

SOUTH WEBER CITY COUNCIL AGENDA

SPECIAL MEETING FOR MUNICIPAL ELECTION CANVASS; WORK MEETING

PUBLIC NOTICE is hereby given that the City Council of SOUTH WEBER, Davis County, Utah will meet in a **SPECIAL PUBLIC MEETING** followed by a **PUBLIC WORK MEETING** on **TUESDAY, 15 NOVEMBER 2011** at the City Council Chambers, 1600 E South Weber Dr, South Weber, UT commencing at **5:30 p.m.**

SPECIAL MEETING

- 5:30 p.m. **PLEDGE OF ALLEGIANCE** – Councilmember Poll
PRAYER - Councilmember Woodbury
- 5:35 p.m. **CANVASS – 2011 MUNICIPAL GENERAL ELECTION**
- 5:40 p.m. **ADJOURN TO WORK MEETING**

WORK MEETING

- 5:45 p.m. **HILL AFB ENVIRONMENTAL REPORT – Dr. Barbara “B” Hall,
Environmental Engineer**
- 6:15 p.m. **SOUTH WEBER COALITION – Brent Poll**

THE UNDERSIGNED DULY APPOINTED CITY RECORDER FOR THE MUNICIPALITY OF SOUTH WEBER CITY HEREBY CERTIFIES THAT A COPY OF THE FOREGOING NOTICE WAS MAILED, EMAILED, FAXED OR POSTED TO:

CITY OFFICE BUILDING
CITY WEBSITE www.southwebercity.com
UT PUBLIC NOTICE WEBSITE www.utah.gov/pmn

EACH MEMBER OF GOVERNING BODY
THOSE LISTED ON THE AGENDA
SOUTH WEBER ELEMENTARY
SOUTH WEBER FAMILY ACTIVITY CENTER

DAVIS COUNTY CLIPPER
STANDARD-EXAMINER
SALT LAKE TRIBUNE
DESERET NEWS

DATE: November 9, 2011

CITY RECORDER: Erika J. Ahlstrom

IN COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT, INDIVIDUALS NEEDING SPECIAL ACCOMMODATIONS DURING THIS MEETING SHOULD NOTIFY ERIKA AHLSTROM, 1600 EAST SOUTH WEBER DRIVE, SOUTH WEBER, UTAH 84405 (801-479-3177)

Agenda times are approximate and may be move in order, sequence and time to meet the needs of the Council.

Erika Ahlstrom

From: Fisher, Barbara Civ USAF AFMC 75 ABW/PA [Barbara.Fisher2@hill.af.mil]
Sent: Tuesday, November 08, 2011 2:35 PM
To: Erika Ahlstrom
Cc: Hall, Barbara L Civ USAF AFMC 75 CEG/CEVR; Loucks, Mark D Civ USAF AFMC 75 CEG/CEVR; Case, Jarrod D Civ USAF AFMC 75 CEG/CEVR; Mabry, Lindsay L CTR USAF AFMC 75 CEG/CEVR
Subject: RE: Hill Update to City Council
Signed By: There are problems with the signature. Click the signature button for details.
Follow Up Flag: Follow up
Due By: Wednesday, November 09, 2011 12:00 AM
Flag Status: Red
Attachments: South Weber Briefing 15 Nov 2011.pdf; SWC
RTCs_AppendixD_HillAFBOU1HillsideHHRARReport_Final_v2.pdf



South Weber



SWC

Briefing 15 Nov 2011.AppendixD_HillAFBC

Erika,

Attached is information we have put together for our environmental presentation to the city council at its work meeting on Nov. 15. Dr. Barbara "B" Hall will do the presentation. She plans to primarily discuss the Supplemental Human Health Risk Assessment (Supplemental HHRA) completed as part of the arsenic cleanup on the hillside just east of the base boundary. We have included other information and maps here to give the council additional background on our entire environmental program in South Weber.

For the council's information, I'm also attaching the public comments we received from the property owner, Mr. Brent Poll, and his technical advisor, Dr. John Carter, on the Supplemental HHRA. The Air Force's response to those comments is included. I let Mr. Poll know we will be briefing the city council, and when we last spoke, Mr. Poll indicated he would be attending the work meeting.

If any of the members would like us to address any other topics, we would be happy to do so. If you could let us know in advance about any questions they have or additional topics they would like covered during the work meeting, B will come prepared to answer them as well.

If the council would like us to provide printed copies of this or if you're unable to open the attached, please let me know.

Barbara Fisher
75th Air Base Wing Public Affairs
Hill Air Force Base, Utah
(801) 775-3652

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

From: Erika Ahlstrom [mailto:eahlstrom@southwebercity.com]
Sent: Friday, September 30, 2011 11:13 AM
To: Fisher, Barbara Civ USAF AFMC 75 ABW/PA
Subject: RE: Hill Update to City Council

Thank you:)

Erika

Hill Air Force Base Environmental Restoration South Weber City Council Update

Nov. 15, 2011

Hill AFB Representatives

B Hall, OU-1 Project Manager: 801-777-0493

Barbara Fisher, Public Affairs: 801-775-3652

Hill AFB Restoration Advisory Board South Weber Representatives

Jan Ukena, Community: jukena@hillrab.org

Scott Petersen, City: spetersen@hillrab.org

Regulatory Agency Representatives

Sandra Bourgeois, U.S. Environmental Protection Agency: 303-312-6666

Mo Slam, Utah Department of Environmental Quality: 801-536-4178

Dave Allison, Utah Department of Environmental Quality: 801-536-4479

South Weber Contamination Background

In a number of communities surrounding Hill AFB, including South Weber, chemicals historically disposed on base have contaminated areas of groundwater. This is not the drinking water.

Groundwater: Contamination plumes have been discovered in South Weber. The primary chemicals found in these plumes are cis-1,2-dichloroethene (DCE), and trichloroethene (TCE), degreasing solvents used historically on base.

Soil: There are also arsenic-contaminated sediments around certain seeps and springs located on private property on the steep hillside just east of the base boundary. The most likely source of this contamination is from arsenic that occurs naturally in the soil. The waste disposed of in Hill AFB's nearby former landfills changed the geochemical properties of the groundwater below. The changed conditions caused the arsenic in the soil to dissolve into the groundwater. The dissolved arsenic traveled with the groundwater to the seeps and springs on the hillside. When the groundwater emerged from the springs and contacted air, the geochemistry changed again, causing the arsenic to deposit on the soil around the springs. There were five main springs where the water seeped from the hillside. Four have been dry since the groundwater extraction system was installed by the Air Force in 2001 and arsenic-impacted soil was removed from around three of these in 2008.

Cleanup: Groundwater treatment and containment systems are in place and cleanup is progressing as expected.

Since Last Time (3/15/2011)

- Completed Supplemental Human Health Risk Assessment (HHRA) for OU-1 Hillside ("Arsenic cleanup") which showed no need for further excavation
- Sewer Ventilation
 - Sampled homes near sewer—all below action level

Upcoming Plans

- Complete regulatory documentation of HHRA Results (2012)
- Continue monitoring indoor air and groundwater
- Continue operating extraction trench system on Hill AFB

South Weber Air Sampling

Because chemicals could evaporate into homes from the groundwater below, the Air Force provides free air sampling, and if necessary, vapor removal systems. The few detections found in South Weber have been very low.

The Air Force worked with the Utah Department of Environmental Quality and the U.S. Environmental Protection Agency to set an action level, based on health risks, for each of the chemicals found in the groundwater. This action level is the lowest level at which the Air Force recommends taking action to prevent vapors from entering the home.

Homes in Affected Area: **48**

Homes Sampled Since 2003: **42**

Agreed to 2012 Sampling: **16***

Historical Above Action Level Detections: **1**

Historical Below Action Level Detections: **15**

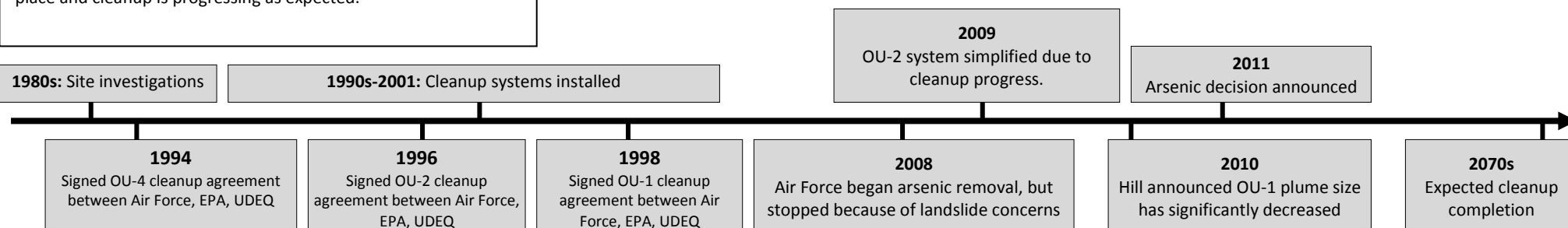
Sampled in 2011: **21**

2011 Above Action Level Detections: **0**

2011 Below Action Level Detections: **3**

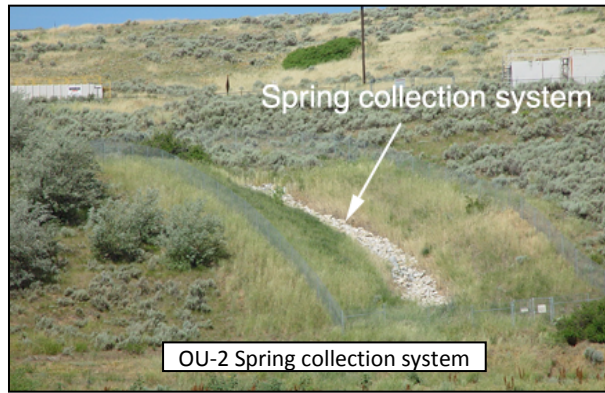
Installed Vapor Removal Systems: **4**

*Requests for sampling continue to be received.





