Executive Summary

This document presents the Performance Standard Verification Plan (PSVP) for Operable Unit 4 (OU4) at Hill Air Force Base (HAFB). The PSVP establishes a monitoring program for OU4 post-Record of Decision (ROD) operations including a long-term plan to reach site closeout. The PSVP defines long-term goals, types of decisions to be made, data analysis procedures, and reporting formats. The PSVP also defines a standardized assessment and monitoring protocol to provide HAFB with an improved, documented understanding and agreement with the regulatory agencies and the public. The documenting of procedures and decision criteria provides continuity during personnel turnover, lowers costs by ensuring only necessary data is collected, and optimizes sampling frequencies to meet specific information goals.

The *Final Record of Decision and Responsiveness Summary for Operable Unit 4 (ROD)*, (MW, 1994) requires a performance and compliance sampling program, referred to in this document as the PSVP. The PSVP includes both compliance and performance monitoring to determine if Remedial Action Objectives (RAOs) are being met. These monitoring requirements are meant to ensure that selected remedies achieve appropriate protection of human health and the environment, comply with regulatory requirements, and continue to pursue attainment of remediation goals. The long-term RAOs for OU4 are, in general, to protect human health and the environment by minimizing the potential for exposure to contaminated media, to prevent migration of contaminated media, and to restore groundwater and surface water to Maximum Contaminant Levels (MCLs). Media-specific RAOs were established in the *Feasibility Study (FS) for Operable Unit 4,* (MW, 1993), which are to protect human health and the environment, and address potential future unacceptable risk scenarios. Quantitative preliminary remediation goals (PRGs) were developed for groundwater, surface water, and air. The PRGs establish media-specific concentrations for contaminants of concern. The various components of the remedial action were evaluated to determine which media-specific RAOs were associated with the remedial actions. This data is summarized in Table ES-1.

The PSVP outlines the RAOs, identifies data needs, and addresses the issues of whether OU4 remedial actions are "operating properly and successfully." The phrase "operating properly and successfully" involves two separate concepts. A remedial action is operating "properly" if it is operating as designed. The system is operating "successfully" if its operation will achieve the clean up levels or performance goals delineated in the decision document. Additionally, in order to be successful, "that remedy must be protective of human health and the environment."

An evaluation will be conducted to determine whether the OU4 remedial actions are operating properly and successfully. Results of the evaluation will be documented in the OU4 Performance Standard Verification Report (PSVR). The first PSVR will be completed after the scheduled review of the OU4 Remedial Action operations in 2006. The frequency of the first review period allows sufficient data to be collected during OU4 operations to provide confidence that data collected represents true contaminant concentrations at OU4.

As part of the PSVR, any needed changes to the monitoring program, data assessment methods, data collection frequency, review frequency, etc. will be recommended and the PSVP will be modified as appropriate. Any changes to the PSVP found to be necessary before the PSVR is implemented will be annotated by letter.

The geologic units underlying OU4 consist mainly of the Alpine Formation. The Alpine Formation consists mainly of silty clay materials with thin, fine-grained sand interbeds. Groundwater appears to flow mainly along the thin, fine-grained sand layers. Due to the thinness and discontinuous nature of the fine-grained sand layers, separate water-bearing zones could not be identified. Therefore, the water-bearing zone at OU4 is considered a single water-bearing zone. These geologic units form the basis for the OU4 conceptual model. The conceptual model for OU4 is fully described in numerous other documents and only a brief description is presented in Section 2 of this document.

The OU4 site is addressed by media: groundwater, surface water, Landfill 1, and indoor air in off-Base residences. The groundwater remedy consists of the collection and extraction of contaminated groundwater using a horizontal drain system, which was installed in 1993 and upgraded in 1997. The purpose of this remedy is to remove contamination mass in order to achieve MCLs in groundwater. Downgradient monitoring is also performed to assess the degree to which natural attenuation is occurring. The surface water remedy consists of the monitoring of springs within the boundaries of the contaminated groundwater plume. Springs are intermittent and seasonal in this area; when springs are observed during a regular sampling event, samples are collected. Minor exceedances of PRGs (MCLs) in springs have been identified at OU4. The landfill remedy is the upgrade and maintenance of the cap, and the collection of water from within the landfill contents. The cap upgrade was implemented in 1996. Water is collected from within the landfill in a sump connected to a perforated pipe system located above the average depth to groundwater. The indoor air remedy involves the sampling of residences located over the contaminated groundwater plume. No residences are currently located over the plume. Therefore, PRGs for indoor air are not currently applicable to the remedial action for OU4. Implementation of this remedy will be performed if the contaminated groundwater plume migrates to the extent that the plume underlies the existing residences, or if new residences are constructed over the groundwater plume and airborne contamination levels exceed PRGs in the residences. Institutional controls are in place to control the use of groundwater, surface water, and on-Base construction in the area of the landfill.

