RfD has been lowered by a factor of 2 x 3, or 6. The Table now reflects manganese RBCs for both "food" and "non-food" (most environmental) sources.

3. What is the source of the child's inhalation rate of 12 m^3/day?

The calculation comes from basic physiology. It's a scaling of the mass-specific 20 m^3/day rate for adults from a body mass of 70 kg to 15 kg, using the 2/3 power of mass, as follows:

Ircm = mass-specific child inhalation rate (m^3/kg/day)
Irc = child inhalation rate (m^3/day)

20 m^3/day / 70 kg = 0.286 m^3/kg/day (mass-specific adult inhalation rate)

0.286 m^3/kg/day x ($70^{0.67}$) = (Ircm) x ($15^{0.67}$)

Ircm = 0.803 m^3/kg/day

Irc = Ircm x 15 kg = 0.803 m^3/kg/day x 15 kg = 12.04 m^3/day

4. Can the oral RfDs in the RBC Table be applied to dermal exposure?

Not directly. Oral RfDs are usually based on administered dose and therefore tacitly include a GI absorption factor. Thus, any use of oral RfDs (or CSFs) in dermal risk calculations should involve removing this absorption factor. Consult the Risk Assessment Guidance for Superfund, Part A, Appendix A, for further details on how to do this.

5. The exposure variables table in the RBC background document lists the averaging time for non-carcinogens as "ED*365." What does that mean?

ED is exposure duration, in years, and * is the computer-ese symbol for multiplication.

Multiplying ED by 365 simply converts the duration to days. In fact, the ED term is included in both the numerator and denominator of the RBC algorithms for non-cancer risk, canceling it altogether. See RAGS for more information.

6. Why is inorganic lead not included in the RBC Table?

EPA has no consensus RfD or CSF for inorganic lead, so it is not possible to calculate RBCs as we have done for other chemicals. EPA considers lead to be a special case because of the difficulty in identifying the classic "threshold" needed to develop an RfD.

EPA therefore evaluates lead exposure by using blood-lead modeling, such as the Integrated Exposure-Uptake Biokinetic Model (IEUBK). The EPA Office of Solid Waste has also released a detailed directive on risk assessment and cleanup of residential soil lead. The directive recommends that soil lead levels less than 400 mg/kg are generally safe for residential use. Above that level, the document suggests collecting data and modeling blood-lead levels with the IEUBK model. For the purposes of screening, therefore, 400 mg/kg is recommended for residential soils. For water, we suggest 15 ug/l (the EPA Action Level in water), and for air, the National Ambient Air Quality Standard. However, caution should be used when both water and soil are being assessed. The IEUBK model shows that, if the average soil concentration is 400 mg/kg, an average tap water concentration above 5 ug/L would yield more than 5% of the population above a 10 ug/dL blood-lead level. If the average tap water concentration is 15 ug/L, an average soil concentration greater than 250 mg/kg would yield more than 5% of the population above a 10 ug/dL blood-lead level.

7. Where did the CSFs for carcinogenic PAHs come from?

The PAH CSFs are all calculated relative to benzo[a]pyrene, which has an IRIS slope factor. The relative factors for the other PAHs can be found in "Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons," Final Draft, ECAO-CIN-842 (March, 1993).

8. May I please have a copy of a previous RBC Table?

We do not distribute outdated copies of the RBC Table. Each new version of the Table supersedes all previous versions.

9. Please elaborate on the meaning of the "W" source code in the Table.

The "W" code means that a RfD or CSF is currently not present on either IRIS or HEAST, but that it was once present on either IRIS or HEAST and was removed. Such withdrawal usually indicates that consensus on the number no longer exists among EPA scientists, but not that EPA believes the contaminant to be unimportant.

Withdrawn numbers are shown in the Table because we still need to deal with these

contaminants during the long delays before replacement numbers are ready. For the purpose of screening, a "W" value is similar to a provisional value in that neither value has achieved Agency consensus. The "W" code should serve as a clear warning that before making any serious decision involving that contaminant, you will need to develop an interim value based on current scientific understanding.

If you are assessing risks at a site where a major contaminant is coded "W," consider working with your Regional EPA risk assessor to develop a current toxicity constant. If the site is being studied under CERCLA, the EPA-NCEA Regional Technical Support group may be able to assist.

10. Can I get copies of supporting documents for interim toxicity constants which are coded "E" in the RBC Table?

Unfortunately, Region 3 does not have a complete set of supporting documents. The EPA-NCEA Superfund Technical Support Center prepares these interim toxicity constants in response to site-specific requests from Regional risk assessors, and sends the documentation only to the requestor. The RBC Tables contain only the latest interim values that we've either requested or have otherwise received. NCEA maintains the master data base of these chemicals, but will not release documentation of provisional values unless they are recent. Furthermore, since NCEA's Superfund Technical Support Center is mainly for the support of Superfund, it usually cannot develop new criteria unless authorized to do so for a specific Superfund project.

If an "E"-coded contaminant is a chemical of potential concern at your site, we urge you to work with the EPA Regional risk assessor assigned to the project in order to develop or obtain documentation for provisional values. EPA Region 3 furnishes documents only when needed to support Regional risk assessments or recommendations.

11. Why is there no oral RfD for mercury? How should I handle mercury?

IRIS gives oral RfDs for mercuric chloride and for methylmercury, but not for elemental mercury. Therefore, the RBC Table reflects this primary source. Consult your toxicologist to determine which of the available mercury numbers is suitable for the conditions at your site (e.g., whether mercury is likely to be organic or inorganic.)

12. How are children's risks considered?

The RBCs were examined in 2001 to determine whether the child receptor would be expected to be more sensitive. Because most carcinogenic RBCs already include the child lifetime segment, and worker RBCs do not need to include the child, this assessment focused on non-cancer RBCs for water, air, and fish. (Residential soil non-cancer RBCs already are based on children's exposure.)

For tap water RBCs, 212 chemicals (out of about 450) had child RBCs that would be

lower than adult RBCs. In all cases but one, the difference was a factor of 2.3. The single exception involved a factor of 1.24. For air RBCs, 306 chemicals had child RBCs that would be lower than adult RBCs. In all cases the difference was a factor of 2.8. (This also applies only to the use of inhalation RfDs, not RfCs.) For fish RBCs, 286 chemicals had child RBCs that would be lower than adult RBCs. In all cases but one, the difference was a factor of 2.3. The single exception involved a factor of 1.11.

Therefore, child users could possibly have lower noncancer RBCs, but the factor is less than 3. Users of the RBC table should be aware of this issue in case they wish to consider the child receptor beyond the current standard RBCs. (Note that Region III guidance instructs users to include a tenfold screening factor for non-carcinogens when preparing a Region III risk assessment, for reasons of additivity.)

This FAQ response addresses only the differences in exposure factors between children and adults. Age-based differences in toxicity have not yet been defined for most chemicals. (There are rare exceptions, such as vinyl chloride and nitrate. Note that the child is more sensitive to nitrate, and this may need to be considered when assessing site-specific nitrate risk.)

13. The cadmium numbers are labeled "food" and "water." Which do I use if I have another medium, such as soil?

    The cadmium RfDs on IRIS are based on the same study. The food RfD incorporates a 2.5% absorption adjustment; the water RfD incorporates a 5% absorption adjustment. For another medium such as soil, the risk assessor should choose the number whose absorption factor most closely matches the expected conditions at the site. For example, if the expected absorption of cadmium from soil is 3%, the food-based number would be a good approximation.

14. The slope factors for TCE and benzene are actually ranges, yet the RBC table shows only a single number. Which number was chosen and why?

    For both chemicals, the upper end of the slope factor range was chosen. This is because the RBC Table is a screening tool, and the consequences of screening out a chemical that could pose a significant risk are more serious than the consequences of carrying the chemical through to the next step of the risk assessment. (At each step of the risk assessment, the risk is further refined using site-specific analysis. Chemicals can always be eliminated from the risk assessment at a later step than the initial screening, if appropriate.)

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

							Risk-based concentrations					Region III SSLs	
							Tap	Ambient		Soil		Soil, for groundwater migration	
		RfDo	CSFo	RfDi	CSFi		water	air	Fish	Industrial	Residential	DAF 1	DAF 20
Chemical	CAS	mg/kg/d	1/mg/kg/d	mg/kg/d	1/mg/kg/d	VOC	ug/l	ug/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ACETALDEHYDE	75070			2.57E-003 I	7.7E-003 I	y	1.6E+000 C	8.1E-001 C				3.8E-004	7.7E-003 C
ACETOCHLOR	34256821	2E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
ACETONE	67641	1.00E-001 I				y	6.1E+002 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	1.2E-001	2.5E+000 N
ACETONITRILE	75058			1.7E-002 I		y	1.2E+002 N	6.2E+001 N				2.9E-002	5.8E-001 N
ACETOPHENONE	98862	1.00E-001 I		5.70E-006 W		y	4.2E-002 N	2.1E-002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	1.1E-005	2.2E-004 N
ACROLEIN	107028	2.00E-002 H		5.70E-006 I		y	4.2E-002 N	2.1E-002 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	1.0E-005	2.0E-004 N
ACRYLAMIDE	79061	2.00E-004 I	4.50E+000 I		4.50E+000 I		1.5E-002 C	1.4E-003 C	7.0E-004 C	1.3E+000 C	1.4E-001 C	3.7E-006	7.4E-005 C
ACRYLONITRILE	107131	1.00E-003 H	5.40E-001 I	5.70E-004 I	2.40E-001 I	y	3.7E-002 C	2.6E-002 C	5.8E-003 C	1.1E+001 C	1.2E+000 C	7.4E-006	1.5E-004 C
ALACHLOR	15972608	1.00E-002 I	8.00E-002 H				8.4E-001 C	7.8E-002 C	3.9E-002 C	7.2E+001 C	8.0E+000 C	3.5E-004	7.0E-003 C
ALAR	1596845	1.50E-001 I					5.5E+003 N	5.5E+002 N	2.0E+002 N	3.1E+005 N	1.2E+004 N		
ALDICARB	116063	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N	1.0E-002	2.1E-001 N
ALDICARB SULFONE	1646884	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N	7.5E-003	1.5E-001 N
ALDRIN	309002	3.00E-005 I	1.70E+001 I		1.70E+001 I		3.9E-003 C	3.7E-004 C	1.9E-004 C	3.4E-001 C	3.8E-002 C	3.8E-004	7.7E-003 C
ALUMINUM	7429905	1.00E+000 E		1.00E-003 E			3.7E+004 N	3.7E+000 N	1.4E+003 N	2.0E+006 N	7.8E+004 N		
AMINODINITROTOLUENES		6.00E-005 E					2.2E+000 N	2.2E-001 N	8.1E-002 N	1.2E+002 N	4.7E+000 N		
4-AMINOPYRIDINE	504245	2.00E-005 H					7.3E-001 N	7.3E-002 N	2.7E-002 N	4.1E+001 N	1.6E+000 N		
AMMONIA	7664417			2.86E-002 I		y	2.1E+002 N	1.0E+002 N					
ANILINE	62533	7.00E-003 E	5.70E-003 I	2.90E-004 I			1.2E+001 C	1.1E+000 N	5.5E-001 C	1.0E+003 C	1.1E+002 C !	6.8E-003	1.4E-001 C
ANTIMONY	7440360	4.00E-004 I					1.5E+001 N	1.5E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N	6.6E-001	1.3E+001 N
ANTIMONY PENTOXIDE	1314609	5.00E-004 H					1.8E+001 N	1.8E+000 N	6.8E-001 N	1.0E+003 N	3.9E+001 N		
ANTIMONY TETROXIDE	1332816	4.00E-004 H					1.5E+001 N	1.5E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N		
ANTIMONY TRIOXIDE	1309644	4.00E-004 H		5.70E-005 I			1.5E+001 N	2.1E-001 N	5.4E-001 N	8.2E+002 N	3.1E+001 N		
ARSENIC	7440382	3.00E-004 I	1.50E+000 I		1.51E+001 I		4.5E-002 C	4.1E-004 C	2.1E-003 C	3.8E+000 C	4.3E-001 C	1.3E-003	2.6E-002 C
ARSINE	7784421			1.40E-005 I		y	1.0E-001 N	5.1E-002 N					
ASSURE	76578148	9.00E-003 I					3.3E+002 N	3.3E+001 N	1.2E+001 N	1.8E+004 N	7.0E+002 N		
ATRAZINE	1912249	3.50E-002 I	2.20E-001 H				3.0E-001 C	2.8E-002 C	1.4E-002 C	2.6E+001 C	2.9E+000 C	4.4E-004	8.8E-003 C
AZOBENZENE	103333		1.10E-001 I		1.10E-001 I		6.1E-001 C	5.7E-002 C	2.9E-002 C	5.2E+001 C	5.8E+000 C	1.8E-003	3.5E-002 C
BARIUM	7440393	7.00E-002 I		1.40E-004 A			2.6E+003 N	5.1E-001 N	9.5E+001 N	1.4E+005 N	5.5E+003 N	1.1E+002	2.1E+003 N
BAYGON	114261	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N		
BAYTHROID	68359375	2.50E-002 I					9.1E+002 N	9.1E+001 N	3.4E+001 N	5.1E+004 N	2.0E+003 N		
BENTAZON	25057890	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N		
BENZALDEHYDE	100527	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
BENZENE	71432	3.00E-003 E	5.5E-002 I	1.70E-003 E	2.90E-002 I	y	3.2E-001 C	2.2E-001 C	5.7E-002 C	1.0E+002 C	1.2E+001 C	9.0E-005	1.8E-003 C
BENZENETHIOL	108985	1.00E-005 H				y	6.1E-002 N	3.7E-002 N	1.4E-002 N	2.0E+001 N	7.8E-001 N		
BENZIDINE	92875	3.00E-003 I	2.30E+002 I		2.30E+002 I		2.9E-004 C	2.7E-005 C	1.4E-005 C	2.5E-002 C	2.8E-003 C		
BENZOIC ACID	65850	4.00E+000 I					1.5E+005 N	1.5E+004 N	5.4E+003 N	8.2E+006 N	3.1E+005 N		
BENZYL ALCOHOL	100516	3.00E-001 H					1.1E+004 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N	4.4E+000	8.8E+001 N
BENZYL CHLORIDE	100447		0.17 I			y	6.2E-002 C	3.7E-002 C	1.9E-002 C	3.4E+001 C	3.8E+000 C	1.9E-005	3.7E-004 C
BERYLLIUM	7440417	2.00E-003 I		5.7E-006 I	8.40E+000 I		7.3E+001 N	7.5E-004 C	2.7E+000 N	4.1E+003 N	1.6E+002 N	5.8E+001	1.2E+003 N
BIPHENYL	92524	5.00E-002 I				y	3.0E+002 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N	4.8E+000	9.6E+001 N
BIS(2-CHLOROETHYL)ETHER	111444		1.10E+000 I		1.10E+000 I	y	9.6E-003 C	5.7E-003 C	2.9E-003 C	5.2E+000 C	5.8E-001 C	2.2E-006	4.4E-005 C
BIS(2-CHLOROISOPROPYL)ETHER	108601	4.00E-002 I	7.00E-002 H		3.50E-002 H	y	2.6E-001 C	1.8E-001 C	4.5E-002 C	8.2E+001 C	9.1E+000 C	8.4E-005	1.7E-003 C
BIS(CHLOROMETHYL)ETHER	542881		2.20E+002 I		2.20E+002 I	y	4.8E-005 C	2.8E-005 C	1.4E-005 C	2.6E-002 C	2.9E-003 C	9.7E-009	1.9E-007 C
BIS(2-ETHYLHEXYL)PHTHALATE	117817	2.00E-002 I	1.40E-002 I		1.40E-002 E		4.8E+000 C	4.5E-001 C	2.3E-001 C	4.1E+002 C	4.6E+001 C	1.4E+002	2.9E+003 C
BORON	7440428	9.00E-002 I		5.70E-003 H			3.3E+003 N	2.1E+001 N	1.2E+002 N	1.8E+005 N	7.0E+003 N		