OU-1 Arsenic-impacted soil removal in 2008



OU-2 Spring collection system



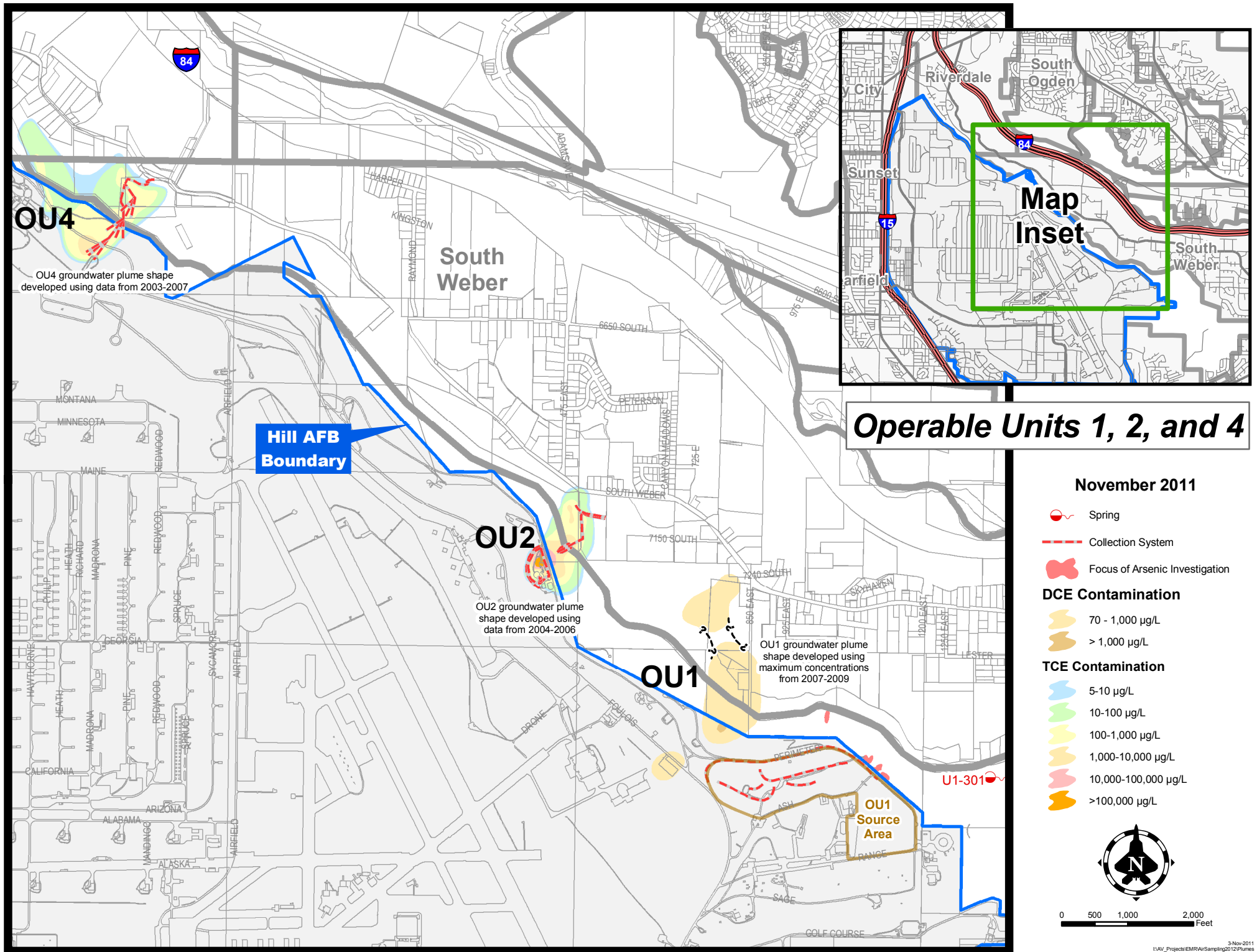
OU-4 Horizontal drain collection system

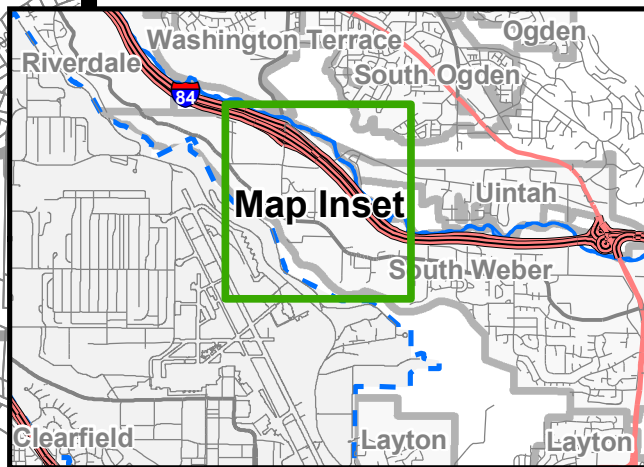
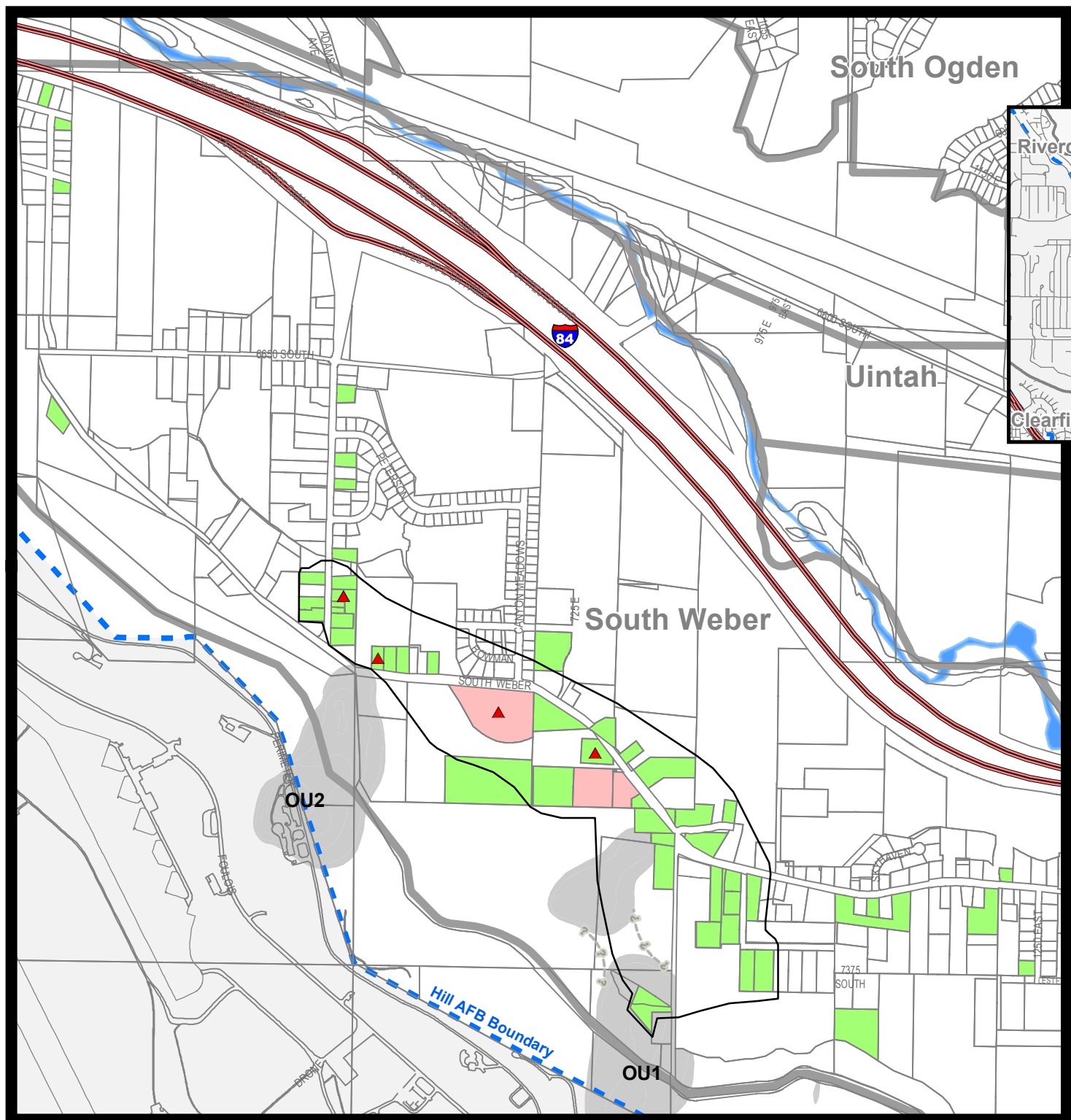
Operable Unit 1 Barbara 'B' Hall: 801-777-0493	
Location	Approximately from Hill AFB boundary to 7240 South and from just east of 850 East for about 0.3 miles westward <i>Depth to groundwater: 3-100 feet</i>
Chemicals	Cis-1,2-Dichloroethene (DCE) Arsenic
Extent	53 acres affected 30 homes in the area Contamination plume shrinking
Sources	Industrial waste pits/landfills on Hill AFB Fire training areas on Hill AFB
Remedies	<p>Source containment system: Four gravel trenches direct groundwater flow to drains and collection sumps on Hill AFB. The groundwater is treated and discharged to the sewer.</p> <p>Landfill caps on Hill AFB: Layers of natural and manmade materials cover contaminated soil, preventing contamination from coming into contact with it.</p> <p>Monitored natural attenuation: Natural chemical breakdown processes are carefully observed and monitored to ensure progress.</p>