A statistical method was developed to evaluate data to determine whether the OU4 groundwater remedy action is making progress toward achieving the RAOs. The statistical method uses a comparison to the PRGs to determine whether concentrations of a particular constituent are above unacceptable levels for a monitoring well or group of monitoring wells (plume mean). The goal of the RAO comparison is to determine whether average onsite concentrations for a given constituent exceed the standard (MCL). Since only a finite number of samples are available to estimate true onsite concentrations, there is some uncertainty in this estimate. Confidence limits are calculated based upon the sample size, the variability in measurements, and the assumed distribution of the target population. These confidence limits bound the true concentration mean (or median) with a 95 percent confidence level. The 95 percent upper confidence limit (UCL) represents the one-sided upper confidence bound for the true mean (or median), while the 95 percent lower

confidence limit (LCL) represents the one-sided lower confidence bound for the true mean (or median).

Where contaminant concentrations have exceeded MCLs, the UCL is compared to the standard to ensure (with 95 percent confidence) that the true mean concentration is below the standard. If the UCL exceeds the standard, then the conclusion is made that the site is still contaminated, on average, at a level exceeding the standard. On the other hand, if the site is undergoing performance monitoring for areas below MCLs, then the LCL is compared to the standard (MCL). If the LCL is below the MCL, then the site is considered clean. This provides a reasonable level of confidence, for a location presumed clean, that the standard is not exceeded.

As described above, the remediation for OU4 has been divided into five distinct remedial actions:

1) Groundwater extraction and treatment or direct discharge to a POTW.
2) Landfill 1 cap upgrade and sump extraction.
3) Surface water (springs and seeps) monitoring and remediation as needed.
4) Off-Base residential indoor air monitoring and remediation as needed.
5) Implementation of institutional and engineering controls.

Performance monitoring parameters are established for direct measurement of performance of the remedial actions in achieving the RAOs. The performance monitoring criteria include measurement of groundwater elevations, analytical sampling of groundwater and surface water, air monitoring for off-Base residences within the plume boundary, and visual inspection of institutional and engineering controls.

The performance indicators, monitoring network, monitoring frequency, data evaluation, and anticipated timeframe for achieving the RAOs, have been identified for each of the remedial actions. These indicator criteria will be used to assess whether the treatment system is performing as anticipated. Exceedance of these criteria is not considered proof that the RAO is not being achieved. However, if these criteria are exceeded, a review will be conducted to determine if modification to the system operation is warranted. Remedial action closure criteria were also developed for each remedial action. An OU4 Annual Report will be prepared to summarize monitoring activities conducted during the preceding 12 months. The OU4 Annual Report will be made up of three subreports: the Treatment System Operation Report (TSOR); the Inspection, Monitoring and Maintenance Report (IMMR); and the Annual Groundwater Sampling Report. The intent of the OU4 Annual Report will be to document the preceding year's monitoring results. The annual report will serve as a repository for the monitoring criteria result database (water level measurements, groundwater recovery volumes, water quality field measurements and analytical reports, total O&M costs, etc). The data documented in the annual reports will be interpreted in the PSVR. The PSVR process will thoroughly evaluate the performance of the OU4 system operation performance and progress toward RAOs. General evaluations regarding the effectiveness and efficiency of each remedial component of the selected remedy, as well as the cumulative effect of all components of the selected remedy, will be included in the PSVR report.

TABLE ES-1
Remedial Action Objective Matrix[1]
OU4 Performance Standard Verification Plan

		REMEDY				
		Groundwater Extraction, Treatment, and Discharge	Surface Water Collection, Treatment, and Discharge (As Needed)[2]	Landfill Cap Maintenance[3]	Off-Base Indoor Air Remediation Systems (As Needed)[4]	Institutional Controls
Remedial Action Objective						
OVERALL REMEDIAL GOALS						
1	Reduce contaminant concentrations within the areas of attainment to comply with the remediation goals.	X	X		X	
2	Meet all Applicable, Relevant, and Appropriate Requirements (ARARs) identified for each medium.	X	X		X	X
3	Remediate groundwater, surface water, and landfill contents in a timely manner and in compliance with the selected remedy to achieve remediation goals as soon as practicable.	X				
GROUNDWATER, SURFACE WATER, AND LANDFILL						
4	Meet chemical-specific ARARs, which are MCLs.	X	X			
5	Limit cancer risk to less than 10^{-4} with a target of 10^{-6} due to accidental ingestion, dermal contact, or inhalation of vapors.	X	X	X		X
6	Maintain contaminant concentrations low enough to avoid chronic health effects (as indicated by a hazard index of less than 1).	X	X	X		X
7	Prevent further degradation of groundwater quality in accordance with Utah Corrective Action Cleanup Policy.	X		X		
AIR						
8	Prevent migration of contaminated soil gas into residences.				X	X
9	Prevent inhalation of carcinogens in excess of 10^{-6} cancer risk within off-Base residences.				X	X
10	Prevent inhalation of noncarcinogens at levels exceeding a hazard index of 1 within off-Base residences.				X	X

[1] Remedial action objectives are taken from the *ROD*, Section 5.1.1 (MW, June 1994).

[2] Minor exceedances of MCLs in springs have been observed. Monitoring is required to determine if springs are contaminated above MCLs.

[3] The landfill vapor extraction system was deemed unnecessary based on the *Final Restoration and Practicability Report for Operable Unit 4* (MW, August 1999). No time frame was established for the remaining elements of the landfill remedy (i.e., upgrade of the landfill cap).

[4] Indoor air monitoring is required in off-Base residences to determine if site-related contaminants are present at concentrations above risk levels.