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Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg	Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg	DAF 20 mg/kg
BROMODICHLOROMETHANE	75274	2.00E-002 I	6.20E-002 I			y	1.7E-001 C	1.0E-001 C	5.1E-002 C	9.2E+001 C	1.0E+001 C	5.4E-005	1.1E-003 C
BROMOETHENE	593602			8.6E-004 I	1.10E-001 H	y	1.1E-001 C	5.7E-002 C				5.4E-005	1.1E-003 C
BROMOFORM	75252	2.00E-002 I	7.90E-003 I		3.90E-003 I		8.5E+000 C	1.6E+000 C	4.0E-001 C	7.2E+002 C	8.1E+001 C	3.3E-003	6.7E-002 C
BROMOMETHANE	74839	1.40E-003 I		1.40E-003 I		y	8.5E+000 N	5.1E+000 N	1.9E+000 N	2.9E+003 N	1.1E+002 N	2.1E-003	4.1E-002 N
BROMOPHOS	2104963	5.00E-003 H					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
1,3-BUTADIENE	106990				1.80E+000 H	y	7.0E-003 C	3.5E-003 C				3.9E-006	7.8E-005 C
1-BUTANOL	71363	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	7.8E-001	1.6E+001 N
BUTYLBENZYLPHTHALATE	85687	2.00E-001 I					7.3E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N	8.4E+002	1.7E+004 N
BUTYLATE	2008415	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
N-BUTYLBENZENE	104518	4.00E-002 E				y	2.4E+002 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
SEC-BUTYLBENZENE	135988	4.00E-002 E				y	2.4E+002 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
TERT-BUTYLBENZENE	98066	4.00E-002 E				y	2.4E+002 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
CADMIUM-WATER	7440439	5.00E-004 I		5.7E-005 E	6.30E+000 I		1.8E+001 N	9.9E-004 C	6.8E-001 N	1.0E+003 N	3.9E+001 N	1.4E+000	2.7E+001 N
CADMIUM-FOOD	7440439	1.00E-003 I		5.7E-005 E	6.30E+000 I		3.7E+001 N	9.9E-004 C	1.4E+000 N	2.0E+003 N	7.8E+001 N	2.7E+000	5.5E+001 N
CAPROLACTAM	105602	5.00E-001 I					1.8E+004 N	1.8E+003 N	6.8E+002 N	1.0E+006 N	3.9E+004 N		
CARBARYL	63252	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	1.5E+000	3.0E+001 N
CARBON DISULFIDE	75150	1.00E-001 I		2.00E-001 I		y	1.0E+003 N	7.3E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	9.5E-001	1.9E+001 N
CARBON TETRACHLORIDE	56235	7.00E-004 I	1.30E-001 I	5.71E-004 E	5.30E-002 I	y	1.6E-001 C	1.2E-001 C	2.4E-002 C	4.4E+001 C	4.9E+000 C	1.1E-004	2.1E-003 C
CARBOSULFAN	55285148	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
CHLORAL HYDRATE	302170	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
CHLORANIL	118752		4.00E-001 H				1.7E-001 C	1.6E-002 C	7.9E-003 C	1.4E+001 C	1.6E+000 C		
CHLORDANE	57749	5.00E-004 I	3.5E-001 I	2.00E-004 I	3.5E-001 I		1.9E-001 C	1.8E-002 C	9.0E-003 C	1.6E+001 C	1.8E+000 C	4.6E-002	9.2E-001 C
CHLORINE	7782505	1.00E-001 I		5.7E-005 E		y	4.2E-001 N	2.1E-001 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
CHLORINE DIOXIDE	10049044	3.00E-002 I		5.70E-005 I		y	4.2E-001 N	2.1E-001 N	4.1E+001 N	6.1E+004 N	2.3E+003 N		
CHLOROACETIC ACID	79118	2.00E-003 H					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N		
4-CHLOROANILINE	106478	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N	4.8E-002	9.7E-001 N
CHLOROBENZENE	108907	2.00E-002 I		1.7E-002 E		y	1.1E+002 N	6.2E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	4.0E-002	8.0E-001 N
CHLOROBENZILATE	510156	2.00E-002 I	2.70E-001 H		2.70E-001 H		2.5E-001 C	2.3E-002 C	1.2E-002 C	2.1E+001 C	2.4E+000 C	1.3E-003	2.7E-002 C
P-CHLOROBENZOIC ACID	74113	2.00E-001 H					7.3E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N		
2-CHLORO-1,3-BUTADIENE	126998	2.00E-002 A		2.00E-003 H		y	1.4E+001 N	7.3E+000 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	6.0E-003	1.2E-001 N
1-CHLOROBUTANE	109693	4.00E-001 H				y	2.4E+003 N	1.5E+003 N	5.4E+002 N	8.2E+005 N	3.1E+004 N	1.0E+000	2.0E+001 N
1-CHLORO-1,1-DIFLUOROETHANE	75683			1.40E+001 I		y	1.0E+005 N	5.1E+004 N				7.0E+001	1.4E+003 N
CHLORODIFLUOROMETHANE	75456			1.40E+001 I		y	1.0E+005 N	5.1E+004 N				7.0E+001	1.4E+003 N
CHLOROETHANE	75003	4.00E-001 E	2.90E-003 E	2.90E+000 I		y	3.6E+000 C	2.2E+000 C	1.1E+000 C	2.0E+003 C	2.2E+002 C	9.6E-004	1.9E-002 C
CHLOROFORM	67663	1.00E-002 I		8.6E-005 E	8.10E-002 I	y	1.5E-001 C !	7.7E-002 C !	1.4E+001 N	2.0E+004 N	7.8E+002 N	4.5E-005	9.1E-004 C
CHLOROMETHANE	74873		1.30E-002 H	2.6E-002 I	3.5E-003 E	y	2.1E+000 C	1.8E+000 C	2.4E-001 C	4.4E+002 C	4.9E+001 C	5.2E-004	1.0E-002 C
4-CHLORO-2-METHYLANILINE	95692		5.80E-001 H				1.2E-001 C	1.1E-002 C	5.4E-003 C	9.9E+000 C	1.1E+000 C		
BETA-CHLORONAPHTHALENE	91587	8.00E-002 I				y	4.9E+002 N	2.9E+002 N	1.1E+002 N	1.6E+005 N	6.3E+003 N	1.6E+000	3.2E+001 N
O-CHLORONITROBENZENE	88733		2.50E-002 H			y	4.2E-001 C	2.5E-001 C	1.3E-001 C	2.3E+002 C	2.6E+001 C		
P-CHLORONITROBENZENE	100005		1.80E-002 H			y	5.9E-001 C	3.5E-001 C	1.8E-001 C	3.2E+002 C	3.5E+001 C		
2-CHLOROPHENOL	95578	5.00E-003 I				y	3.0E+001 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
2-CHLOROPROPANE	75296			2.90E-002 H		y	2.1E+002 N	1.1E+002 N				6.6E-002	1.3E+000 N
O-CHLOROTOLUENE	95498	2.00E-002 I				y	1.2E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	6.5E-002	1.3E+000 N
CHLORPYRIFOS	2921882	3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N	3.2E+000	6.3E+001 N
CHLORPYRIFOS-METHYL	5598130	1.00E-002 H					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		

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Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg	Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg	DAF 20 mg/kg
CHROMIUM III	16065831	1.50E+000 I					5.5E+004 N	5.5E+003 N	2.0E+003 N	3.1E+006 N	1.2E+005 N	9.9E+007	2.0E+009 N
CHROMIUM VI	18540299	3.00E-003 I		3.00E-005 I	4.10E+001 H		1.1E+002 N	1.5E-004 C	4.1E+000 N	6.1E+003 N	2.3E+002 N	2.1E+000	4.2E+001 N
COBALT	7440484	2.00E-002 E		5.7E-006 E			7.3E+002 N	2.1E-002 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
COKE OVEN EMISSIONS (COAL TAR)	8007452				2.2 I			2.8E-003 C					
COPPER	7440508	4.00E-002 H					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N	5.3E+002	1.1E+004 N
CROTONALDEHYDE	123739		1.90E+000 H			y	5.6E-003 C	3.3E-003 C	1.7E-003 C	3.0E+000 C	3.4E-001 C	1.5E-005	3.1E-004 C
CUMENE	98828	1.00E-001 I		1.10E-001 I		y	6.6E+002 N	4.0E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	3.2E+000	6.4E+001 N
CYANIDE (FREE)	57125	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	7.4E+000	1.5E+002 N
CALCIUM CYANIDE	592018	4E-002 I					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
COPPER CYANIDE	544923	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
CYANAZINE	21725462	2.00E-003 H	8.40E-001 H				8.0E-002 C	7.5E-003 C	3.8E-003 C	6.8E+000 C	7.6E-001 C	2.6E-005	5.3E-004 C
CYANOGEN	460195	4.00E-002 I				y	2.4E+002 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
CYANOGEN BROMIDE	506683	9.00E-002 I					3.3E+003 N	3.3E+002 N	1.2E+002 N	1.8E+005 N	7.0E+003 N		
CYANOGEN CHLORIDE	506774	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
HYDROGEN CYANIDE	74908	2.00E-002 I		8.60E-004 I		y	6.2E+000 N	3.1E+000 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	1.1E-001	2.2E+000 N
POTASSIUM CYANIDE	151508	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
POTASSIUM SILVER CYANIDE	506616	2.00E-001 I					7.3E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N		
SILVER CYANIDE	506649	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	3.1E+001	6.2E+002 N
SODIUM CYANIDE	143339	4.00E-002 I					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
THIOCYANATE		5.00E-002 E					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
ZINC CYANIDE	557211	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N	1.1E+002	2.3E+003 N
CYCLOHEXANONE	108941	5.00E+000 I					1.8E+005 N	1.8E+004 N	6.8E+003 N	1.0E+007 N	3.9E+005 N	6.1E+001	1.2E+003 N
CYHALOTHRIN/KARATE	68085858	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
CYPERMETHRIN	52315078	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
DACTHAL	1861321	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
DALAPON	75990	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N	3.5E-001	7.1E+000 N
DDD	72548		2.40E-001 I				2.8E-001 C	2.6E-002 C	1.3E-002 C	2.4E+001 C	2.7E+000 C	5.6E-001	1.1E+001 C
DDE	72559		3.40E-001 I				2.0E-001 C	1.8E-002 C	9.3E-003 C	1.7E+001 C	1.9E+000 C	1.8E+000	3.5E+001 C
DDT	50293	5.00E-004 I	3.40E-001 I		3.40E-001 I		2.0E-001 C	1.8E-002 C	9.3E-003 C	1.7E+001 C	1.9E+000 C	5.8E-002	1.2E+000 C
DIAZINON	333415	9.00E-004 H					3.3E+001 N	3.3E+000 N	1.2E+000 N	1.8E+003 N	7.0E+001 N	2.1E-002	4.3E-001 N
DIBENZOFURAN	132649	4.00E-003 E				y	2.4E+001 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N	3.8E-001	7.7E+000 N
1,4-DIBROMOBENZENE	106376	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
DIBROMOCHLOROMETHANE	124481	2.00E-002 I	8.40E-002 I			y	1.3E-001 C	7.5E-002 C	3.8E-002 C	6.8E+001 C	7.6E+000 C	4.1E-005	8.3E-004 C
1,2-DIBROMO-3-CHLOROPROPANE	96128		1.40E+000 H	5.70E-005 I	2.40E-003 H	y	4.7E-002 C !	2.1E-001 N	2.3E-003 C	4.1E+000 C	4.6E-001 C	4.4E-005	8.7E-004 C
1,2-DIBROMOETHANE	106934		8.50E+001 I	5.70E-005 H	7.60E-001 I	y	7.5E-004 C	8.2E-003 C	3.7E-005 C	6.7E-002 C	7.5E-003 C	4.3E-007	8.5E-006 C
DIBUTYLPHTHALATE	84742	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	2.5E+002	5.0E+003 N
DICAMBA	1918009	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N	2.2E-001	4.5E+000 N
1,2-DICHLOROBENZENE	95501	9.00E-002 I		4.00E-002 H		y	2.7E+002 N	1.5E+002 N	1.2E+002 N	1.8E+005 N	7.0E+003 N	2.3E-001	4.6E+000 N
1,3-DICHLOROBENZENE	541731	3.00E-002 E				y	1.8E+002 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N	1.5E-001	2.9E+000 N
1,4-DICHLOROBENZENE	106467	3.00E-002 E	2.40E-002 H	2.29E-001 I	2.2E-002 E	y	4.7E-001 C	2.8E-001 C	1.3E-001 C	2.4E+002 C	2.7E+001 C	3.6E-004	7.1E-003 C
3,3'-DICHLOROBENZIDINE	91941		4.50E-001 I				1.5E-001 C	1.4E-002 C	7.0E-003 C	1.3E+001 C	1.4E+000 C	2.5E-004	4.9E-003 C
1,4-DICHLORO-2-BUTENE	764410				9.30E+000 H	y	1.3E-003 C	6.7E-004 C				4.0E-007	8.0E-006 C
DICHLORODIFLUOROMETHANE	75718	2.00E-001 I		5.00E-002 A		y	3.5E+002 N	1.8E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N	5.5E-001	1.1E+001 N
1,1-DICHLOROETHANE	75343	1.00E-001 H		1.40E-001 A		y	8.0E+002 N	5.1E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	2.3E-001	4.5E+000 N
1,2-DICHLOROETHANE	107062	3.00E-002 E	9.10E-002 I	1.40E-003 E	9.10E-002 I	y	1.2E-001 C	6.9E-002 C	3.5E-002 C	6.3E+001 C	7.0E+000 C	5.2E-005	1.0E-003 C