Operable Unit 2 Kyle Gorder: 801-775-2559	
Location	Approximately from Hill AFB boundary to South Weber Drive and from about 475 East for about 0.2 miles eastward <i>Depth to groundwater: 1-60 feet</i>
Chemicals	Trichloroethene (TCE)—a degreaser used historically at Hill AFB
Extent	19 acres affected Less than 10 homes in the area Contamination plume shrinking
Source	Chemical disposal pit on Hill AFB
Remedies	<p>Groundwater containment wall: An underground wall surrounds the source area on Hill AFB.</p> <p>Source recovery system: Wells extract groundwater from the source area and deliver it to a nearby treatment plant. The treated water is discharged to the sewer.</p> <p>Interceptor trench: A gravel trench on base directs groundwater flow to a pipe, which discharges it to the sewer.</p> <p>Spring Collection System: An underground pipe on base collects groundwater and discharges it to the sewer.</p>

Operable Unit 4 Alan Jones: 801-775-6910	
Location	Approximately from South Weber Drive to Hill AFB boundary and from 5900 South (Riverdale) to 300 West (South Weber) <i>Depth to groundwater: 0-35 feet</i>
Chemicals	Trichloroethene (TCE)—a degreaser used historically at Hill AFB
Extent	32 acres affected Less than 10 homes in the area Contamination plume stable
Source	Dump-and-burn landfill on Hill AFB
Remedies	<p>Horizontal drain collection system: Three sets of three drains on Hill AFB collect groundwater and directly discharge it to the sewer.</p> <p>Soil cap over Hill AFB landfill: Layers of manmade materials cover contaminated soil to prevent precipitation from coming into contact with and spreading contamination.</p>

For more information, please visit: www.hillrab.org





**Most Recent
Air Sampling Results*
2003-2012**

**South Weber
Operable Units
1 & 2**

*Reflects Current Action Levels
and Chemical Lists

- Affected Area
- Vapor Mitigation System Installed
- Non-Detection
- Below Mitigation Action Level
- Above Mitigation Action Level
- Areas of Groundwater Contamination



Appendix D

Response to Comments

Summary of Revisions

Brent Poll's Comment Letter Annotated with Paragraph-numbering Scheme

Air Force Responses to Brent Poll's Comments

Dr. John Carter's Comment Letter Annotated with Paragraph-numbering Scheme

Air Force Responses to Dr. John Carter's Comments

Summary of Revisions

This appendix presents Air Force responses to comments provided by Mr. Brent Poll (South Weber Coalition) and his advisor Dr. John Carter (Environmental & Engineering Solutions, LLC) on the *Hill Air Force Base, Supplemental Human Health Risk Assessment Report for the Operable Unit 1 Hillside, Draft* (CH2M HILL, 2011), or Supplemental HHRA Report.

The comments that directly addressed the content of the Supplemental HHRA Report are responded to in detail in the following pages. Some changes were made to the Supplemental HHRA Report as a result of these comments, as follows:

Commenter	Comment Letter Paragraph	Supplemental HHRA Report Location	Revision
Mr. Poll	Bullet Point 5(3)	Paragraph ES.0.0.13 Section 3.2.1	Removal of references to “trails”
Mr. Poll	Bullet Point 5(3)	Section 3.4	Discussion of the calculated recreationalist risks/hazards in the Uncertainty Section (Section 3.4)
Dr. Carter	Paragraph #7 & 8	Section 3.2.2	Adding language regarding why the soil to groundwater migration pathway is insignificant
Dr. Carter	Paragraph #25	Section 1.2.0	Adding information, by reference, regarding development of background concentrations for arsenic and chromium as reported in the Record of Decision (ROD)

Some of the comments did not directly address the content of the Supplemental HHRA Report and fell into two broad categories listed below. These comments were not responded to in detail except to correct the record where inaccuracies occurred.

1. **General Comments about the Overall Operable Unit (OU) 1 Remedy.** Comments of this nature would be appropriate during the next Five-Year Review (FYR) process, scheduled for 2012 in preparation for the 2013 Hill Air Force Base (AFB) FYR Report. The Air Force will pursue and will welcome and fully consider comments of this nature from the public as part of that process.
2. **General Comments about the United States Environmental Protection Agency’s (EPA’s) Risk Assessment Methods under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).** Those who commented on the Supplemental HHRA Report are encouraged to engage in the public comment process that occurs when agencies assess new risk assessment methods and their applications. In the meantime, the Air Force will continue to conduct risk assessments and manage sites in accordance with established EPA and Utah guidance, policies, and regulations.

Background and CERCLA Process

Operable Unit 1 is in the post-ROD stage of the CERCLA process. The *OU 1 ROD* (Hill AFB, 1998) stipulated that a removal action related to arsenic-impacted sediment along the hillside north and

downgradient of the OU 1 source areas begin after the springs ceased flowing for 5 years. Consistent with the schedule specified in the ROD, remediation of the arsenic-impacted sediment began in 2008 following the installation and startup of the extraction trench system in 2001. This extraction trench system removes groundwater from the hillside south and above the springs, causing them to stop flowing.

An additional characterization of arsenic in the soil/sediment was done at the same time as the removal action. The Air Force identified and reported the presence of more arsenic-impacted sediment than was known when the 1998 ROD was signed. The Air Force proceeded with the removal of approximately 1,550 cubic yards of arsenic-impacted soil and sediment. Following the removal of this arsenic-impacted soil and sediment at Site 1, no further soil removal was conducted due to concerns for slope destabilization.

Based on the results of the removal action and additional characterization, a Supplemental HHRA was completed for the arsenic-impacted that remained after the removal action. Prior to the Supplemental HHRA, human health risks had only been addressed qualitatively (see Montgomery Watson, 1995, Section 3.5.6), and the potential for significant exposure was considered to be limited. Thus, the Supplemental HHRA Report provides the first quantitative risk estimates for the OU 1 Hillside soil and sediment. The key finding of the Supplemental HHRA is that **current and future risks are within the EPA's target range for potential cancer effects (i.e., risks between 10^{-6} and 10^{-4}) and below the target threshold for noncancer effects (i.e., Hazard Index of 1) even when applying exposure assumptions for unrestricted future land use (residential)**. In other words, the arsenic concentrations remaining in the soil/sediment do not require any restrictions on future land use, even to residential building, in the area.

Once the Supplemental HHRA Report is finalized, the information it contains will be used with the other available project documents to support site management decisions for the hillside. No such decisions have been made at this time, and the Supplemental HHRA's methods and results do not limit the range of site management options.

The existence of new information and the need for refined assessments like this Supplemental HHRA are common and inherent components of CERCLA responses. The CERCLA process anticipates the possibility of new information that could lead to revised decisions through the use of mechanisms such as an Explanation of Significant Difference to capture these revised decisions. In addition, the CERCLA process requires continual reevaluation of cleanup remedy effectiveness, including any new information, through the FYR process.

Approach for Addressing Comments

In the responses that follow, paragraph numbers have been assigned throughout each of the commenters' letters to facilitate preparation and documentation of the Air Force's responses. Copies of the original comments as well as the Air Force's responses to the comments are included. The references cited in the Air Force responses follow.

References

CH2M HILL, 2010. *Supplemental Human Health Risk Assessment Work Plan for the Operable Unit 1 Hillside*. Final. Hill AFB, Utah. November.

CH2M HILL, 2011. *Supplemental Human Health Risk Assessment Report for the Operable Unit 1 Hillside*. Draft. Hill AFB, Utah. April.

Hill Air Force Base (AFB), 1998. *Final Record of Decision for Operable Unit 1*. Hill AFB, Utah. September.

Montgomery Watson, 1995. *Comprehensive Remedial Investigation Report for Operable Unit 1*. Final. Hill AFB, Utah. January.

National Academy of Sciences, 2000. *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc*.

United States Environmental Protection Agency (EPA), 2003. *MEMORANDUM SUBJECT: Human Health Toxicity Values in Superfund Risk Assessments*. OSWER Directive 9285.7-53. December.

United States Environmental Protection Agency (EPA), 2009. *Risk Assessment Guidance for Superfund—Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)*. Final. EPA 540-R-070-002. Office of Superfund Remediation and Technology Innovation. January.

Brent Poll's Comment Letter Annotated with Paragraph-numbering Scheme

28 Jun 2011

Jarrold Case
Remedial Program Manager
Environmental Restoration Branch
75th CEG/CEVR
7274 Wardleigh Road
Hill Air Force Base, UT 84056-5137

Subject: Comments Regarding Draft Supplemental
Human Health Risk

Assessment Report

for the Operable Unit

1 Hillside (April 2011)

Dear Mr. Case,

1 This is a followup to our recent meeting, and the promised response regarding the above subject. Our Technical Advisor's, Dr. Carter's, comments (with which we agree) are also attached.

2 Our Coalition is very disappointed with this effort. We find it unnecessary, misleading and counterproductive to the remediation promised in the 1998 ROD for OU1. This ROD required removal of all arsenic contamination above a certain level in a specifically defined area.

3 However, several years ago, when the Base finally got around to attempting this removal, it found that it had grossly misjudged the size of the area and amount of contaminant at issue. This was another of a long list of underestimations and misjudgments made by the Base (and documented in our reports and responses to related studies over the years). We awaited some level of contrition as the Base reassessed its self-serving assumptions and theories which led to this latest misjudgment.

4 This never happened. Rather than placing the fault with its own planning and performance then working to fix those deficiencies, the Base chose instead to redefine the

problem (through this Supplemental Risk Assessment) it would have to address. The intent is clear. This Supplement bypasses the Base's failure to comply with removal requirements of the 1998 ROD, by generating a new lower risk assessment which allows the contamination at issue to remain in place off-base. How convenient for the Base, but hurtful to those anticipating actual removal of this contaminant as required in the ROD.

5 The following are a few specific complaints with this flawed effort:

5(1) (1) The draft included input from the City of South Weber about future utility of the area, but this city has no jurisdiction over this property. A thorough study would have shown that property owners, not the City, have control over if, when, and where their unincorporated-county property will come under a city's jurisdiction. Further review would show that the property owners have documented with the City of South Weber, based on the advice of their engineers, that their 100 plus acres above the canal should not be annexed into South Weber for logistical/cost reasons.