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Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg	Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg	DAF 20 mg/kg
**1,1-DICHLOROETHENE	75354	5.00E-002 I		6.00E-002 I		y	3.5E+002 N	2.2E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N	1.5E-001	2.9E+000 N
CIS-1,2-DICHLOROETHENE	156592	1.00E-002 H				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N	1.7E-002	3.5E-001 N
TRANS-1,2-DICHLOROETHENE	156605	2.00E-002 I				y	1.2E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	4.1E-002	8.2E-001 N
TOTAL 1,2-DICHLOROETHENE	540590	9.00E-003 H				y	5.5E+001 N	3.3E+001 N	1.2E+001 N	1.8E+004 N	7.0E+002 N	1.9E-002	3.7E-001 N
2,4-DICHLOROPHENOL	120832	3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N	6.0E-002	1.2E+000 N
2,4-D	94757	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N	4.5E-001	9.0E+000 N
4-(2,4-DICHLOROPHENOXY)BUTYRIC ACID	94826	8E-003 I					2.9E+002 N	2.9E+001 N	1.1E+001 N	1.6E+004 N	6.3E+002 N		
1,2-DICHLOROPROPANE	78875		6.80E-002 H	1.14E-003 I		y	1.6E-001 C	9.2E-002 C	4.6E-002 C	8.4E+001 C	9.4E+000 C	1.0E-004	2.1E-003 C
2,3-DICHLOROPROPANOL	616239	3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N		
1,3-DICHLOROPROPENE	542756	3.00E-002 I	1.00E-001 I	5.71E-003 I	1.00E-002 I	y	4.4E-001 C	6.3E-001 C	3.2E-002 C	5.7E+001 C	6.4E+000 C	1.6E-004	3.1E-003 C
DICHLORVOS	62737	5E-004 I	0.29 I	1.43E-004 I			2.3E-001 C	2.2E-002 C	1.1E-002 C	2.0E+001 C	2.2E+000 C	5.5E-005	1.1E-003 C
DICOFOL	115322		4.4E-001 W				1.5E-001 C	1.4E-002 C	7.2E-003 C	1.3E+001 C	1.5E+000 C	9.3E-004	1.9E-002 C
DICYCLOPENTADIENE	77736	3E-002 H		6.00E-005 A		y	4.4E-001 N	2.2E-001 N	4.1E+001 N	6.1E+004 N	2.3E+003 N		
DIELDRIN	60571	5.00E-005 I	1.60E+001 I		1.60E+001 I		4.2E-003 C	3.9E-004 C	2.0E-004 C	3.6E-001 C	4.0E-002 C	1.1E-004	2.2E-003 C
DIESEL EMISSIONS				1.40E-003 I				5.1E+000 N					
DIETHYLPHTHALATE	84662	8.00E-001 I					2.9E+004 N	2.9E+003 N	1.1E+003 N	1.6E+006 N	6.3E+004 N	2.3E+001	4.5E+002 N
DIETHYLENE GLYCOL, MONOBUTYL ETHER	112345			5.70E-003 H				2.1E+001 N					
DIETHYLENE GLYCOL, MONOETHYL ETHER	111900	2.00E+000 H					7.3E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N		
DI(2-ETHYLHEXYL)ADIPATE	103231	6.00E-001 I	1.20E-003 I				5.6E+001 C	5.2E+000 C	2.6E+000 C	4.8E+003 C	5.3E+002 C		
DIETHYLSTILBESTROL	56531		4.70E+003 H				1.4E-005 C	1.3E-006 C	6.7E-007 C	1.2E-003 C	1.4E-004 C		
DIFENZOQUAT (AVENGE)	43222486	8.00E-002 I					2.9E+003 N	2.9E+002 N	1.1E+002 N	1.6E+005 N	6.3E+003 N		
1,1-DIFLUOROETHANE	75376			1.10E+001 I		y	8.0E+004 N	4.0E+004 N					
DIISOPROPYL METHYLPHOSPHONATE (DIMP)	1445756	8.00E-002 I					2.9E+003 N	2.9E+002 N	1.1E+002 N	1.6E+005 N	6.3E+003 N		
3,3'-DIMETHOXYBENZIDINE	119904		1.40E-002 H				4.8E+000 C	4.5E-001 C	2.3E-001 C	4.1E+002 C	4.6E+001 C		
DIMETHYLAMINE	124403			5.70E-006 W		y	4.2E-002 N	2.1E-002 N				8.5E-006	1.7E-004 N
2,4-DIMETHYLANILINE HYDROCHLORIDE	21436964		5.80E-001 H				1.2E-001 C	1.1E-002 C	5.4E-003 C	9.9E+000 C	1.1E+000 C		
2,4-DIMETHYLANILINE	95681		7.50E-001 H				8.9E-002 C	8.3E-003 C	4.2E-003 C	7.6E+000 C	8.5E-001 C		
N,N-DIMETHYLANILINE	121697	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N		
3,3'-DIMETHYLBENZIDINE	119937		9.20E+000 H				7.3E-003 C	6.8E-004 C	3.4E-004 C	6.2E-001 C	6.9E-002 C		
1,1-DIMETHYLHYDRAZINE	57147		2.60E+000 W		3.50E+000 W		2.6E-002 C	1.8E-003 C	1.2E-003 C	2.2E+000 C	2.5E-001 C		
1,2-DIMETHYLHYDRAZINE	540738		3.70E+001 W		3.70E+001 W		1.8E-003 C	1.7E-004 C	8.5E-005 C	1.5E-001 C	1.7E-002 C		
2,4-DIMETHYLPHENOL	105679	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	3.4E-001	6.7E+000 N
2,6-DIMETHYLPHENOL	576261	6.00E-004 I					2.2E+001 N	2.2E+000 N	8.1E-001 N	1.2E+003 N	4.7E+001 N		
3,4-DIMETHYLPHENOL	95658	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N		
DIMETHYLPHTHALATE	131113	1.00E+001 W					3.7E+005 N	3.7E+004 N	1.4E+004 N	2.0E+007 N	7.8E+005 N		
1,2-DINITROBENZENE	528290	4.00E-004 H					1.5E+001 N	1.5E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N		
1,3-DINITROBENZENE	99650	1.00E-004 I					3.7E+000 N	3.7E-001 N	1.4E-001 N	2.0E+002 N	7.8E+000 N	1.8E-003	3.7E-002 N
1,4-DINITROBENZENE	100254	4.00E-004 H					1.5E+001 N	1.5E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N		
4,6-DINITRO-O-CYCLOHEXYL PHENOL	131895	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N		
**4,6-DINITRO-2-METHYLPHENOL	534521	1.00E-004 E					3.7E+000 N	3.7E-001 N	1.4E-001 N	2.0E+002 N	7.8E+000 N		
2,4-DINITROPHENOL	51285	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N		
DINITROTOLUENE MIX			6.80E-001 I				9.8E-002 C	9.2E-003 C	4.6E-003 C	8.4E+000 C	9.4E-001 C		
2,4-DINITROTOLUENE	121142	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N	2.9E-002	5.7E-001 N
2,6-DINITROTOLUENE	606202	1.00E-003 H					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N	1.2E-002	2.5E-001 N
DINOSEB	88857	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N	8.7E-003	1.7E-001 N

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DIOCTYLPHTHALATE	117840	2.00E-002 H					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	1.2E+005	2.4E+006 N
1,4-DIOXANE	123911		1.10E-002 I				6.1E+000 C	5.7E-001 C	2.9E-001 C	5.2E+002 C	5.8E+001 C	1.3E-003	2.6E-002 C
DIPHENYLAMINE	122394	2.50E-002 I					9.1E+002 N	9.1E+001 N	3.4E+001 N	5.1E+004 N	2.0E+003 N	1.3E+000	2.5E+001 N
1,2-DIPHENYLHYDRAZINE	122667		8.00E-001 I		8.00E-001 I		8.4E-002 C	7.8E-003 C	3.9E-003 C	7.2E+000 C	8.0E-001 C	1.3E-004	2.5E-003 C
DIQUAT	85007	2.20E-003 I					8.0E+001 N	8.0E+000 N	3.0E+000 N	4.5E+003 N	1.7E+002 N	1.7E-002	3.3E-001 N
DISULFOTON	298044	4.00E-005 I					1.5E+000 N	1.5E-001 N	5.4E-002 N	8.2E+001 N	3.1E+000 N	3.2E-003	6.4E-002 N
1,4-DITHIANE	505293	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
DIURON	330541	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N	5.8E-002	1.2E+000 N
ENDOSULFAN	115297	6.00E-003 I					2.2E+002 N	2.2E+001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N	9.8E-001	2.0E+001 N
ENDRIN	72208	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N	2.7E-001	5.4E+000 N
EPICHLOROHYDRIN	106898	2.00E-003 H	9.90E-003 I	2.86E-004 I	4.20E-003 I	y	2.0E+000 N	1.0E+000 N	3.2E-001 C !	5.8E+002 C !	6.5E+001 C !	4.2E-004	8.4E-003 N
ETHION	563122	5.00E-004 I					1.8E+001 N	1.8E+000 N	6.8E-001 N	1.0E+003 N	3.9E+001 N	3.2E-001	6.4E+000 N
2-ETHOXYETHANOL	110805	4.00E-001 H		5.70E-002 I			1.5E+004 N	2.1E+002 N	5.4E+002 N	8.2E+005 N	3.1E+004 N	3.3E+000	6.5E+001 N
ETHYL ACETATE	141786	9.00E-001 I				y	5.5E+003 N	3.3E+003 N	1.2E+003 N	1.8E+006 N	7.0E+004 N	1.7E+000	3.5E+001 N
ETHYLBENZENE	100414	1.00E-001 I		2.90E-001 I	3.85E-003 E	y	3.3E+000 C	1.6E+000 C	1.4E+002 N	2.0E+005 N	7.8E+003 N	1.8E-003	3.6E-002 C
ETHYLENE DIAMINE	107153	2.00E-002 H					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
ETHYLENE GLYCOL	107211	2.00E+000 I					7.3E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N	1.5E+001	3.0E+002 N
ETHYLENE GLYCOL, MONOBUTYL ETHER	111762	5.00E-001 I		3.70E+000 I			1.8E+004 N	1.4E+004 N	6.8E+002 N	1.0E+006 N	3.9E+004 N		
ETHYLENE OXIDE	75218		1.00E+000 H		3.50E-001 H	y	2.3E-002 C	1.8E-002 C	3.2E-003 C	5.7E+000 C	6.4E-001 C	4.8E-006	9.5E-005 C
ETHYLENE THIOUREA	96457	8.00E-005 I	1.1E-001 H				6.1E-001 C !	5.7E-002 C !	2.9E-002 C !	5.2E+001 C !	5.8E+000 C !		
ETHYL ETHER	60297	2.00E-001 I				y	1.2E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N	4.2E-001	8.5E+000 N
ETHYL METHACRYLATE	97632	9.00E-002 H				y	5.5E+002 N	3.3E+002 N	1.2E+002 N	1.8E+005 N	7.0E+003 N	1.0E+000	2.1E+001 N
FENAMIPHOS	22224926	2.50E-004 I					9.1E+000 N	9.1E-001 N	3.4E-001 N	5.1E+002 N	2.0E+001 N	7.8E-003	1.6E-001 N
FLUOMETURON	2164172	1.30E-002 I					4.7E+002 N	4.7E+001 N	1.8E+001 N	2.7E+004 N	1.0E+003 N		
FLUORINE	7782414	6.00E-002 I					2.2E+003 N	2.2E+002 N	8.1E+001 N	1.2E+005 N	4.7E+003 N		
FOMESAFEN	72178020		1.90E-001 I				3.5E-001 C	3.3E-002 C	1.7E-002 C	3.0E+001 C	3.4E+000 C		
FONOFOS	944229	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N	1.8E-001	3.5E+000 N
FORMALDEHYDE	50000	2.00E-001 I			4.50E-002 I		7.3E+003 N	1.4E-001 C	2.7E+002 N	4.1E+005 N	1.6E+004 N	1.5E+000	3.0E+001 N
FORMIC ACID	64186	2.00E+000 H					7.3E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N		
FURAN	110009	1.00E-003 I				y	6.1E+000 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N	1.5E-003	3.0E-002 N
FURAZOLIDONE	67458		3.80E+000 H				1.8E-002 C	1.6E-003 C	8.3E-004 C	1.5E+000 C	1.7E-001 C		
FURFURAL	98011	3.00E-003 I		1.00E-002 A			1.1E+002 N	3.7E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N	2.3E-002	4.6E-001 N
GLYCIDALDEHYDE	765344	4.00E-004 I		2.90E-004 H			1.5E+001 N	1.1E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N		
GLYPHOSATE	1071836	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	2.6E+001	5.3E+002 N
HEPTACHLOR	76448	5.00E-004 I	4.50E+000 I		4.50E+000 I		1.5E-002 C	1.4E-003 C	7.0E-004 C	1.3E+000 C	1.4E-001 C	4.2E-002	8.4E-001 C
HEPTACHLOR EPOXIDE	1024573	1.30E-005 I	9.10E+000 I		9.10E+000 I		7.4E-003 C	6.9E-004 C	3.5E-004 C	6.3E-001 C	7.0E-002 C	1.2E-003	2.5E-002 C
HEXABROMOBENZENE	87821	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N		
HEXACHLOROBENZENE	118741	8.00E-004 I	1.60E+000 I		1.60E+000 I		4.2E-002 C	3.9E-003 C	2.0E-003 C	3.6E+000 C	4.0E-001 C	2.6E-003	5.2E-002 C
HEXACHLOROBUTADIENE	87683	2.00E-004 H	7.80E-002 I		7.80E-002 I		8.6E-001 C !	8.0E-002 C !	4.0E-002 C !	7.3E+001 C !	8.2E+000 C !	9.2E-002	1.8E+000 C
ALPHA-HCH	319846		6.30E+000 I		6.30E+000 I		1.1E-002 C	9.9E-004 C	5.0E-004 C	9.1E-001 C	1.0E-001 C	4.5E-005	8.9E-004 C
BETA-HCH	319857		1.80E+000 I		1.80E+000 I		3.7E-002 C	3.5E-003 C	1.8E-003 C	3.2E+000 C	3.5E-001 C	1.6E-004	3.1E-003 C
GAMMA-HCH (LINDANE)	58899	3.00E-004 I	1.30E+000 H				5.2E-002 C	4.8E-003 C	2.4E-003 C	4.4E+000 C	4.9E-001 C	2.2E-004	4.3E-003 C
TECHNICAL HCH	608731		1.80E+000 I		1.80E+000 I		3.7E-002 C	3.5E-003 C	1.8E-003 C	3.2E+000 C	3.5E-001 C		
HEXACHLOROCYCLOPENTADIENE	77474	6.00E-003 I		5.7E-005 I			2.2E+002 N	2.1E-001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N	8.8E+001	1.8E+003 N
HEXACHLORODIBENZODIOXIN MIX	19408743		6.20E+003 I		4.55E+003 I		1.1E-005 C	1.4E-006 C	5.1E-007 C	9.2E-004 C	1.0E-004 C		

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Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

							Risk-based concentrations					Region III SSLs	
							Tap	Ambient		Soil		Soil, for groundwater migration	
		RfDo	CSFo	RfDi	CSFi		water	air	Fish	Industrial	Residential	DAF 1	DAF 20
Chemical	CAS	mg/kg/d	1/mg/kg/d	mg/kg/d	1/mg/kg/d	VOC	ug/l	ug/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
HEXACHLOROETHANE	67721	1.00E-003 I	1.40E-002 I		1.40E-002 I		4.8E+000 C !	4.5E-001 C !	2.3E-001 C !	4.1E+002 C !	4.6E+001 C !	1.8E-002	3.6E-001 C
HEXACHLOROPHENE	70304	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N	1.0E+002	2.0E+003 N
1,6-HEXAMETHYLENE DIISOCYANATE	822060			2.90E-006 I				1.1E-002 N					
HEXANE	110543	6.00E-002 H		5.71E-002 I		y	3.5E+002 N	2.1E+002 N	8.1E+001 N	1.2E+005 N	4.7E+003 N	6.9E-001	1.4E+001 N
2-HEXANONE	591786	4.00E-002 E		1.4E-003 E			1.5E+003 N	5.1E+000 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
HEXAZINONE	51235042	3.30E-002 I					1.2E+003 N	1.2E+002 N	4.5E+001 N	6.7E+004 N	2.6E+003 N		
HMX	2691410	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
HYDRAZINE	302012		3.00E+000 I		1.70E+001 I		2.2E-002 C	3.7E-004 C	1.1E-003 C	1.9E+000 C	2.1E-001 C		
HYDROGEN CHLORIDE	7647010			5.70E-003 I				2.1E+001 N					
HYDROGEN SULFIDE	7783064	3.00E-003 I		2.85E-004 I			1.1E+002 N	1.0E+000 N	4.1E+000 N	6.1E+003 N	2.3E+002 N		
HYDROQUINONE	123319	4.00E-002 H					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
IRON	7439896	3.00E-001 E					1.1E+004 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N		
ISOBUTANOL	78831	3.00E-001 I				y	1.8E+003 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N	5.9E-001	1.2E+001 N
ISOPHORONE	78591	2.00E-001 I	9.50E-004 I				7.0E+001 C	6.6E+000 C	3.3E+000 C	6.0E+003 C	6.7E+002 C	2.1E-002	4.1E-001 C
ISOPROPALIN	33820530	1.50E-002 I					5.5E+002 N	5.5E+001 N	2.0E+001 N	3.1E+004 N	1.2E+003 N		
ISOPROPYL METHYL PHOSPHONIC ACID	1832548	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
TETRAETHYLLEAD	78002	1.00E-007 I					3.7E-003 N	3.7E-004 N	1.4E-004 N	2.0E-001 N	7.8E-003 N	4.6E-005	9.2E-004 N
**KEPONE	143500	3.00E-004 E	8.00E+000 E				8.4E-003 C	7.8E-004 C	3.9E-004 C	7.2E-001 C	8.0E-002 C		
LITHIUM	7439932	2.00E-002 E					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
MALATHION	121755	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	4.0E-001	8.1E+000 N
MALEIC ANHYDRIDE	108316	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
MANGANESE-NONFOOD	7439965	2.00E-002 I		1.43E-005 I			7.3E+002 N	5.2E-002 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	4.8E+001	9.5E+002 N
MANGANESE-FOOD	7439965	1.40E-001 I		1.43E-005 I			5.1E+003 N	5.2E-002 N	1.9E+002 N	2.9E+005 N	1.1E+004 N	3.3E+002	6.7E+003 N
MEPHOSFOLAN	950107	9.00E-005 H					3.3E+000 N	3.3E-001 N	1.2E-001 N	1.8E+002 N	7.0E+000 N		
MEPIQUAT CHLORIDE	24307264	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N		
MERCURIC CHLORIDE	7487947	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N		
MERCURY (INORGANIC)	7439976			8.60E-005 I				3.1E-001 N					
METHYLMERCURY	22967926	1.00E-004 I					3.7E+000 N	3.7E-001 N	1.4E-001 N	2.0E+002 N	7.8E+000 N		
METHACRYLONITRILE	126987	1.00E-004 I		2.00E-004 A		y	1.0E+000 N	7.3E-001 N	1.4E-001 N	2.0E+002 N	7.8E+000 N	2.1E-004	4.2E-003 N
METHANOL	67561	5.00E-001 I					1.8E+004 N	1.8E+003 N	6.8E+002 N	1.0E+006 N	3.9E+004 N	3.8E+000	7.5E+001 N
METHIDATHION	950378	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N		
METHOXYCHLOR	72435	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N	1.5E+001	3.1E+002 N
METHYL ACETATE	79209	1.00E+000 H				y	6.1E+003 N	3.7E+003 N	1.4E+003 N	2.0E+006 N	7.8E+004 N	1.2E+000	2.5E+001 N
METHYL ACRYLATE	96333	3.00E-002 A				y	1.8E+002 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N	5.0E-001	1.0E+001 N
2-METHYLANILINE	95534		2.40E-001 H				2.8E-001 C	2.6E-002 C	1.3E-002 C	2.4E+001 C	2.7E+000 C	2.8E-004	5.7E-003 C
4-(2-METHYL-4-CHLOROPHENOXY) BUTYRIC ACID	94815	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
2-METHYL-4-CHLOROPHENOXYACETIC ACID (MCPA)	94746	5.00E-004 I					1.8E+001 N	1.8E+000 N	6.8E-001 N	1.0E+003 N	3.9E+001 N		
2-(2-METHYL-4-CHLOROPHENOXY)PROPIONIC ACID (MCP	93652	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N		
METHYLCYCLOHEXANE	108872			8.60E-001 H		y	6.3E+003 N	3.1E+003 N					
METHYLENE BROMIDE	74953	1.00E-002 A				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N	1.5E-002	3.0E-001 N
METHYLENE CHLORIDE	75092	6.00E-002 I	7.50E-003 I	8.60E-001 H	1.65E-003 I	y	4.1E+000 C	3.8E+000 C	4.2E-001 C	7.6E+002 C	8.5E+001 C	9.5E-004	1.9E-002 C
4,4'-METHYLENE BIS(2-CHLOROANILINE)	101144	7.00E-004 H	1.30E-001 H		1.30E-001 H		5.2E-001 C	4.8E-002 C	2.4E-002 C	4.4E+001 C	4.9E+000 C		
4,4'-METHYLENE BIS(N,N'-DIMETHYL)ANILINE	101611		4.60E-002 I				1.5E+000 C	1.4E-001 C	6.9E-002 C	1.2E+002 C	1.4E+001 C		
4,4'-METHYLENEDIPHENYL ISOCYANATE	101688			1.7E-004 I				6.2E-001 N					
METHYL ETHYL KETONE (2-BUTANONE)	78933	6.00E-001 I		2.86E-001 I		y	1.9E+003 N	1.0E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N	4.0E-001	7.9E+000 N