5(2) (2) While input concerning the property's utility and possible exposure scenarios was solicited from a City with no knowledge about or authority over the property at issue, no effort was made to obtain input from the property owners. If contacted for input, the owners would have indicated that:

5(2)(a) (a) The land in question was regularly used for livestock grazing prior to the mass escapes of the Base's pollution in the 1980s, and such use would be continued after the removal of arsenic promised in the 1998 ROD.

5(2)(b) (b) The hillside is rich with top soil which the owners could sell (to a depth of several feet) and then still reclaim the ground for other high and better uses than livestock raising.

5(2)(c) (c) The area has always been a magnet for people to recreate and enjoy in a variety of ways. Consistent with this, the City of South Weber, over the opposition of the Canal Company and the property owners, has placed a canal trail, adjacent to the area in question, as a projected part of the City's General Plan.

5(2)(d) (d) Any restrictions on access or use of this property, since its massive contamination by the Base through the 1970-1990s, were instigated by the Poll family at the direction of their legal advisers and property insurers. They felt that anyone injured in anyway by the contamination, which had originated on Base but was allowed to migrate onto or through Poll property, would stand a better chance in seeking relief from the family than the federal government. None of those restrictions were initiated by the Base, yet it incorrectly represents them in this draft as the norm for limiting future exposures.

5(2)(e)

(e) The conclusions in the draft about the steepness and general utility of the property are greatly exaggerated. This is property surrounded by a rapidly growing Wasatch front where all available open space is finding new and higher uses. Some of this, like the subject property, may need some remedial engineering to fully utilize some of the acreage, but every indicator shows nothing inherent to this property (except the Base's pollution upon and passing through it) to preclude higher, better and more aggressive long-term utility than suggested in this draft.

5(2)(f)

(f) Having wasted between \$1-2 million dollars in failures to remove the arsenic from the Hillside, the Base is resorting now (through this supplement) to leave its pollution on private property. This equates to a permanent 'taking,' without compensation, of future economic value of such property. Private landowners would be obligated to inform potential buyers of this condition. It represents a far greater long-term negative factor for such land than the imagined or exaggerated adverse elements mentioned in the Supplement.

5(3)

(3) The draft ignored historical facts concerning the utility and topography of the area. For example, the Base's own records (Project Hil# 292-5, Contract F42650-85-C-3649) show that the Base caused most of the slides and instability in the subject area in 1986 and committed (but failed "to followup) to remedy it as "repair(s) needed to prevent further damage." The Base has numerous pictures showing this damage in the 1980s. Likewise, in an earlier draft, the false claim was made that there were no trails in the area, but the Base has numerous photographs showing three significant roads (often used for vehicular traffic before the pollution problems) through this area. The Coalition too has color copies of those pictures. The Supplement's disregard of the above realities, about access and typography of the subject area, reflects negatively on the credibility of the entire exercise.

5(4)

(4) The work orders or job instructions, which guided the conduct of this supplemental risk assessment, are so restrictive in nature that they largely predetermine the outcome. Those guidelines cherry-picked assumptions and theories which limit rather than expand the scope of a real supplemental risk assessment. For instance, arsenic is embraced as the only contaminant of concern (COC). However, as this supplemental was allegedly necessitated by the Base's failure to accurately project the distribution and amount of arsenic ROD-required for cleanup, it is reasonable to believe the Base was equally incorrect in determining that arsenic was the only COC. Huge amounts of other heavy metals and chemicals were also dumped in this area. Only a supplemental designed for a certain predetermined outcome could ignore other possibly related deficiencies.

5(5)

(5) The Coalition questions how the State of Utah and EPA can support this Supplement. The residents of the South Weber Valley have been waiting for over a

decade for the ROD-promised removal of arsenic immediately above the South Weber Elementary School. Removal, per the ROD, is noted as the most certain remedy for the well-being of the potentially-affected population. If this Supplemental is approved; the Base, EPA and the State will renege on the removal required in the ROD. They would then replace this commitment with the nebulous inference that the problem is now simply unworthy of the promises made in 1998. The Coalition notes that the State did not comment on this draft while the EPA representative found that “authors did an excellent job with this document.”

b Believing in the Superfund process (administered mainly by the polluter) has been difficult especially when monitored natural attenuation until “sometime in the 2070s is its primary focus for OUI. If this supplemental is approved to eliminate the basic requirement for removal of the arsenic, our Coalition contends the superfund processes, as exercised here would be without credibility.

Let me know if you have any questions concerning this response.

Sincerely,

Brent Poll
Executive Director

Air Force Responses to Brent Poll's Comments

28 Jun 2011

Jarrold Case
Remedial Program Manager
Environmental Restoration Branch
75th CEG/CEVR
7274 Wardleigh Road
Hill Air Force Base, UT 84056-5137

Subject: Comments Regarding Draft Supplemental
Human Health Risk Assessment Report
for the Operable Unit 1 Hillside (April 2011)

Dear Mr. Case,

Paragraphs #1 - 4

This is a followup to our recent meeting, and the promised response regarding the above subject. Our Technical Advisor's, Dr. Carter's, comments (with which we agree) are also attached.

Our Coalition is very disappointed with this effort. We find it unnecessary, misleading and counterproductive to the remediation promised in the 1998 ROD for OU1. This ROD required removal of all arsenic contamination above a certain level in a specifically defined area.

However, several years ago, when the Base finally got around to attempting this removal, it found that it had grossly misjudged the size of the area and amount of contaminant at issue. This was another of a long list of underestimations and misjudgments made by the Base (and documented in our reports and responses to related studies over the years). We awaited some level of contrition as the Base reassessed its self-serving assumptions and theories which led to this latest misjudgment.

This never happened. Rather than placing the fault with its own planning and performance then working to fix those deficiencies, the Base chose instead to redefine

the problem (through this Supplemental Risk Assessment) it would have to address. The intent is clear. This Supplement bypasses the Base's failure to comply with removal requirements of the 1998 ROD, by generating a new lower risk assessment which allows the contamination at issue to remain in place off-base. How convenient for the Base, but hurtful to those anticipating actual removal of this contaminant as required in the ROD.

Response: *As stipulated in the Record of Decision (ROD) for Hill Air Force Base (AFB) Operable Unit (OU) 1, the Air Force began remediation of the arsenic-impacted sediment in 2008, within 5 years after the springs stopped flowing. This remediation effort included an additional analysis and characterization of the arsenic in the soil/sediment. This characterization revealed there was more arsenic-impacted sediment than was known when the 1998 ROD was signed.*

After beginning the soil removal and removing approximately 1,550 cubic yards of arsenic-impacted sediment, it was determined that further soil removal could result in destabilization of the hillside or slope where the work was occurring. Because of this, the Air Force decided to perform a Supplemental HHRA for the arsenic-impacted sediment sites of OU 1 to assess potential exposures and risks of any arsenic concentrations remaining after the soil removal action. This Supplemental HHRA was developed to be used in future site management decision making.

*Prior to the Supplemental HHRA, human health risks for the arsenic-impacted sediment had only been addressed qualitatively (see Montgomery Watson, 1995, Section 3.5.6). Thus, the Supplemental HHRA does not result in "a new lower risk estimate," as stated in this comment, because quantitative risk estimates did not previously exist. The key finding of the Supplemental HHRA is that **current and future risks are within the United States Environmental Protection Agency's (EPA's) target range for potential cancer effects (i.e., risks between 10^{-6} and 10^{-4}) and below the target threshold for noncancer effects (i.e., Hazard Index of 1) even when applying exposure assumptions for unrestricted future land use (residential).***

Paragraph #5 and Bullet Point 5(1)

The following are a few specific complaints with this flawed effort:

(1) The draft included input from the City of South Weber about future utility of the area, but this city has no jurisdiction over this property. A thorough study would have shown that property owners, not the City, have control over if, when, and where their unincorporated-county property will come under a city's jurisdiction. Further review would show that the property owners have documented with the City of South Weber, based on the advice of their engineers, that their 100 plus acres above the canal should not be annexed into South Weber for logistical/cost reasons.

Response: *The relevance of this comment to the methods and findings presented in the Supplemental HHRA Report is unclear. The Air Force neither solicited nor received input from South Weber City. The South Weber City Landslide Hazard Map is provided on the city website and was reviewed as one piece of information used in selecting exposure scenarios for the Supplemental HHRA.*

Bullet Point 5(2)

(2) While input concerning the property's utility and possible exposure scenarios was solicited from a City with no knowledge about or authority over the property at issue, no effort was made to obtain input from the property owners. If contacted for input, the owners would have indicated that:

Response: *The issue of city input was addressed above. Regarding landowner input, the property owners were provided copies of the Supplemental HHRA for the Operable Unit 1 Hillside Work Plan and given opportunity to provide comments on that document (see Appendix D of the Final Supplemental HHRA Work Plan [CH2M HILL, 2010]). That document presented the land use scenarios that would be evaluated as part of the Supplemental HHRA for the Operable Unit 1 Hillside. In their comments on the work plan, the property owners did not provide suggestions about alternatives to or refinement of the recreationalist/trespasser and residential exposure scenarios that were included in the Supplemental HHRA.*

Bullet Point 5(2)(a)

(a) The land in question was regularly used for livestock grazing prior to the mass escapes of the Base's pollution in the 1980s, and such use would be continued after the removal of arsenic promised in the 1998 ROD.

Response: *This statement has no bearing on the formulation or results of the Supplemental HHRA. The Supplemental HHRA places no limitations on grazing activities.*

Bullet Point 5(2)(b)

(b) The hillside is rich with top soil which the owners could sell (to a depth of several feet) and then still reclaim the ground for other high and better uses than livestock raising.

Response: *The soil-mining scenario is not considered a probable land use and, thus, was not addressed in the Supplemental HHRA Report. As noted in the EPA comment letter on the Draft Supplemental HHRA Work Plan (CH2M HILL, 2010), "EPA's Risk Assessment Guidance for Superfund recommends that all probable scenarios be*

evaluated, not necessarily all conceivable scenarios.” It is the Air Force’s opinion that the soil-mining scenario would not conceivably arise along the geologically unstable hillside.