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Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg	Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg	DAF 20 mg/kg
METHYL HYDRAZINE	60344		1.10E+000 W				6.1E-002 C	5.7E-003 C	2.9E-003 C	5.2E+000 C	5.8E-001 C		
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	108101	8.00E-002 H		2.00E-002 A		y	1.4E+002 N	7.3E+001 N	1.1E+002 N	1.6E+005 N	6.3E+003 N	6.5E-002	1.3E+000 N
METHYL METHACRYLATE	80626	1.40E+000 I		2.00E-001 I		y	1.4E+003 N	7.3E+002 N	1.9E+003 N	2.9E+006 N	1.1E+005 N	3.2E-001	6.5E+000 N
2-METHYL-5-NITROANILINE	99558		3.30E-002 H				2.0E+000 C	1.9E-001 C	9.6E-002 C	1.7E+002 C	1.9E+001 C		
METHYL PARATHION	298000	2.50E-004 I					9.1E+000 N	9.1E-001 N	3.4E-001 N	5.1E+002 N	2.0E+001 N	4.3E-003	8.5E-002 N
2-METHYLPHENOL	95487	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
3-METHYLPHENOL	108394	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
4-METHYLPHENOL	106445	5.00E-003 H					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
METHYLSTYRENE MIX	25013154	6.00E-003 A		1.00E-002 A		y	5.5E+001 N	3.7E+001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N	5.1E-002	1.0E+000 N
ALPHA-METHYLSTYRENE	98839	7.00E-002 A				y	4.3E+002 N	2.6E+002 N	9.5E+001 N	1.4E+005 N	5.5E+003 N	4.0E-001	7.9E+000 N
METHYL TERT-BUTYL ETHER	1634044		4.00E-003 O	8.57E-001 I		y	2.6E+000 C	1.6E+000 C	7.9E-001 C	1.4E+003 C	1.6E+002 C	5.9E-004	1.2E-002 C
METOLACHLOR (DUAL)	51218452	1.50E-001 I					5.5E+003 N	5.5E+002 N	2.0E+002 N	3.1E+005 N	1.2E+004 N		
MIREX	2385855	2.00E-004 I					7.3E+000 N	7.3E-001 N	2.7E-001 N	4.1E+002 N	1.6E+001 N		
MOLYBDENUM	7439987	5E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
MONOCHLORAMINE	10599903	1E-001 I		1.00E-001 H			3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
NALED	300765	2E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N		
NICKEL REFINERY DUST					8.4E-001 I			7.5E-003 C					
NICKEL	7440020	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
NITRATE	14797558	1.60E+000 I					5.8E+004 N	5.8E+003 N	2.2E+003 N	3.3E+006 N	1.3E+005 N		
NITRIC OXIDE	10102439	1.00E-001 W				y	6.1E+002 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
NITRITE	14797650	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
2-NITROANILINE	88744			5.70E-005 H				2.1E-001 N					
**3-NITROANILINE	99092	3.00E-004 E	2.00E-002 E	3.00E-004 E			3.3E+000 C !	3.1E-001 C !	1.6E-001 C !	2.9E+002 C !	2.3E+001 N		
**4-NITROANILINE	100016	3.00E-003 E	2.00E-002 E	1.00E-003 E			3.3E+000 C	3.1E-001 C	1.6E-001 C	2.9E+002 C	3.2E+001 C !		
NITROBENZENE	98953	5.00E-004 I		6.00E-004 A		y	3.5E+000 N	2.2E+000 N	6.8E-001 N	1.0E+003 N	3.9E+001 N	1.2E-003	2.3E-002 N
NITROFURANTOIN	67209	7.00E-002 H					2.6E+003 N	2.6E+002 N	9.5E+001 N	1.4E+005 N	5.5E+003 N		
NITROFURAZONE	59870		1.50E+000 H				4.5E-002 C	4.2E-003 C	2.1E-003 C	3.8E+000 C	4.3E-001 C		
NITROGEN DIOXIDE	10102440	1.00E+000 W				y	6.1E+003 N	3.7E+003 N	1.4E+003 N	2.0E+006 N	7.8E+004 N		
NITROGLYCERIN	55630		1.4E-002 E				4.8E+000 C	4.5E-001 C	2.3E-001 C	4.1E+002 C	4.6E+001 C		
4-NITROPHENOL	100027	8.00E-003 E					2.9E+002 N	2.9E+001 N	1.1E+001 N	1.6E+004 N	6.3E+002 N	8.7E-002	1.7E+000 N
2-NITROPROPANE	79469			5.70E-003 I	9.40E+000 H	y	1.3E-003 C	6.7E-004 C				3.2E-007	6.4E-006 C
N-NITROSO-DI-N-BUTYLAMINE	924163		5.40E+000 I		5.60E+000 I	y	1.9E-003 C	1.1E-003 C	5.8E-004 C	1.1E+000 C	1.2E-001 C	1.4E-006	2.7E-005 C
N-NITROSODIETHANOLAMINE	1116547		2.80E+000 I				2.4E-002 C	2.2E-003 C	1.1E-003 C	2.0E+000 C	2.3E-001 C		
N-NITROSODIETHYLAMINE	55185		1.50E+002 I		1.50E+002 I		4.5E-004 C	4.2E-005 C	2.1E-005 C	3.8E-002 C	4.3E-003 C	1.1E-007	2.3E-006 C
N-NITROSODIMETHYLAMINE	62759		5.10E+001 I		5.10E+001 I		1.3E-003 C	1.2E-004 C	6.2E-005 C	1.1E-001 C	1.3E-002 C	2.8E-007	5.7E-006 C
N-NITROSODIPHENYLAMINE	86306		4.90E-003 I				1.4E+001 C	1.3E+000 C	6.4E-001 C	1.2E+003 C	1.3E+002 C	3.8E-002	7.6E-001 C
N-NITROSODIPROPYLAMINE	621647		7.00E+000 I				9.6E-003 C	8.9E-004 C	4.5E-004 C	8.2E-001 C	9.1E-002 C	2.4E-006	4.7E-005 C
N-NITROSO-N-ETHYLUREA	759739		1.40E+002 H				4.8E-004 C	4.5E-005 C	2.3E-005 C	4.1E-002 C	4.6E-003 C		
N-NITROSO-N-METHYLETHYLAMINE	10595956		2.20E+001 I				3.0E-003 C	2.8E-004 C	1.4E-004 C	2.6E-001 C	2.9E-002 C		
N-NITROSOPYRROLIDINE	930552		2.10E+000 I		2.10E+000 I		3.2E-002 C	3.0E-003 C	1.5E-003 C	2.7E+000 C	3.0E-001 C		
M-NITROTOLUENE	99081	2.00E-002 E				y	1.2E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
O-NITROTOLUENE	88722	1.00E-002 H				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
P-NITROTOLUENE	99990	1.00E-002 H				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
NUSTAR	85509199	7.00E-004 I					2.6E+001 N	2.6E+000 N	9.5E-001 N	1.4E+003 N	5.5E+001 N		
ORYZALIN	19044883	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		

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OXADIAZON	19666309	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
OXAMYL	23135220	2.50E-002 I					9.1E+002 N	9.1E+001 N	3.4E+001 N	5.1E+004 N	2.0E+003 N	1.9E-001	3.8E+000 N
OXYFLUORFEN	42874033	3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N		
PARAQUAT DICHLORIDE	1910425	4.50E-003 I					1.6E+002 N	1.6E+001 N	6.1E+000 N	9.2E+003 N	3.5E+002 N		
PARATHION	56382	6.00E-003 H					2.2E+002 N	2.2E+001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N	5.0E-001	1.0E+001 N
PENTACHLOROBENZENE	608935	8.00E-004 I					2.9E+001 N	2.9E+000 N	1.1E+000 N	1.6E+003 N	6.3E+001 N	1.0E+000	2.0E+001 N
PENTACHLORONITROBENZENE	82688	3.00E-003 I	2.60E-001 H				2.6E-001 C	2.4E-002 C	1.2E-002 C	2.2E+001 C	2.5E+000 C	4.1E-003	8.2E-002 C
PENTACHLOROPHENOL	87865	3.00E-002 I	1.20E-001 I				5.6E-001 C	5.2E-002 C	2.6E-002 C	4.8E+001 C	5.3E+000 C		
PERMETHRIN	52645531	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N	1.2E+002	2.4E+003 N
**PHENOL	108952	3.00E-001 I					1.1E+004 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N	3.3E+000	6.7E+001 N
M-PHENYLENEDIAMINE	108452	6.00E-003 I					2.2E+002 N	2.2E+001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N	4.9E-002	9.8E-001 N
O-PHENYLENEDIAMINE	95545		4.70E-002 H				1.4E+000 C	1.3E-001 C	6.7E-002 C	1.2E+002 C	1.4E+001 C		
P-PHENYLENEDIAMINE	106503	1.90E-001 H					6.9E+003 N	6.9E+002 N	2.6E+002 N	3.9E+005 N	1.5E+004 N		
2-PHENYLPHENOL	90437		1.90E-003 H				3.5E+001 C	3.3E+000 C	1.7E+000 C	3.0E+003 C	3.4E+002 C		
PHOSPHINE	7803512	3.00E-004 I		8.60E-005 I			1.1E+001 N	3.1E-001 N	4.1E-001 N	6.1E+002 N	2.3E+001 N		
PHOSPHORIC ACID	7664382			2.90E-003 I				1.1E+001 N					
PHOSPHORUS (WHITE)	7723140	2.00E-005 I					7.3E-001 N	7.3E-002 N	2.7E-002 N	4.1E+001 N	1.6E+000 N		
P-PHTHALIC ACID	100210	1.00E+000 H					3.7E+004 N	3.7E+003 N	1.4E+003 N	2.0E+006 N	7.8E+004 N		
PHTHALIC ANHYDRIDE	85449	2.00E+000 I		3.43E-002 H			7.3E+004 N	1.3E+002 N	2.7E+003 N	4.1E+006 N	1.6E+005 N	2.6E+001	5.2E+002 N
POLYBROMINATED BIPHENYLS		7.00E-006 H	8.90E+000 H				7.5E-003 C	7.0E-004 C	3.5E-004 C	6.4E-001 C	7.2E-002 C !		
POLYCHLORINATED BIPHENYLS	1336363		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C	2.1E-002	4.1E-001 C
AROCLOR-1016	12674112	7.00E-005 I	7.00E-002 I		7.00E-002 I		9.6E-001 C !	8.9E-002 C !	4.5E-002 C !	8.2E+001 C !	5.5E+000 N	2.1E-001	4.2E+000 C
AROCLOR-1221	11104282		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C		
AROCLOR-1232	11141165		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C		
AROCLOR-1242	53469219		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C		
AROCLOR-1248	12672296		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C		
AROCLOR-1254	11097691	2.00E-005 I	2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C !	5.4E-002	1.1E+000 C
AROCLOR-1260	11096825		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C		
POLYCHLORINATED TERPHENYLS	61788338		4.50E+000 E				1.5E-002 C	1.4E-003 C	7.0E-004 C	1.3E+000 C	1.4E-001 C		
POLYNUCLEAR AROMATIC HYDROCARBONS:													
ACENAPHTHENE	83329	6.00E-002 I				y	3.7E+002 N	2.2E+002 N	8.1E+001 N	1.2E+005 N	4.7E+003 N	5.2E+000	1.0E+002 N
ANTHRACENE	120127	3.00E-001 I				y	1.8E+003 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N	2.3E+001	4.7E+002 N
BENZ[A]ANTHRACENE	56553		7.30E-001 E				9.2E-002 C	8.6E-003 C	4.3E-003 C	7.8E+000 C	8.7E-001 C	7.3E-002	1.5E+000 C
BENZO[B]FLUORANTHENE	205992		7.30E-001 E				9.2E-002 C	8.6E-003 C	4.3E-003 C	7.8E+000 C	8.7E-001 C	2.3E-001	4.5E+000 C
BENZO[K]FLUORANTHENE	207089		7.30E-002 E				9.2E-001 C	8.6E-002 C	4.3E-002 C	7.8E+001 C	8.7E+000 C	2.3E+000	4.5E+001 C
BENZO[A]PYRENE	50328		7.30E+000 I		3.10E+000 E		9.2E-003 C	2.0E-003 C	4.3E-004 C	7.8E-001 C	8.7E-002 C	1.9E-002	3.7E-001 C
CARBAZOLE	86748		2.00E-002 H				3.3E+000 C	3.1E-001 C	1.6E-001 C	2.9E+002 C	3.2E+001 C	2.3E-002	4.7E-001 C
CHRYSENE	218019		7.30E-003 E				9.2E+000 C	8.6E-001 C	4.3E-001 C	7.8E+002 C	8.7E+001 C	7.3E+000	1.5E+002 C
DIBENZ[A,H]ANTHRACENE	53703		7.30E+000 E				9.2E-003 C	8.6E-004 C	4.3E-004 C	7.8E-001 C	8.7E-002 C	7.0E-002	1.4E+000 C
DIBENZOFURAN	132649	4.00E-003 E				y	2.4E+001 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N	3.8E-001	7.7E+000 N
FLUORANTHENE	206440	4.00E-002 I					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N	3.1E+002	6.3E+003 N
FLUORENE	86737	4.00E-002 I				y	2.4E+002 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N	6.8E+000	1.4E+002 N
INDENO[1,2,3-C,D]PYRENE	193395		7.30E-001 E				9.2E-002 C	8.6E-003 C	4.3E-003 C	7.8E+000 C	8.7E-001 C	6.4E-001	1.3E+001 C
2-METHYLNAPHTHALENE	91576	2.00E-002 E				y	1.2E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	1.1E+000	2.2E+001 N
NAPHTHALENE	91203	2.00E-002 I		9.00E-004 I		y	6.5E+000 N	3.3E+000 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	7.7E-003	1.5E-001 N

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Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg	Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg	DAF 20 mg/kg
PYRENE	129000	3.00E-002 I				y	1.8E+002 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N	3.4E+001	6.8E+002 N
PROMETON	1610180	1.50E-002 I					5.5E+002 N	5.5E+001 N	2.0E+001 N	3.1E+004 N	1.2E+003 N		
PROMETRYN	7287196	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N		
PROPACHLOR	1918167	1.30E-002 I					4.7E+002 N	4.7E+001 N	1.8E+001 N	2.7E+004 N	1.0E+003 N		
PROPANIL	709988	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
PROPARGITE	2312358	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
N-PROPYLBENZENE	103651	4.00E-002 E				y	2.4E+002 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N	1.4E+000	2.8E+001 N
PROPYLENE GLYCOL	57556	2.00E+001 H					7.3E+005 N	7.3E+004 N	2.7E+004 N	4.1E+007 N	1.6E+006 N		
PROPYLENE GLYCOL, MONOETHYL ETHER	52125538	7.00E-001 H					2.6E+004 N	2.6E+003 N	9.5E+002 N	1.4E+006 N	5.5E+004 N		
PROPYLENE GLYCOL, MONOMETHYL ETHER	107982	7.00E-001 H		5.70E-001 I			2.6E+004 N	2.1E+003 N	9.5E+002 N	1.4E+006 N	5.5E+004 N		
PURSUIT	81335775	2.50E-001 I					9.1E+003 N	9.1E+002 N	3.4E+002 N	5.1E+005 N	2.0E+004 N		
PYRIDINE	110861	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N		
QUINOLINE	91225		3.00E+000 I				2.2E-002 C	2.1E-003 C	1.1E-003 C	1.9E+000 C	2.1E-001 C		
RDX	121824	3.00E-003 I	1.10E-001 I				6.1E-001 C	5.7E-002 C	2.9E-002 C	5.2E+001 C	5.8E+000 C		
RESMETHRIN	10453868	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N		
RONNEL	299843	5.00E-002 H					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
ROTENONE	83794	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N		
SELENIOUS ACID	7783008	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
SELENIUM	7782492	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N	9.5E-001	1.9E+001 N
SILVER	7440224	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N	1.6E+000	3.1E+001 N
SIMAZINE	122349	5.00E-003 I	1.20E-001 H				5.6E-001 C	5.2E-002 C	2.6E-002 C	4.8E+001 C	5.3E+000 C	1.7E-004	3.3E-003 C
SODIUM AZIDE	26628228	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N		
SODIUM DIETHYLDITHIOCARBAMATE	148185	3.00E-002 I	2.70E-001 H				2.5E-001 C	2.3E-002 C	1.2E-002 C	2.1E+001 C	2.4E+000 C		
STRONTIUM, STABLE	7440246	6.00E-001 I					2.2E+004 N	2.2E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N	7.7E+002	1.5E+004 N
STRYCHNINE	57249	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N	8.3E-003	1.7E-001 N
STYRENE	100425	2.00E-001 I		2.86E-001 I		y	1.6E+003 N	1.0E+003 N	2.7E+002 N	4.1E+005 N	1.6E+004 N	2.9E+000	5.7E+001 N
2,3,7,8-TETRACHLORODIBENZODIOXIN	1746016		1.50E+005 H		1.50E+005 H		4.5E-007 C	4.2E-008 C	2.1E-008 C	3.8E-005 C	4.3E-006 C	4.3E-007	8.6E-006 C
1,2,4,5-TETRACHLOROBENZENE	95943	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N	3.3E-002	6.6E-001 N
1,1,1,2-TETRACHLOROETHANE	630206	3.00E-002 I	2.60E-002 I		2.60E-002 I	y	4.1E-001 C	2.4E-001 C	1.2E-001 C	2.2E+002 C	2.5E+001 C	2.0E-004	4.0E-003 C
1,1,2,2-TETRACHLOROETHANE	79345	6.00E-002 E	2.00E-001 I		2.00E-001 I	y	5.3E-002 C	3.1E-002 C	1.6E-002 C	2.9E+001 C	3.2E+000 C	3.4E-005	6.8E-004 C
TETRACHLOROETHENE	127184	1.00E-002 I	5.2E-002 E	1.4E-001 E	1.00E-002 E	y	6.3E-001 C	6.3E-001 C	6.1E-002 C	1.1E+002 C	1.2E+001 C	1.4E-003	2.9E-002 C
2,3,4,6-TETRACHLOROPHENOL	58902	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N		
P,A,A,A-TETRACHLOROTOLUENE	5216251		2.00E+001 H				3.3E-003 C	3.1E-004 C	1.6E-004 C	2.9E-001 C	3.2E-002 C		
1,1,1,2-TETRAFLUOROETHANE	811972			2.29E+001 I		y	1.7E+005 N	8.4E+004 N					
TETRAHYDROFURAN	109999	2.00E-001 E	7.6E-003 E	8.6E-002 E	6.8E-003 E		8.8E+000 C	9.2E-001 C	4.2E-001 C	7.5E+002 C	8.4E+001 C		
TETRYL	479458	1.00E-002 H					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
THALLIC OXIDE	1314325	7.00E-005 W					2.6E+000 N	2.6E-001 N	9.5E-002 N	1.4E+002 N	5.5E+000 N		
THALLIUM	7440280	7.00E-005 O					2.6E+000 N	2.6E-001 N	9.5E-002 N	1.4E+002 N	5.5E+000 N	1.8E-001	3.6E+000 N
THALLIUM ACETATE	563688	9.00E-005 I					3.3E+000 N	3.3E-001 N	1.2E-001 N	1.8E+002 N	7.0E+000 N		
THALLIUM CARBONATE	6533739	8.00E-005 I					2.9E+000 N	2.9E-001 N	1.1E-001 N	1.6E+002 N	6.3E+000 N		
THALLIUM CHLORIDE	7791120	8.00E-005 I					2.9E+000 N	2.9E-001 N	1.1E-001 N	1.6E+002 N	6.3E+000 N		
THALLIUM NITRATE	10102451	9.00E-005 I					3.3E+000 N	3.3E-001 N	1.2E-001 N	1.8E+002 N	7.0E+000 N		

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							Risk-based concentrations					Region III SSLs	
							Tap	Ambient		Soil		Soil, for groundwater migration	
		RfDo	CSFo	RfDi	CSFi		water	air	Fish	Industrial	Residential	DAF 1	DAF 20
Chemical	CAS	mg/kg/d	1/mg/kg/d	mg/kg/d	1/mg/kg/d	VOC	ug/l	ug/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
THALLIUM SULFATE (2:1)	7446186	8.00E-005 I					2.9E+000 N	2.9E-001 N	1.1E-001 N	1.6E+002 N	6.3E+000 N		
THIOBENCARB	28249776	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
TIN	7440315	6.00E-001 H					2.2E+004 N	2.2E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N		
TITANIUM	7440326	4.00E+000 E		8.60E-003 E			1.5E+005 N	3.1E+001 N	5.4E+003 N	8.2E+006 N	3.1E+005 N		
TITANIUM DIOXIDE	13463677	4.00E+000 E		8.60E-003 E			1.5E+005 N	3.1E+001 N	5.4E+003 N	8.2E+006 N	3.1E+005 N		
TOLUENE	108883	2.00E-001 I		1.14E-001 I		y	7.5E+002 N	4.2E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N	4.4E-001	8.8E+000 N
TOLUENE-2,4-DIAMINE	95807		3.20E+000 H				2.1E-002 C	2.0E-003 C	9.9E-004 C	1.8E+000 C	2.0E-001 C		
TOLUENE-2,5-DIAMINE	95705	6.00E-001 H					2.2E+004 N	2.2E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N		
TOLUENE-2,6-DIAMINE	823405	2.00E-001 H					7.3E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N		
P-TOLUIDINE	106490		1.90E-001 H				3.5E-001 C	3.3E-002 C	1.7E-002 C	3.0E+001 C	3.4E+000 C	3.0E-004	5.9E-003 C
TOXAPHENE	8001352		1.10E+000 I		1.10E+000 I		6.1E-002 C	5.7E-003 C	2.9E-003 C	5.2E+000 C	5.8E-001 C	3.1E-002	6.3E-001 C
1,2,4-TRIBROMOBENZENE	615543	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
TRIBUTYLTIN OXIDE	56359	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N		
2,4,6-TRICHLOROANILINE	634935		3.40E-002 H				2.0E+000 C	1.8E-001 C	9.3E-002 C	1.7E+002 C	1.9E+001 C		
**1,2,4-TRICHLOROBENZENE	120821	1.00E-002 I		1.00E-003 E		y	7.2E+000 N	3.7E+000 N	1.4E+001 N	2.0E+004 N	7.8E+002 N	1.4E-002	2.8E-001 N
1,1,1-TRICHLOROETHANE	71556	2.80E-001 E		6.30E-001 E		y	3.2E+003 N	2.3E+003 N	3.8E+002 N	5.7E+005 N	2.2E+004 N	3.0E+000	6.0E+001 N
1,1,2-TRICHLOROETHANE	79005	4.00E-003 I	5.70E-002 I		5.60E-002 I	y	1.9E-001 C	1.1E-001 C	5.5E-002 C	1.0E+002 C	1.1E+001 C	3.9E-005	7.8E-004 C
TRICHLOROETHENE	79016	3.00E-004 E	4.00E-001 E	1.00E-002 E	4.00E-001 E	y	2.6E-002 C	1.6E-002 C	7.9E-003 C	1.4E+001 C	1.6E+000 C	1.3E-005	2.6E-004 C
TRICHLOROFLUOROMETHANE	75694	3.00E-001 I		2.00E-001 A		y	1.3E+003 N	7.3E+002 N	4.1E+002 N	6.1E+005 N	2.3E+004 N	1.1E+000	2.3E+001 N
2,4,5-TRICHLOROPHENOL	95954	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
2,4,6-TRICHLOROPHENOL	88062		1.10E-002 I		1.00E-002 I		6.1E+000 C	6.3E-001 C	2.9E-001 C	5.2E+002 C	5.8E+001 C		
2,4,5-T	93765	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N	9.8E-002	2.0E+000 N
2-(2,4,5-TRICHLOROPHENOXY)PROPIONIC ACID	93721	8.00E-003 I					2.9E+002 N	2.9E+001 N	1.1E+001 N	1.6E+004 N	6.3E+002 N	1.1E+000	2.1E+001 N
1,1,2-TRICHLOROPROPANE	598776	5.00E-003 I				y	3.0E+001 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N	1.2E-002	2.5E-001 N
1,2,3-TRICHLOROPROPANE	96184	6.00E-003 I	2.00E+000 E	1.4E-003 E		y	5.3E-003 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C	1.8E-006	3.6E-005 C
1,2,3-TRICHLOROPROPENE	96195	5.00E-003 H				y	3.0E+001 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N	1.2E-002	2.5E-001 N
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76131	3.00E+001 I		8.60E+000 H		y	5.9E+004 N	3.1E+004 N	4.1E+004 N	6.1E+007 N	2.3E+006 N	1.2E+002	2.3E+003 N
1,2,4-TRIMETHYLBENZENE	95636	5.00E-002 E		1.70E-003 E		y	1.2E+001 N	6.2E+000 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
1,3,5-TRIMETHYLBENZENE	108678	5.00E-002 E		1.70E-003 E		y	1.2E+001 N	6.2E+000 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
TRIMETHYL PHOSPHATE	512561		3.70E-002 H				1.8E+000 C	1.7E-001 C	8.5E-002 C	1.5E+002 C	1.7E+001 C		
1,3,5-TRINITROBENZENE	99354	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N		
2,4,6-TRINITROTOLUENE	118967	5.00E-004 I	3.00E-002 I				2.2E+000 C !	2.1E-001 C !	1.1E-001 C !	1.9E+002 C !	2.1E+001 C !		
URANIUM (SOLUBLE SALTS; from IRIS)	7440611	3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N		
URANIUM (SOLUBLE SALTS; provisional)	7440611	2.00E-004 E					7.3E+000 N	7.3E-001 N	2.7E-001 N	4.1E+002 N	1.6E+001 N		
VANADIUM	7440622	7.00E-003 H					2.6E+002 N	2.6E+001 N	9.5E+000 N	1.4E+004 N	5.5E+002 N	2.6E+002	5.1E+003 N
VANADIUM PENTOXIDE	1314621	9.00E-003 I					3.3E+002 N	3.3E+001 N	1.2E+001 N	1.8E+004 N	7.0E+002 N		
VANADIUM SULFATE	16785812	2.00E-002 H					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
VINCLOZOLIN	50471448	2.50E-002 I					9.1E+002 N	9.1E+001 N	3.4E+001 N	5.1E+004 N	2.0E+003 N		
VINYL ACETATE	108054	1.00E+000 H		5.71E-002 I		y	4.1E+002 N	2.1E+002 N	1.4E+003 N	2.0E+006 N	7.8E+004 N	8.7E-002	1.7E+000 N
VINYL CHLORIDE inc earlylife(see cover memos)	75014	3.00E-003 I	1.40E+000 I	2.8E-002 I	3.00E-002 I	y	1.5E-002 C	7.2E-002 C			9.0E-002 C	1.7E-005	3.3E-004 C
VINYL CHLORIDE: adult (see cover memos)	75014	3.00E-003 I	7.20E-001 I	2.8E-002 I	1.5E-002 I	y			4.4E-003 C	7.9E+000 C			
WARFARIN	81812	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N	2.2E-002	4.4E-001 N

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST E = EPA-NCEA provisional value O = other							Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c Risk-based concentrations					Region III SSLs	
							Tap	Ambient		Soil		Soil, for groundwater migration	
		RfDo	CSFo	RfDi	CSFi		water	air	Fish	Industrial	Residential	DAF 1	DAF 20
Chemical	CAS	mg/kg/d	1/mg/kg/d	mg/kg/d	1/mg/kg/d	VOC	ug/l	ug/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
M-XYLENE	108383	2.00E+000 H				y	1.2E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N	1.3E+001	2.5E+002 N
O-XYLENE	95476	2.00E+000 H				y	1.2E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N	1.1E+001	2.3E+002 N
P-XYLENE	106423					y							
XYLENES	1330207	2.00E+000 I				y	1.2E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N	8.5E+000	1.7E+002 N
ZINC	7440666	3.00E-001 I					1.1E+004 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N	6.8E+002	1.4E+004 N
ZINC PHOSPHIDE	1314847	3E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N		
ZINEB	12122677	5E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		

Rule R309-200. Monitoring and Water Quality: Drinking Water Standards.