In the unlikely event that the soil-mining scenario was realized, please note the finding highlighted above regarding risk estimates being within or below risk criteria established by the EPA, even for residential land use.

Bullet Point 5(2)(c)

(c) The area has always been a magnet for people to recreate and enjoy in a variety of ways. Consistent with this, the City of South Weber, over the opposition of the Canal Company and the property owners, has placed a canal trail, adjacent to the area in question, as a projected part of the City’s General Plan.

Response: *Recreational property use is one of the two scenarios considered in the Supplemental HHRA Report.*

Bullet Point 5(2)(d)

(d) Any restrictions on access or use of this property, since its massive contamination by the Base through the 1970-1990s, were instigated by the Poll family at the direction of their legal advisers and property insurers. They felt that anyone injured in anyway by the contamination, which had originated on Base but was allowed to migrate onto or through Poll property, would stand a better chance in seeking relief from the family than the federal government. None of those restrictions were initiated by the Base, yet it incorrectly represents them in this draft as the norm for limiting future exposures.

Response: *Hill AFB is unaware of any restrictions on land use of this property, except for those related to natural geological instability, which are not related to Hill AFB activities.*

Bullet Point 5(2)(e)

(e) The conclusions in the draft about the steepness and general utility of the property are greatly exaggerated. This is property surrounded by a rapidly growing Wasatch front where all available open space is finding new and higher uses. Some of this, like the subject property, may need some remedial engineering to fully utilize some of the acreage, but every indicator shows nothing inherent to this property (except the Base’s pollution upon and passing through it) to preclude higher, better and more aggressive long-term utility than suggested in this draft.

Response: Residential land use is considered in the Supplemental HHRA and the estimated cancer risks were within the EPA's target risk range (40 Code of Federal Regulations [CFR] 300) and the noncancer hazard index was below the target value of 1.

Bullet Point 5(2)(f)

(f) Having wasted between \$1-2 million dollars in failures to remove the arsenic from the Hillside, the Base is resorting now (through this supplement) to leave its pollution on private property. This equates to a permanent 'taking,' without compensation, of future economic value of such property. Private landowners would be obligated to inform potential buyers of this condition. It represents a far greater long-term negative factor for such land than the imagined or exaggerated adverse elements mentioned in the Supplement.

Response: This is the commenter's opinion and is not relevant to the methods or results presented in the Supplemental HHRA Report.

Bullet Point 5(3)

(3) The draft ignored historical facts concerning the utility and topography of the area. For example, the Base's own records (Project Hil# 292-5, Contract F42650-85-C-3649) show that the Base caused most of the slides and instability in the subject area in 1986 and committed (but failed "to followup) to remedy it as "repair(s) needed to prevent further damage." The Base has numerous pictures showing this damage in the 1980s. Likewise, in an earlier draft, the false claim was made that there were no trails in the area, but the Base has numerous photographs showing three significant roads (often used for vehicular traffic before the pollution problems) through this area. The Coalition too has color copies of those pictures. The Supplement's disregard of the above realities, about access and typography of the subject area, reflects negatively on the credibility of the entire exercise.

Response: This comment appears to be in response to text in Section 3.2.1 of the Supplemental HHRA Report that states, "There are no features (ponds, streams, trails, etc.) that would attract intensive recreational uses at either site." The purpose of this statement was to clarify the type of recreationalist exposures that might occur at the site. For example, a higher exposure frequency might be assumed if features such as ponds or streams existed that might result in a person consistently spending more time in one particular place over their lifetime versus a person just passing through the areas.

Including trails in this statement may cause confusion since the exposure assumptions for the recreationalist are appropriate for people moving through the sites regardless of

whether they are on a trail. The reference to trails will be removed from the document. Removing this reference will have no impact on the results of the Supplemental HHRA since a recreational exposure scenario was included using appropriate exposure assumptions.

The assumed daily intensity of recreational use has no impact on the risk results. This is because this factor was only accounted for through use of the daily exposure time for the inhalation pathway and inhalation exposures are orders of magnitude below (1) the risks related to incidental soil ingestion and (2) the EPA acceptable risk/hazard values. The referenced results are presented in Table 3-9 of the Supplemental HHRA Report. The 50-milligram-per-day assumed incidental soil ingestion rate for the recreationist in effect requires that 100 percent of each site visit occur within the former Springs U1-303, U1-304, U1-305, and U1-318. In other words, there was no accounting for the idea that these sites represent a small fraction of the larger hillside over which daily recreational (e.g., hiking) oral exposures would likely occur. Thus, the calculated recreationalist risks/hazards in the Supplemental HHRA, which are below the EPA risk/hazard acceptable values, are likely to be substantially (conservatively) overestimated. Discussion of this concept will be added to the Uncertainty Analysis section (Section 3.4 of the Supplemental HHRA Report).

Regarding the commenter's assertion that "the Base caused most of the slides and instability in the subject area," the Supplemental HHRA Report already provides reference to independent scientific documentation of widespread, naturally occurring geological instabilities in the area. No further consideration of this topic is warranted.

Bullet Point 5(4)

(4) The work orders or job instructions, which guided the conduct of this supplemental risk assessment, are so restrictive in nature that they largely predetermine the outcome. Those guidelines cherry-picked assumptions and theories which limit rather than expand the scope of a real supplemental risk assessment. For instance, arsenic is embraced as the only contaminant of concern (COC). However, as this supplemental was allegedly necessitated by the Base's failure to accurately project the distribution and amount of arsenic ROD-required for cleanup, it is reasonable to believe the Base was equally incorrect in determining that arsenic was the only COC. Huge amounts of other heavy metals and chemicals were also dumped in this area. Only a supplemental designed for a certain predetermined outcome could ignore other possibly related deficiencies.

Response: *The Air Force stands by its agency-approved data-evaluation and risk-screening process that resulted in arsenic being identified as the sole contaminant of potential concern. This process (see Sections 2.0 and 3.0 of the Supplemental HHRA Report) included assessing and screening a large database of analytical results for samples collected on the hillside that included analysis for volatile organic compounds*

(VOCs), total petroleum hydrocarbons (TPHs), metals, semivolatile organic compounds (SVOCs), pesticides, herbicides, and polychlorinated biphenyls (PCBs).

Bullet Point 5(5)

(5) The Coalition questions how the State of Utah and EPA can support this Supplement. The residents of the South Weber Valley have been waiting for over a decade for the ROD-promised removal of arsenic immediately above the South Weber Elementary School. Removal, per the ROD, is noted as the most certain remedy for the well-being of the potentially-affected population. If this Supplemental is approved; the Base, EPA and the State will renege on the removal required in the ROD. They would then replace this commitment with the nebulous inference that the problem is now simply unworthy of the promises made in 1998. The Coalition notes that the State did not comment on this draft while the EPA representative found that “authors did an excellent job with this document.”

Response: *The Utah Department of Environmental Quality (UDEQ) did state their concurrence with EPA comments on the draft Supplemental HHRA Report (see Appendix C of the draft report).*

Paragraph #6

Believing in the Superfund process (administered mainly by the polluter) has been difficult especially when monitored natural attenuation until “sometime in the 2070s is its primary focus for OU1. If this supplemental is approved to eliminate the basic requirement for removal of the arsenic, our Coalition contends the superfund processes, as exercised here would be without credibility.

Let me know if you have any questions concerning this response.

Sincerely,

Brent Poll
Executive Director

Response: *This paragraph does not address the methods or findings presented in the Supplemental HHRA Report.*

Dr. John Carter's Comment Letter Annotated with Paragraph-numbering Scheme



June 1, 2011

Mr. Brent Poll
South Weber Coalition
7605 South 1300 East
South Weber, Utah 84405

Re: Comments on Draft Supplemental Human Health Risk Assessment Report for the Operable Unit 1 Hillside.

Dear Brent:

In preparing these comments, I have reviewed a number of documents, including:

- Statement of Work CH2M Hill Contract #FA 8201-09-D-0002 April 2010
- Draft Supplemental Human Health Risk Assessment Report for the Operable Unit 1 Hillside April 2011
- Final Record of Decision Operable Unit 1 September 1998
- Final Supplemental Human Health Risk Assessment Work Plan November 2010
- Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. US EPA OSWER Directive 9200.4-17P April 1999
- National Contingency Plan

I recently prepared comments on the Quarter 4 2010 Mass Escape Calculations for Operable Unit 1, in which HAFB acknowledged that OU1 continues to release contaminants from the Source Areas. I pointed out that there are additional pathways from the Source Areas that are not addressed. Until reviewing that report, I was unfamiliar with the concept of Mass Escape. I always considered that these are "releases" which would be dealt with by additional remedial measures. Now, added to the other problems with OU1 remediation, we have soil contaminated with arsenic and other compounds that will likely be left in place. OU1 lacks a liner, or containment of sufficient integrity to eliminate further releases.

In the face of these continuing releases and the fact that residents in South Weber are already living with the plume emanating from the Source Areas with no end in sight, the preparation of this current Draft HHRA troubles me. I find it troubling for many reasons, but a primary reason is in regard to the April 2010 Statement of Work (SOW) referenced above. That SOW severely constrained the efforts of the Contractor in several ways by requiring:

- No additional sampling
- Address human health and shall not include an ecological risk assessment
- The risk assessment will focus on arsenic by direct human exposure
- Migration to groundwater and vapor intrusion pathways will not be addressed

- The risk assessment shall incorporate site-specific information regarding the relative bioavailability of arsenic consumed orally via incidental ingestion of the soil based on bioavailability and arsenic speciation analysis during CY2009.
- Risk assessment protocols used shall be in accordance with EPA/540/R/99/005

4 HAFB, by limiting the scope in this manner has essentially dictated the outcome, an outcome consistent with past performance in which the least cost action alternative was applied to OUI in the ROD. I will return to this point later. By limiting the scope and not considering other sources of risk to life, property or the ecosystem, HAFB may be violating the intent of the law. I believe at the least, HAFB is operating in a compromised ethical position. Let me explain.