As in effect on February 1, 2003

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- KEY
- Date of Enactment or Last Substantive Amendment
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R309-200-1. Purpose.

The purpose of this rule is to set forth the water quality and drinking water standards for public water systems.
R309-200-2 Authority.
R309-200-3 Definitions.
R309-200-4 General.
R309-200-5 Primary Drinking Water Standards
(1) Inorganic Contaminants
(2) Lead and Copper
(3) Organic Monitoring.
(4) Radiological Chemicals.
(5) Turbidity.
(6) Microbiological quality

(7) Disinfection
R309-200-6 Secondary Drinking Water Standards.
R309-200-7 Treatment Techniques and Unregulated Contamiants.
R309-200-8 Approved Laboratories.

R309-200-2. Authority.

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104 of the Utah Code and in accordance with 63-46a fo the same, known as the Administrative Rulemaking Act.

R309-200-3. Definitions.

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

R309-200-4. General.

(1) Maximum contaminant levels (MCLs) and treatment techniques are herein established for those routinely measurable substances which may be found in water supplies. "Primary" standards and treatment techniques are established for the protection of human health. "Secondary" regulations are established to provide guidance in evaluating the aesthetic qualities of drinking water.
(2) The applicable "Primary" standards and treatment techniques shall be met by all public drinking water systems. The "Secondary" standards are recommended levels which should be met in order to avoid consumer complaint.
(3) The methods used to determine compliance with these maximum contaminant levels and treatment techniques are given in R309-205 through R309-215. Analytical techniques which shall be followed in making the required determinations shall be as given in 40 CFR 141 as published on July 1, 2001 by the Office of the Federal Register.
(4) Unless otherwise required by the Board, the effective dates on which new analytical methods shall be initiated are identical to the dates published in 40 CFR 141 on July 1, 2001 by the Office of the Federal Register.
(5) If the water fails to meet these minimum standards, then certain public notification procedures shall be carried out, as outlined in R309-220. Water suppliers shall also keep analytical records in their possession, for a required length of time, as outlined in R309-105-17.

R309-200-5. Primary Drinking Water Standards.

(1) Inorganic Contaminants.
(a) The maximum contaminant levels (MCLs) for antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, selenium, sodium, thallium and total dissolved solids are applicable to community and non-transient non-community water systems.
(b) The MCLs for nitrate, nitrite, and total nitrate, nitrite and sulfate are applicable to community, non-transient non-community, and transient non-community water systems.
(c) The maximum contaminant levels for inorganic chemicals are listed in Table 200-1.

TABLE 200-1
PRIMARY INORGANIC CONTAMINANTS

Contaminant	Maximum Contaminant Level
1. Antimony	0.006 mg/L

2.	Arsenic	0.05 mg/L
3.	Asbestos	7 Million Fibers/liter (longer than 10 um)
4.	Barium	2 mg/L
5.	Beryllium	0.004 mg/L
6.	Cadmium	0.005 mg/L
7.	Chromium	0.1 mg/L
8.	Cyanide (as free Cyanide)	0.2 mg/L
9.	Fluoride	4.0 mg/L
10.	Mercury	0.002 mg/L
11.	Nickel	--- (see Note 1 below)
12.	Nitrate	10 mg/l (as Nitrogen) (see Note 4 below)
13.	Nitrite	1 mg/L (as Nitrogen)
14.	Total Nitrate and Nitrite	10 mg/L (as Nitrogen)
15.	Selenium	0.05 mg/L
16.	Sodium	--- (see Note 1 below)
17.	Sulfate	1000 mg/L (see Note 2 below)
18.	Thallium	0.002 mg/L
19.	Total Dissolved Solids	2000 mg/L (see Note 3 below)

NOTE:

(1) No maximum contaminant level has been established for nickel and sodium. However, these contaminant shall be monitored and reported in accordance with the requirements of R309-205-5(3).

(2) If the sulfate level of a public (community, NTNC and non-community) water system is greater than 500 mg/L, the supplier shall satisfactorily demonstrate that:

(a) No better quality water is available, and

(b) The water shall not be available for human consumption from commercial establishments.

In no case shall the Board allow the use of water having a sulfate level greater than 1000 mg/L.

(3) If TDS is greater than 1000 mg/L, the supplier shall satisfactorily demonstrate to the Board that no better water is available. The Board shall not allow the use of an inferior source of water if a better source of water (i.e. lower in TDS) is available.

(4) In the case of a non-community water systems which exceed the MCL for nitrate, the Executive Secretary may allow, on a case-by-case basis, a nitrate level not to exceed 20 mg/L if the supplier can adequately demonstrate that:

(a) such water will not be available to children under 6 months of age as may be the case in hospitals, schools and day care centers; and

(b) there will be continuous posting of the fact that nitrate levels exceed 10 mg/L and the potential health effect of exposure in accordance with R309-220-12; and

(c) the water is analyzed in conformance to R309-205-5(4); and

(d) that no adverse health effects will result.

(2) Lead and copper.

(a) The lead action level is exceeded if the concentration of lead in more than 10 percent of tap water samples collected during any monitoring period conducted in accordance with R309-210-6(3) is greater than 0.015 mg/L (i.e., if the "90th percentile" lead level is greater than 0.015 mg/L).

(b) The copper action level is exceeded if the concentration of copper in more than 10 percent of tap water samples collected during any monitoring period conducted in accordance with R309-210-6(3) is greater than 1.3 mg/L (i.e., if the "90th percentile" copper level is greater than 1.3 mg/L).
(c) The 90th percentile lead and copper levels shall be computed as follows:
(i) The results of all lead or copper samples taken during a monitoring period shall be placed in ascending order from the sample with the lowest concentration to the sample with the highest concentration. Each sampling result shall be assigned a number, ascending by single integers beginning with the number 1 for the sample with the lowest contaminant level. The number assigned to the sample with the highest contaminant level shall be equal to the total number of samples taken.
(ii) The number of samples taken during the monitoring period shall be multiplied by 0.9.
(iii) The contaminant concentration in the numbered sample yielded by the calculation in paragraph (c)(ii) above is the 90th percentile contaminant level.
(iv) For water systems serving fewer than 100 people that collect 5 samples per monitoring period, the 90th percentile is computed by taking the average of the highest and second highest concentrations.
(3) Organic Contaminants.
The following are the maximum contaminant levels for organic chemicals. For the purposes of R309-100 through R309-R309-605, organic chemicals are divided into three categories: Pesticides/PCBs/SOCs, volatile organic contaminants (VOCs) and total trihalomethanes.
(a) Pesticides/PCBs/SOCs - The MCLs for organic contaminants listed in Table 200-2 are applicable to community water systems and non-transient, non-community water systems.

TABLE 200-2
PESTICIDE/PCB/SOC CONTAMINANTS

Contaminant	Maximum Contaminant Level
1. Alachlor	0.002 mg/L
2. Aldicarb	(see Note 1 below)
3. Aldicarb sulfoxide	(see Note 1 below)
4. Aldicarb sulfone	(see Note 1 below)
5. Atrazine	0.003 mg/L
6. Carbofuran	0.04 mg/L
7. Chlordane	0.002 mg/L
8. Dibromochloropropane	0.0002 mg/L
9. 2,4-D	0.07 mg/L
10. Ethylene dibromide	0.00005 mg/L
11. Heptachlor	0.0004 mg/L
12. Heptachlor epoxide	0.0002 mg/L
13. Lindane	0.0002 mg/L
14. Methoxychlor	0.04 mg/L
15. Polychlorinated biphenyls	0.0005 mg/L
16. Pentachlorophenol	0.001 mg/L
17. Toxaphene	0.003 mg/L
18. 2,4,5-TP	0.05 mg/L
19. Benzo(a)pyrene	0.0002 mg/L
20. Dalapon	0.2 mg/L
21. Di(2-ethylhexyl)adipate	0.4 mg/L
22. Di(2-ethylhexyl)phthalate	0.006 mg/L
23. Dinoseb	0.007 mg/L
24. Diquat	0.02 mg/L

25.	Endothall	0.1 mg/L
26.	Endrin	0.002 mg/L
27.	Glyphosate	0.7 mg/L
28.	Hexachlorobenzene	0.001 mg/L
29.	Hexachlorocyclopentadiene	0.05 mg/L
30.	Oxamyl (Vydate)	0.2 mg/L
31.	Picloram	0.5 mg/L
32.	Simazine	0.004 mg/L
33.	2,3,7,8-TCDD (Dioxin)	0.00000003 mg/L

Note 1: The MCL for this contaminant is under further review, however, this contaminant shall be monitored in accordance with R309-205-6(1).

(b) Volatile organic contaminants - The maximum contaminant levels for organic contaminants listed in Table 200-3 apply to community and non-transient non-community water systems.

TABLE 200-3
VOLATILE ORGANIC CONTAMINANTS

	Contaminant	Maximum Contaminant Level
1.	Vinyl chloride	0.002 mg/L
2.	Benzene	0.005 mg/L
3.	Carbon tetrachloride	0.005 mg/L
4.	1,2-Dichloroethane	0.005 mg/L
5.	Trichloroethylene	0.005 mg/L
6.	para-Dichlorobenzene	0.075 mg/L
7.	1,1-Dichloroethylene	0.007 mg/L
8.	1,1,1-Trichloroethane	0.2 mg/L
9.	cis-1,2-Dichloroethylene	0.07 mg/L
10.	1,2-Dichloropropane	0.005 mg/L
11.	Ethylbenzene	0.7 mg/L
12.	Monochlorobenzene	0.1 mg/L
13.	o-Dichlorobenzene	0.6 mg/L
14.	Styrene	0.1 mg/L
15.	Tetrachloroethylene	0.005 mg/L
16.	Toluene	1 mg/L
17.	trans-1,2-Dichloroethylene	0.1 mg/L
18.	Xylenes (total)	10 mg/L
19.	Dichloromethane	0.005 mg/L
20.	1,2,4-Trichlorobenzene	0.07 mg/L
21.	1,1,2-Trichloroethane	0.005 mg/L

(c) Disinfection Byproducts and Disinfectant Residuals:
(i) Community and Non-transient non-community water systems. Surface Water systems serving 10,000 or more persons shall comply with this section beginning January 1, 2002. Surface water systems serving fewer than 10,000 persons and systems using only ground water not under the direct influence of surface water shall comply with this section beginning January 1, 2004. Community water systems utilizing only groundwater sources serving 10,000 persons or more shall monitor in accordance with R309-210-9 and meet the MCL listed in paragraph (vii) of this section until December 31, 2003.
(ii) Transient non-community water systems. Surface water systems serving 10,000 or more persons and using chlorine dioxide as a disinfectant or oxidant shall comply with the chlorine dioxide MRDL beginning January 1, 2002. Surface water

systems serving fewer than 10,000 persons and using chlorine dioxide as a disinfectant or oxidant and systems using only ground water not under the direct influence of surface water and using chlorine dioxide as a disinfectant or oxidant shall comply with the chlorine dioxide MRDL beginning January 1, 2004.
(iii) The maximum contaminant levels (MCLs) for disinfection byproducts are listed in Table 200- 4.

TABLE 200-4
DISINFECTION BYPRODUCTS

DISINFECTION BYPRODUCT	MCL (mg/L)
Total trihalomethanes (TTHM)	0.080
Haloacetic acids (five) (HAA5)	0.060
Bromate	0.010
Chlorite	1.0

(iv) The maximum residual disinfectant levels (MRDLs) are listed in Table 200-5.

TABLE 200-5
MAXIMUM RESIDUAL DISINFECTANT LEVELS

DISINFECTANT RESIDUAL	MRDL (mg/L)
Chlorine	4.0 (as Cl_2)
Chloramines	4.0 (as Cl_2)
Chlorine dioxide	0.8 (as ClO_2)

(v) Control of Disinfectant Residuals. Notwithstanding the MRDLs listed in Table 200-5, systems may increase residual disinfectant levels in the distribution system of chlorine or chloramines (but not chlorine dioxide) to a level and for a time necessary to protect public health, to address specific microbiological contamination problems caused by circumstances such as, but not limited to, distribution line breaks, storm run-off events, source water contamination events, or cross-connection events.
(vi) A system that is installing GAC or membrane technology to comply with this section may apply to the Executive Secretary for an extension of up to 24 months past the dates in paragraph (c)(i) of this section, but not beyond December 31, 2003. In granting the extension, the Executive Secretary shall set a schedule for compliance and may specify any interim measures that the system shall take. Failure to meet the schedule or interim treatment requirements constitutes a violation of Utah Public Drinking Water Rules.
(vii) Community water systems utilizing only groundwater sources serving 10,000 persons or more shall monitor in accordance with R309-210-9 and meet the following MCL until December 31, 2003.
(A) The running average of analyses of quenched TTHM samples for four consecutive calendar quarters shall not exceed 100 micrograms per liter.
(B) The single sample Total Trihalomethane Formation Potential (THMFP) shall not exceed 100 micrograms per liter. Approval is needed from the Executive Secretary to substitute this test for TTHM samples and may only be used for groundwater sources. Compliance for each source is based on measurement of this sample.
(4) Radiologic Chemicals.
(a) Compliance dates. Compliance dates for combined radium-226 and -228, gross alpha particle activity, gross beta particle and photon radioactivity, and uranium: Community water systems shall comply with the MCLs listed in paragraphs (b), (c), (d), and (e) of this section beginning December 8, 2003 and compliance shall be determined in accordance with the requirements of this sub-section (4) and R309-

205-7. Compliance with reporting requirements for the radionuclides under R309-220 and R309-225 is required on December 8, 2003.
(b) Combined radium-226 and -228. The maximum contaminant level for combined radium-226 and radium- 228 is 5 pCi/L. The combined radium-226 and radium-228 value is determined by the addition of the results of the analysis for radium-226 and the analysis for radium-228.
(c) Gross alpha particle activity (excluding radon and uranium). The maximum contaminant level for gross alpha particle activity (including radium-226 but excluding radon and uranium) is 15 pCi/L.
(d) The MCL for beta particle and photon radioactivity.
(i) The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year (mrem/year).
(ii) Except for the radionuclides listed in Table 200-6, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be calculated on the basis of 2 liters per day drinking water intake using the 168 hour data list in "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure," NBS (National Bureau of Standards) Handbook 69 as amended August 1963, U.S. Department of Commerce. Copies of this document are available from the National Technical Information Service, NTIS ADA 280 282, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161. The toll-free number is 800-553-6847. Copies may be inspected at the Division of Drinking Water offices. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 mrem/year.

TABLE 200-6
MAN-MADE RADIONUCLIDE CONTAMINANTS

Average Annual Concentrations Assumed to Produce: A Total Body or Organ Dose of 4 mrem/yr

Radionuclide	Critical organ	pCi per liter
Tritium	Total body	20,000
Strontium-90	Bone Marrow	8

(e) The MCL for uranium. The maximum contaminant level for uranium is 30 þg/L.
(5) TURBIDITY
(a) Large surface water systems serving 10,000 or more population shall provide treatment consisting of both disinfection, as specified in R309-200-5(7)(a), and filtration treatment which complies with the requirements of paragraph (i), (ii) or (iii) of this section by January 1, 2002.
(i) Conventional filtration treatment or direct filtration.
(A) For systems using conventional filtration or direct filtration, the turbidity level of representative samples of a system's filtered water shall be less than or equal to 0.3 NTU in at least 95 percent of the measurements taken each month, measured as specified in R309-200-4(3) and R309-215-9.
(B) The turbidity level of representative samples of a system's filtered water shall at no time exceed 1 NTU, measured as specified in R309-200-4(3) and R309-215-9.
(C) A system that uses lime softening may acidify representative samples prior to analysis using a protocol approved by the Executive Secretary.
(ii) Filtration technologies other than conventional filtration treatment, direct filtration, slow sand filtration, or diatomaceous earth filtration. A public water

system may use a filtration technology not listed in paragraph (i) or (iii) of this section if it demonstrates to the Executive Secretary, using pilot plant studies or other means, that the alternative filtration technology, in combination with disinfection treatment that meets the requirements of R309-200-7, consistently achieves 99.9 percent removal and/or inactivation of Giardia lamblia cysts and 99.99 percent removal and/or inactivation of viruses, and 99 percent removal of Cryptosporidium oocysts, and the Executive Secretary approves the use of the filtration technology. For each approval, the Executive Secretary will set turbidity performance requirements that the system shall meet at least 95 percent of the time and that the system may not exceed at any time at a level that consistently achieves 99.9 percent removal and/or inactivation of Giardia lamblia cysts, 99.99 percent removal and/or inactivation of viruses, and 99 percent removal of Cryptosporidium oocysts.
(iii) The turbidity limit for slow sand filtration and diatomaceous earth filtration shall be less than or equal to 1.0 NTU in at least 95 percent of the measurements taken each month, measured as specified in R309-215- 9(1)(c) and (d). For slow sand filtration only, if the Executive Secretary determines that the system is capable of achieving 99.9 percent removal and inactivation of Giardia lamblia cysts at some turbidity level higher than 1.0 NTU in at least 95 percent of the measurements, the Executive Secretary may substitute this higher turbidity limit for that system.
(b) Small surface water systems serving a population less than 10,000:
(i) The following turbidity limit applies to finished water from small surface water treatment facilities providing water to all public water systems whether community, non-transient non-community or non-community.
(ii) The limit for turbidity in drinking water from treatment facilities which utilize surface water sources or ground water sources under the direct influence of surface water is 0.5 NTU in at least 95 percent of the samples as required by R309-215-9(1)(c) for conventional complete treatment and direct filtration. If the Executive Secretary determines that the system is capable of achieving at least 99.9 percent removal and inactivation of Giardia lamblia cysts at some turbidity level higher than 0.5 NTU in at least 95 percent of the measurements, the Executive Secretary may substitute this higher turbidity limit for that system. However, in no case may the Executive Secretary approve a turbidity limit that allows more than 1.0 NTU in more than 5 percent of the samples taken each month, measured as specified in R309- 215-9(1)(c) and (d).
(A) The turbidity limit for slow sand filtration and diatomaceous earth filtration shall be less than or equal to 1.0 NTU in at least 95 percent of the measurements taken each month, measured as specified in R309-215-9(1)(c) and (d). For slow sand filtration only, if the Executive Secretary determines that the system is capable of achieving 99.9 percent removal and inactivation of Giardia lamblia cysts at some turbidity level higher than 1.0 NTU in at least 95 percent of the measurements, the Executive Secretary may substitute this higher turbidity limit for that system.
(B) The turbidity level of representative samples shall at no time exceed 5.0 NTU for any treatment technique, measured as specified in R309-215-9(1)(c) and (d).
(C) The Executive Secretary may allow the higher turbidity limits for the above treatment techniques only if the supplier of water can demonstrate to the Executive Secretary's satisfaction that the higher turbidity does not do any of the following:
(I) Interfere with disinfection;
(II) Prevent maintenance of an effective disinfectant agent throughout the distribution system;
(III) Interfere with microbiological determinations; or

(IV) Interfere with a treatment technique's ability to achieve the required log removal/inactivation of pathogens or virus as required by R309-505-6(2)(a) and (b).
(c) Ground water sources not under the direct influence of surface water:
(i) The following turbidity limit applies to community water systems only.
(ii) The limit for turbidity in drinking water from ground water sources not under the direct influence of surface sources is 5.0 NTU based on an average for two consecutive days pursuant to R309-205-8(3).
(6) MICROBIOLOGICAL QUALITY
(a) The maximum contaminant level (MCL) for microbiological contaminants for all public water systems is:
(i) For a system which collects less than 40 total coliform samples per month, no more than one sample per month may be total coliform-positive.
(ii) For a system which collects 40 or more total coliform samples per month, no more than 5.0 percent of the samples collected during a month may be total coliform-positive.
(b) Any fecal coliform-positive or Escherichia coliform (E. coli)-positive repeat sample or any total coliform-positive repeat sample following a fecal coliform positive or E. coli-positive routine sample constitutes a violation of the MCL for total coliforms. For the purposes of public notification requirements in R309-220-5 this is a violation that may pose an acute risk to health.
(c) For NTNC and transient non-community systems that are required to sample at a rate of less than one per month, compliance with paragraphs (a) or (b) of this subsection shall be determined for the month in which the sample was taken.
(7) DISINFECTION
Continuous disinfection is recommended for all water sources. It shall be required of all ground water sources which do not consistently meet standards of bacteriologic quality. Surface water sources or ground water sources under direct influence of surface water shall be disinfected and continuously monitored for disinfection residual during the course of required conventional complete treatment for systems serving greater than 3,300 people. Disinfection shall not be considered a substitute for inadequate collection or filtration facilities.
Successful disinfection assures 99.9 percent inactivation of Giardia lamblia cysts and 99.99 percent inactivation of enteric viruses. Both filtration and disinfection are considered treatment techniques to protect against the potential adverse health effects of exposure to Giardia lamblia, viruses, Legionella, and heterotrophic bacteria in water. Minimum disinfection levels are set by "CT" values as defined in R309-110.
(a) Each public water system that provides filtration treatment shall provide disinfection treatment as follows:
(i) The disinfection treatment shall be sufficient to ensure that the total treatment processes of the system achieve at least 99.9 percent (3-log) inactivation and/or removal of Giardia lamblia cysts and at least 99.99 percent (4-log) inactivation and/or removal of viruses, as determined by the Executive Secretary.
(ii) The residual disinfectant concentration in the water entering the distribution system cannot be less than 0.2 mg/L for more than 4 hours.
(iii) The residual disinfectant concentration in the distribution system, measured as combined chlorine or chlorine dioxide, cannot be undetectable in more than 5 percent of the samples each month, for any two consecutive months that the system serves water to the public. Water in the distribution system with a heterotrophic bacteria concentration less than or equal to 500/ml, measured as heterotrophic plate count (HPC) is deemed to have a detectable disinfectant residual for purposes of determining compliance with this requirement. Thus, the

value "V" in the following formula cannot exceed 5 percent in one month, for any two consecutive months.
V = ((c + d + e) / (a + b)) x 100 where:
a = number of instances where the residual disinfectant concentration is measured;
b = number of instances where the residual disinfectant concentration is not measured but heterotrophic bacteria plate count (HPC) is measured;
c = number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;
d = number of instances where no residual disinfectant concentration is detected and where HPC is greater than 500/ml;
e = number of instances where the residual disinfectant concentration is not measured and HPC is greater than 500/ml.
(b) If the Executive Secretary determines, based on site-specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions specified in Heterotrophic Plate Count (Pour Plate Method) as set forth in the latest edition of Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association et al. (Method 907A in the 16th edition) and that the system is providing adequate disinfection in the distribution system, the requirements of R309-200-5(7)(a)(iii) do not apply.
(c) If a system utilizes a combination of sources, some surface water influenced (requiring filtration and disinfection treatment) and others deemed ground water (not requiring any treatment, even disinfection), the Executive Secretary may, based on site-specific considerations, allow sampling for residual disinfectant or HPC at locations other than those specified by total coliform monitoring required by R309-210-5.

R309-200-6. Secondary Drinking Water Standards for Community, Non-Transient Non-Community and Transient Non-Community Water.

The Secondary Maximum Contaminant Levels for public water systems deals with substances which affect the aesthetic quality of drinking water. They are presented here as recommended limits or ranges and are not grounds for rejection. The taste of water may be unpleasant and the usefulness of the water may be impaired if these standards are significantly exceeded.

TABLE 200-5
SECONDARY INORGANIC CONTAMINANTS

Contaminant	Level
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 Color Units
Copper	1 mg/L
Corrosivity	Non-corrosive
Fluoride	2.0 mg/L (see Note below)
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 Threshold Odor Number
pH	6.5-8.5
Silver	0.1 mg/L
Sulfate	250 mg/L (see Note below)
TDS	500 mg/L (see Note below)
Zinc	5 mg/L

Note: Maximum allowable Fluoride, TDS and Sulfate levels are given in the Primary Drinking Water Standards, R309-200-5(1). They are listed as secondary standards because levels in excess of these recommended levels will likely cause consumer complaint.

R309-200-7. Treatment Techniques and Unregulated Contaminants.

(1) The Board has determined that the minimum level of treatment as described in R309-525 and R309- 530 herein or its equivalent is required for surface water sources and ground water contaminated by surface sources.
(2) For surface water systems, R309-200, 215, 505, 510, 520, 525 and 530 establish or extend treatment technique requirements in lieu of maximum contaminant levels for the following contaminants: Giardia lamblia, viruses, heterotrophic plate count bacteria, Legionella, Cryptosporidium, and turbidity. The treatment technique requirements consist of installing and properly operating water treatment processes which reliably achieve:
(a) at least 99.9 percent (3-log) removal and/or inactivation of Giardia lamblia cysts between a point where the raw water is not subject to re-contamination by surface water runoff and a point downstream before or at the first customer;
(b) at least 99.99 percent (4-log) removal and/or inactivation of viruses between a point where the raw water is not subject to re-contamination by surface water runoff and a point downstream before or at the first customer.
(c) At least 99 percent (2-log) removal of Cryptosporidium between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer. for filtered systems, or Cryptosporidium control under the watershed control plan for unfiltered systems.
(d) Compliance with the profiling and benchmark requirements under the provisions of R309-215-14.
(3) No MCLs are established herein for unregulated contaminants; viruses, protozoans and other chemical and biological substances. Some unregulated contaminants shall be monitored for in accordance with 40 CFR 141.40.

R309-200-8. Approved Laboratories.

(1) For the purpose of determining compliance, samples may be considered only if they have been analyzed by the State of Utah primacy laboratory or a laboratory certified by the Utah State Health Laboratory. However, measurements for pH, temperature, turbidity and disinfectant residual, daily chlorite, TOC, UV254, DOC and SUVA may, under the direction of the direct responsible charge operator, be performed by any water supplier or their representative.
(2) All samples shall be marked either: routine, repeat, check or investigative before submission of such samples to a certified lab. Routine, repeat, and check samples shall be considered compliance purposes samples.
(3) All public water systems shall either: contract with a certified laboratory to have the laboratory send all compliance purposes sample results, with the exception of Lead/Copper data, to the Division of Drinking Water, or shall inform the Division of Drinking Water that they intend to forward all compliance purposes samples to the Division. Each public water system shall furnish the Division of Drinking Water a copy of the contract with their certified laboratory or inform the Division in writing of the public water system's intent to forward the data to the Division.
(4) All sample results can be sent either electronically or in hard copy form.

KEY

drinking water, quality standards, regulated contaminants

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