5 For many years I have addressed environmental issues on National Forest and BLM lands. When projects are proposed there, an EA or EIS is prepared under the National Environmental Policy Act. That Act requires that the context and intensity of an action will be addressed and that the analysis will not be fragmented by ignoring other projects or activities in the region of the proposed project. It further prevents using the NEPA process to justify a "decision already made". In other words, it is illegal to set up the EA or EIS in such a way that the preferred outcome is arrived at through the environmental analysis process, i.e. a self-fulfilling prophesy. I view NEPA as our strongest ally in ensuring that projects are analyzed so that decisions are objective and without bias.

6 While this is not a NEPA case, are these principles assumed to be absent when dealing with Superfund? It seems inconsistent to have governmental environmental policy that requires an objective analysis of all related factors when dealing with environmental issues on National Forests and BLM lands, but when it comes to human health and Superfund Sites to depart from that policy. I cannot read the SOW and then accept an HHRA in which the desired outcome is so obviously designed in to the analysis.

7 The ROD states that *"The selected remedy for OUI addresses the principal threats posed by the site by minimizing or preventing direct contact with contaminated soils and landfill contents, preventing ingestion of and direct contact with contaminated groundwater, surface water, and sediments as well as preventing further offsite transport of contaminants."*¹ (emphasis added) This was signed by the Assistant Regional Administrator Office of Ecosystems Protection and Remediation EPA Region VIII; Dianne R. Nielson, Executive Director State of Utah Department of Environmental Quality; and Stewart E. Cranston, Lieutenant General, USAF Vice Commander Air Force Materiel Command Wright-Patterson Air Force Base, Ohio. I took this to mean the Air Force was committed to remedial measures that would prevent further releases from the Source Area once the remedial action was implemented.

8 The ROD further stated that, *"Arsenic contaminated sediments having concentrations exceeding background levels, as defined in the Baseline Risk Assessment portion of the RI, will be excavated at seeps U1-301, U1-303, U1-304, U1-305, and U1-318."* Now, because the volume of soil excavated is larger than anticipated, the contaminated sediments will likely remain in place. No removal was conducted at U1-305 and it will remain as well. Spring U1-301 is contaminated, but not addressed. The arsenic at these sites which will likely remain in place is

¹ ROD Declaration for the Record of Decision, page xi.

not considered a secondary source subject to further migration or ecological damage. Failure to consider these factors and the other contamination present at the arsenic sites, as well as other pathways and contaminants present in the Non-Source Areas, constitutes fragmentation of the analysis and can be seen as an effort to “justify a decision already made” as described in the NEPA analogy above.

9 The Final Supplemental Human Health Risk Assessment Work Plan (page 1-2) states, “*Arsenic-impacted sediment has also been identified at Spring U1-301, which is located approximately 1,800 feet east of the OU 1 site; however, the flow from this spring has not been affected by the OU 1 groundwater extraction and treatment system.*” The fact that it is still flowing is used to omit it from the analysis. One would think this is a red flag to HAFB. If U1-301 continues to flow, is contaminated by arsenic and other compounds, the rationale used by HAFB for arsenic migration would surely lead one to conclude that this contamination is escaping from the Source Areas and an investigation would ensue to determine the source and remediate the problem.

10 I have been concerned about the North and East portion of the Source Area with its detections of Vinyl chloride, the soil gas plumes on the hillside and the lack of a confining layer at the base of the slope. That seep (or spring) U1-301 continues to flow, contains arsenic which HAFB deems originates from changes in redox potential due to capping the landfills, indicates to me that the site is still leaking this contamination from the Source Area. HAFB contends the arsenic is naturally occurring and only migrated due to changes in chemical or physical conditions in the Source Area. So, if this is the case, why is HAFB ignoring this spring in its evaluations? The fact that it flows does not negate the presence of contaminants.

11 The SOW set in motion a process of elimination of all considerations except a small part of the arsenic present, while ignoring all other sources of human health risk. The HHRA appears to have successfully met this goal of narrowing the scope by its incremental and fragmented approach to risk.

12 Regarding the presence of arsenic in the springs, seeps and soils in the non-Source areas, the Draft HHRA states, “Arsenic wastes were not specifically managed at OU 1. Rather, the most plausible explanation for the presence of arsenic on the hillside is that geochemically reduced groundwater conditions, exacerbated by disposal of wastes in the OU 1 landfills, mobilized arsenic occurring naturally in the subsurface soil.” (page ES-1). It is curious that HAFB has not done research to determine if arsenic was used at the Ogden Arsenal, in its weapons manufacturing or as a preservative and dismisses it as naturally occurring. I did a simple Google search and found in Wikipedia some interesting information on arsenic:

- In the 1950s a process of treating wood with chromated copper arsenate was invented, and for decades this treatment was the most extensive industrial use of arsenic.
- Organoarsenic compounds were used as chemical warfare agents after WWI.
- It was used in bronzing and pyrotechnics (flares?).
- Up to 2% of arsenic is used in lead alloys for lead shots and bullets
- During the Vietnam War the United States used Agent Blue to destroy crops

13 It would seem strange, given HAFB's role in WWII, the Ogden Arsenal operating for decades, and its other large role in managing weaponry over time that no arsenic would have been used in these various military or industrial activities. At least the HHRA should have acknowledged these probable uses on HAFB. Regardless, HAFB owns the arsenic as it admits it's own remedial actions and waste disposal have caused arsenic to migrate from the Source Areas.

14 In another step of this process of elimination to study only arsenic, at just two locations, while ignoring all other factors of risk or damage to property and its potential uses, iron was also found in high concentrations, being "mobilized" along with arsenic and manganese by the reducing conditions in the Source Area. As stated in the Draft HHRA, *"The reducing conditions resulted in the mobilization of naturally occurring metals (including iron, manganese, and arsenic)"* (Draft HHRA page 1-2) (emphasis added).

15 The Draft HHRA (page 2-4) then goes on to eliminate iron by the following rationale. *"This screening-level review found that only arsenic and iron exceeded their respective RSLs. Per EPA Region 8 risk assessment guidance (EPA, 1994), iron is a commonly occurring and essential nutrient. It comprises approximately 5 percent of the earth's crust and is commonly detected at relatively high concentrations in soil. Minimum levels are necessary to ensure good nutrition. Therefore, the concentrations of iron detected at OU 1 present, at most, a de minimis risk. Since the non-arsenic contaminants present de minimis risk (i.e., maximum concentrations are less than the RSL based on an incremental excess lifetime cancer risk of 10^{-6} or hazard quotient of 1), broader delineation of their concentrations in soil is not warranted at Sites 1 and 2, and the existing dataset is suitable for use in the supplemental HHRA and subsequent remedial action decision making. Therefore, arsenic was the only COC evaluated quantitatively in the supplemental HHRA."*

16 In another Google search, and also because I am dealing with iron in a well on my property, I found the following information from a water treatment company discussing the health effects of iron². *"Iron may cause conjunctivitis, choroiditis, and retinitis if it contacts and remains in the tissues. Chronic inhalation of excessive concentrations of iron oxide fumes or dusts may result in development of a benign pneumoconiosis, called siderosis, which is observable as an x-ray change. No physical impairment of lung function has been associated with siderosis. Inhalation of excessive concentrations of iron oxide may enhance the risk of lung cancer development in workers exposed to pulmonary carcinogens. LD50 (oral, rat) = 30 gm/kg."* *"Iron (III)-O-arsenite, pentahydrate may be hazardous to the environment; special attention should be given to plants, air and water. It is strongly advised not to let the chemical enter into the environment because it persists in the environment."* So, the Draft HHRA explains away iron even though it exceeds the RSL. Yet, once again, one has to wonder why there is an RSL if it is to be ignored.

17 The EPA guidance cited in the SOW regarding these Regional Screening Levels was for the Mid-Atlantic Region. That document noted that it is *"recommended, but not mandatory* to employ these RSLs."³ It further states, *"Alternative approaches for risk assessment may be found to be more appropriate at specific sites (e.g., where site circumstances do not match the underlying assumptions, conditions and models of the guidance).* The Guidance cautions,

² <http://www.lenntech.com/periodic/elements/fe.htm>

³ http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm

"Users within and outside the CERCLA program should use the tables or calculator results at their own discretion and they should take care to understand the assumptions incorporated in these results and to apply the SLs appropriately." Finally, whether these generic SLs or site-specific screening levels are used, it is important to clearly demonstrate the equations and exposure parameters used in deriving SLs at a site. A discussion of the assumptions used in the SL calculations should be included in the documentation for a CERCLA site. I don't recall HAFB evaluating the guidance for its appropriateness. I don't recall seeing any evaluation of the potential cumulative effects of the multiple compounds present, multiple sites, ambient conditions such as Wasatch Front Air Quality, residential or workplace exposures that when added, can confound the result. For example, the Draft HHRA Table 2-1 provided a list of analytes, of which 25, including arsenic, were detected in the sediment/soil samples used in this analysis. Because these were below the RSL, their effects were not included in the analysis. At what point does the presence of multiple hazardous compounds, their synergistic and/or cumulative effects become an issue?

18 In my September 30, 2010 comments on the Draft Supplemental Human Health Risk Assessment Work Plan for Operable Unit 1 Hillside, I attached my April 11, 2003 comments on the ATSDR Public Health Assessment. That ATSDR assessment pointed out studies that have documented health risks based on proximity to waste sites. Those would be instructive to review as they indicate just living near a Superfund site can result in birth defects, cancer of various types, low birth weights, eczema, ulcers, hay fever and other health issues. Further, some studies cited indicate that there are no threshold values for cancer-causing agents and that exposure to low doses of these substances produces some increased risk of developing cancer. An interesting and counter-intuitive study showed that vinyl chloride has a cancer potency at low doses 30 times higher than at the highest dose. Yet, as cited below, the HHRA used linear functions to estimate health effects, while apparently effects do not necessarily follow a linear function.

19 The concept of excess lifetime risk which is used in the Draft HHRA (page 3-11) is described as, *"The dose-response relationship for cancer effects is expressed as a cancer slope factor that converts estimated intake directly to the incremental excess lifetime cancer risk (ELCR)." The discussion then goes on to state, "However, because risk at low intake levels cannot be directly measured in animal or human epidemiological studies, a number of mathematical models and procedures have been developed to extrapolate from the high doses used in the studies to the low doses typically associated with environmental exposures. This modeling leads to uncertainty. The EPA typically assumes linearity at low doses and primarily uses the linearized multistage procedure when uncertainty exists about the mechanism of action of a carcinogen and when information suggesting nonlinearity is absent."* Then, *"The EPA has stated that cancer risks estimated by this method produce estimates that "provide a rough but plausible upper limit of risk." In other words, it is not likely that the true risk would be much more than the estimated risk, but "the true value of the risk is unknown and may be as low as zero" (EPA, 1996c).*

20 The following quote is from a paper dealing with risk determinations relative to radiation exposures: *"As a measure of excess cancer deaths, the excess lifetime risk has several drawbacks largely related to the fact that since everybody must die, excess cancer mortality can only occur by decreasing the mortality to other causes; this has important implications for calculation of site-specific excess lifetime risks after wholebody exposure. In particular, if it had*

been found that radiation increases the rate of all major causes of death by the same factor, then there would be no excess lifetime cancer risk at all (but, of course, the life expectancy would be shortened)."⁴ This appears to me to say that other detrimental health effects or shortened lifespan can occur but not be represented by the calculations and generic screening levels contained in risk assessments. The bottom line for an individual is that they either do (probability of 1) or do not (probability of zero) suffer an adverse effect.

21 The SOW prescribed use of EPA/540/R/99/005⁵ for the risk assessment. This guidance applies to dermal exposures by water and soil, but excludes vapors and other routes of exposure. A disclaimer on the title page states, "Some of the statutory provisions described in this document contain legally binding requirements. However, this document does not substitute for those provisions or regulations, nor is it a regulation itself. Thus, it cannot impose legally-binding requirements on EPA, states, or the regulated community, and may not apply to a particular situation based upon the circumstances. Any decisions regarding a particular remedy selection decision will be made based on the statute and regulations, and EPA decisionmakers retain the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate. EPA may change this guidance in the future." In addition, Chapter 1, page 1-1 states, "This guidance is considered interim, pending release of any update to the DEA from ORD. As more data become available, RAGS Part E may be updated." Chapter 2, page 2-1 discussing use of screening of compounds, states, "However, risk assessors may decide not to use the screening and proceed to a quantitative assessment of all chemicals at a site." It also notes, "Very limited data exist in the literature for the dermal absorption of chemicals from soil."

22 This describes a process that is continuing to evolve, with many compounds lacking specific exposure data. It also does not limit HAFB in its ability to remediate the sites at OUI. For example, the exclusion of seep/spring U1-301 from any assessment because it is still flowing appears inappropriate given there are exposure factors for water and soil/sediment. This guidance provided for evaluation of dermal exposure from compounds in both soil and water. By the time one reviews this manual, it becomes clear there are many possible outcomes based on the decisions made by the risk assessor, choice of statistics, choice of exposure factors, and the many other decisions that have to be made to come up with a final numerical risk. I note that a single factor, skin adherence for soils ranges over an order of magnitude between the geometric mean and 95th percentile (Exhibit 3-3, page 3-15 RAGS Part E). The Draft HHRA (Page 3-11) states, "In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime." So, here is another order of magnitude range. How many of these are necessary until the output of a risk assessment becomes meaningless?

⁴ Vaeth, Michael and Donald A. Pierce. 1990. Calculating excess lifetime risk in relative risk models. Env. Health Perspectives vol. 87:83-94.

⁵ EPA. 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment – Final.

I could not find a methodology in the EPA reference cited above for addressing the cumulative effects of exposure to multiple compounds. Exhibit 3-4 indicates that the dermal exposure factors from soil are experimental.

23 The SOW instructed the Contractor to not address ecological risks. The Final HHRA Workplan cited the National Contingency Plan (40CFR300) as a governing document. Paragraph 300.415(b) of the NCP, *"Authorizes the lead agency to initiate appropriate removal action in the event of a hazardous substance release. Decisions of action will be based on threats to human or animal populations, contamination of drinking water supplies or sensitive ecosystems, high levels of hazardous substances in soils, weather conditions that may cause migration or release of hazardous substances, the threat of fire or explosion, or other significant factors effecting the health or welfare or the public or the environment."* (emphasis added).

24 The aerial photograph in Figure 2-1 of the Final HHRA Workplan appears to show numerous animal or other trails through the contaminated areas. Given the loss of habitat due to development in other nearby areas, this hillside may constitute a local wildlife concentration area. It would seem an omission to refuse to address the ecosystem impacts from continued releases or leaving contaminants in place. Further, the NCP mentions human health or welfare. I didn't see any discussion of welfare in the documents I reviewed. It would seem this should cover the physical and psychological impacts of residing in or adjacent to a contaminated area, having your property values compromised due to the contaminations, deed recordings, loss of springs and use of the property. HAFB is the PRP, responsible for the chemical releases that have contaminated these adjacent properties. Leaving arsenic and other contaminants in the land is not restoring the land to its former uses. These are real effects to residents. They remain unaddressed and lack any final resolution so residents must live with this condition for an undetermined length of time, or perhaps forever, in terms of a human lifespan.

25 I have questioned the determination of background values for arsenic and chromium in past comments. It appears from the ROD that the maximum arsenic value may have been chosen from the background samples taken. I have never seen a report, maps or the complete data set obtained when these samples were taken. Please request HAFB to provide the following:

- Location of all soil samples used for determining background for heavy metals, including GPS coordinates, aerial photographs, maps, field notes.
- Results of chemical analysis for these samples for all compounds analyzed. Include speciation results, complexes of metals with other metals or other compounds.
- Rationale for selecting the background concentration for both arsenic and chromium.

26 I note also that 40CFR302 provides that arsenic has a reportable quantity of 1 lb for a release. Has HAFB determined the relationship of continued releases of numerous listed compounds to its reporting obligation for arsenic and other compounds under various laws such as Community Right to Know?

27 A review of the ROD provides some points of significance. For example, in examining alternatives, SAI, the No Action alternative was *"not considered protective of public health and the environment because it allows continued releases of contaminants to groundwater and their*

28 migration offsite.” Likewise, for the Non-Source Area, NSA1, No Further Action, was not considered protective. How it was made “protective” was the use of institutional controls to prevent potable use of springs and groundwater while remedial actions were to resolve the issue within 5 to 12 years (ROD page 6-3). We now know that the time needed was badly underestimated according to the 2008 Five Year Review. While MNA was selected, other action alternatives were not. The present worth costs estimated for these actions were small in the overall picture. Plume cut-off was estimated at \$3.8 million; hydraulic containment was \$2.8 million; groundwater collection throughout the plume was \$3.3 million. The accepted action of Monitored Natural Attenuation had a present worth of \$1.5 million. Now that we near the 12th year since the remediation was activated, with continued leakage from the Source Areas perhaps explaining the length of time the plume has remained, HAFB apparently has no contingency plan to implement the other alternatives for both Source and Non-Source Areas.

28 The EPA 2008 Five Year Review noted (Table OUI-1, page 3 of 6) noted that, “The ROD indicates that other remedies will be implemented if concentrations do not attenuate in a reasonable time frame.” Table OUI-3 (page 1 of 3) states, “The PSVReport indicates that the non-source area plume will likely not naturally attenuate in the 12 years estimated in the OUI 1 ROD (Hill AFB CEVR, 2008). In addition, although the off-Base dissolved VOC plume appears to be shrinking in most areas, the PSVR indicated that elevated concentrations at monitoring well U1-1602 need to be investigated further (Hill AFB CEVR, 2008). The natural attenuation calculations are being reevaluated to incorporate more refined depth constraints on estimates of MNA timeframe, and to establish bounds on the timeframe.” Does this bode for another simplification that discounts the reality in order to justify MNA and the leaky condition of the Source Area remedy?

29 The ROD was signed on 9/29/98, while the following guidance document from EPA was published in April, 1999, “Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites”⁶. A look at that guidance document might be instructive. In the Purpose, EPA states, “EPA remains fully committed to its goals of protecting human health and the environment by remediating contaminated soils, restoring contaminated groundwaters to their beneficial uses, preventing migration of contaminant plumes, and protecting groundwaters and other environmental resources.” EPA goes on to qualify the use of MNA as to whether it: is the most “appropriate” technology; will meet site remediation objectives within a timeframe that, “is reasonable compared to that offered by other methods”; incorporate “contingency measures” into the remedy; and, “EPA expects that **source control and long-term performance monitoring will be fundamental components of any MNA remedy.**” (emphasis EPA’s).

30 In the Background section, EPA states, “When relying on natural attenuation processes for site remediation, EPA prefers those processes that degrade or destroy contaminants. Also, EPA generally expects that MNA will only be appropriate for sites that have a low potential for contaminant migration.” In the first statement, we have seen that dilution is the principal mechanism at work to reduce pollutants in the non-Source area. Regarding the second statement, OUI has extreme topographic relief with its Source Areas on top of the hill and leaky geology. So, the potential for migration to Non-Source Areas is great and as we have seen, continues in

⁶ Directive 9200.4-17P, April 1999

31 spite of remedial measures taken to date. The valley below, where MNA is applied, has no apparent confining layer and a downward groundwater gradient. These are ideal conditions for dilution in what should otherwise be uncontaminated groundwater.

32 Regarding chlorinated solvents such as trichloroethylene, the Directive states (page 7), "the hydrologic and geochemical conditions favoring significant biodegradation of chlorinated solvents sufficient to achieve remediation objectives within a reasonable timeframe are anticipated to occur only in limited circumstances." The Directive goes on with further points regarding these compounds, but this is sufficient. I don't recall an analysis that documents that these conditions exist in the Non-Source Area.

33 The Directive discusses MNA applied to inorganics as well. Given the possibility that HAFB will elect to leave the current arsenic contamination in place with no further remediation, it is important to see what EPA has to say, *"Changes in a contaminant's concentration, pH, redox potential, and chemical speciation may reduce a contaminant's stability at a site and release it into the environment. Determining the existence, and demonstrating the irreversibility, of these mechanisms is important to show that a MNA remedy is sufficiently protective."* If, HAFB determines to leave in place the arsenic contamination it has documented, it would appear to have the burden of showing that the arsenic currently there would remain there and not, through physical, chemical or biological means, migrate further, change states, or become accessible for human or animal consumption or exposure. On this steep slope, which HAFB claims is unstable, surely there will be erosion and slumps to move, expose or change the environment in which the arsenic and other contaminants reside. Of course, this assumes there is no further leakage of arsenic or other compounds off-site. EPA further summarizes by saying, *"Therefore, natural attenuation of inorganic contaminants is most applicable to sites where immobilization or radioactive decay is demonstrated to be in effect and the process/mechanism is irreversible."* While HAFB may contend that it is not relying on natural attenuation for the arsenic-contaminated soils and sediments, if left in place, it is relying on this concept of natural attenuation. Whether it will be MNA is another question.

33 Without going further in analysis of the Directive, my conclusion is that the MNA alternative applied at OUI is inconsistent with the guidance document and we should be discussing how to accelerate remediation, through the necessary contingency measures, rather than dealing with this HHRA. HAFB should evaluate its MNA against this document which came into effect shortly after the ROD was signed.

Yours truly,



John Carter
TAG Advisor

Air Force Responses to Dr. John Carter's Comments

June 1, 2011

Mr. Brent Poll

South Weber Coalition
7605 South 1300 East
South Weber, Utah 84405

Re: Comments on Draft Supplemental Human Health Risk Assessment Report for the Operable Unit 1 Hillside.

Dear Brent:

Paragraph #1

In preparing these comments, I have reviewed a number of documents, including:

- Statement of Work CH2M Hill Contract #FA 8201-09-D-0002 April 2010
- Draft Supplemental Human Health Risk Assessment Report for the Operable Unit 1 Hillside April 2011
- Final Record of Decision Operable Unit 1 September 1998
- Final Supplemental Human Health Risk Assessment Work Plan November 2010
- Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. US EPA OSWER Directive 9200.4-17P April 1999
- National Contingency Plan

Response: *This paragraph contains introductory text. No response needed.*

Paragraph #2

I recently prepared comments on the Quarter 4 2010 Mass Escape Calculations for Operable Unit 1, in which HAFB acknowledged that OU1 continues to release contaminants from the Source Areas. I pointed out that there are additional pathways from the Source Areas that are not addressed. Until reviewing that report, I was unfamiliar with the concept of Mass Escape. I always considered that these are “releases” which would be dealt with by additional remedial measures. Now, added to the other problems with OU1 remediation, we have soil contaminated with arsenic and other compounds that will likely be left in place. OU1 lacks a liner, or containment of sufficient integrity to eliminate further releases.

Response: *Comments of this nature would be appropriate during the next Five-Year Review.*

Paragraph #3

In the face of these continuing releases and the fact that residents in South Weber are already living with the plume emanating from the Source Areas with no end in sight, the preparation of

this current Draft HHRA troubles me. I find it troubling for many reasons, but a primary reason is in regard to the April 2010 Statement of Work (SOW) referenced above. That SOW severely constrained the efforts of the Contractor in several ways by requiring:

- No additional sampling
- Address human health and shall not include an ecological risk assessment
- The risk assessment will focus on arsenic by direct human exposure
- Migration to groundwater and vapor intrusion pathways will not be addressed
- The risk assessment shall incorporate site-specific information regarding the relative bioavailability of arsenic consumed orally via incidental ingestion of the soil based on bioavailability and arsenic speciation analysis during CY2009.
- Risk assessment protocols used shall be in accordance with EPA/540/R/99/005

Response: *The Air Force does not agree that the listed items “severely constrained” the Supplemental Human Health Risk Assessment (HHRA) but, instead, were necessary to define tasks required of the contractor. Any risk assessment performed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) must conform to Risk Assessment Guidance for Superfund (RAGS) Volume I Human Health Evaluation Manual (Part A) (EPA/540/R/99/005) (United States Environmental Protection Agency [EPA], 2009) and subsequent RAGS guidance documents.*

Paragraphs #4, 5 and 6

HAFB, by limiting the scope in this manner has essentially dictated the outcome, an outcome consistent with past performance in which the least cost action alternative was applied to OU1 in the ROD. I will return to this point later. By limiting the scope and not considering other sources of risk to life, property or the ecosystem, HAFB may be violating the intent of the law. I believe at the least, HAFB is operating in a compromised ethical position. Let me explain.

For many years I have addressed environmental issues on National Forest and BLM lands. When projects are proposed there, an EA or EIS is prepared under the National Environmental Policy Act. That Act requires that the context and intensity of an action will be addressed and that the analysis will not be fragmented by ignoring other projects or activities in the region of the proposed project. It further prevents using the NEPA process to justify a “decision already made”. In other words, it is illegal to set up the EA or EIS in such a way that the preferred outcome is arrived at through the environmental analysis process, i.e. a self-fulfilling prophesy. I view NEPA as our strongest ally in ensuring that projects are analyzed so that decisions are objective and without bias.

While this is not a NEPA case, are these principles assumed to be absent when dealing with Superfund? It seems inconsistent to have governmental environmental policy that requires an objective analysis of all related factors when dealing with environmental issues on National Forests and BLM lands, but when it comes to human health and Superfund Sites to depart from that policy. I cannot read the SOW and then accept an HHRA in which the desired outcome is so obviously designed in to the analysis.

Response: *The Air Force complied with both the letter and intent of CERCLA (the applicable law) in conducting the Supplemental HHRA. The Air Force has and will continue to act in an ethical manner and in compliance with applicable laws and regulations in its execution of the Environmental Restoration program.*

The outcome of the Supplemental HHRA was in no way predetermined. Consistent with RAGS Part A, the assumptions and methods were intended to provide estimates of reasonable maximum exposure (RME) and associated potential human health risks for current or probable future receptors at the site. These assumptions and methods were presented in the Supplemental HHRA Work Plan (CH2M HILL, 2010) and were submitted to and approved by the Utah Department of Environmental Quality and EPA Region 8 prior to conducting the Supplemental HHRA and preparing the report.

The Supplemental HHRA does not represent a “fragmented” analysis, and the Air Force did not ignore “other sources of risk to life, property or the ecosystem.” By design, the Supplemental HHRA was focused on a particular area (the hillside) and matrix (soil/sediment). As noted in both the work plan and report, the Supplemental HHRA was not intended to be a comprehensive baseline (i.e., pre-remedy) human health risk assessment such as the baseline risk assessment contained in the Remedial Investigation Report (Montgomery Watson, 1995) and referenced in the OU 1 Record of Decision (ROD) (Hill Air Force Base [AFB], 1998). This approach was taken because implementation of the remedial actions stipulated in the ROD has rendered potential or actual exposures to OU 1 contamination at other locations or to other matrices incomplete or insignificant.

For example, implementation of groundwater-use restrictions, operation of the on-Base extraction trench system, and implementation of the Basewide Indoor Air Program have eliminated or sufficiently minimized exposure to groundwater via ingestion, incidental contact, and the vapor-intrusion pathways. The soil and sediment contamination on the hillside represented the only identified location/matrix where information regarding the degree and significance of potential human exposures was unknown. This was because quantitative data analysis and risk assessment were not previously available for this area, as noted in both the work plan and report. Thus, far from ignoring other “risk to life,” the remedial and risk assessment activities performed post-ROD represent a comprehensive response that is protective of human health. The focused nature of the Supplemental HHRA does not constitute “fragmentation” but is rather an intentional and scientifically defensible approach for developing information needed for making site management decisions.

The Air Force is unclear what the commenter means by a risk to “property” and what this concept means under CERCLA and the National Contingency Plan (NCP). Regarding ecosystem risk, the Remedial Investigation Report (Montgomery Watson, 1995) adequately addressed ecological risks and further evaluation of this topic was not necessary.

Paragraphs #7 and 8

The ROD states that *“The selected remedy for OU1 addresses the principal threats posed by the site by minimizing or preventing direct contact with contaminated soils and landfill contents, preventing ingestion of and direct contact with contaminated groundwater, surface water, and sediments as well as preventing further offsite transport of contaminants.”*¹ (emphasis added) This was signed by the Assistant Regional Administrator Office of Ecosystems Protection and Remediation EPA Region VIII; Dianne R. Nielson, Executive Director State of Utah Department of Environmental Quality; and Stewart E. Cranston, Lieutenant General, USAF Vice Commander Base Materiel Command Wright-Patterson Base Base, Ohio. I took this to mean the Base was committed to remedial measures that would prevent further releases from the Source Area once the remedial action was implemented.

¹ ROD Declaration for the Record of Decision, page xi.

The ROD further stated that, *“Arsenic contaminated sediments having concentrations exceeding background levels, as defined in the Baseline Risk Assessment portion of the RI, will be excavated at seeps U1-301, U1-303, U1-304, U1-305, and U1-318.”* Now, because the volume of soil excavated is larger than anticipated, the contaminated sediments will likely remain in place. No removal was conducted at U1-305 and it will remain as well. Spring U1-301 is contaminated, but not addressed. The arsenic at these sites which will likely remain in place is not considered a secondary source subject to further migration or ecological damage. Failure to consider these factors and the other contamination present at the arsenic sites, as well as other pathways and contaminants present in the Non-Source Areas, constitutes fragmentation of the analysis and can be seen as an effort to “justify a decision already made” as described in the NEPA analogy above.

Response: *There is no cause-and-effect relationship between the volume of impacted soil and the likelihood of soil remaining in place. In making site management decisions related to arsenic-impacted soil and sediment along the hillside, the Air Force and regulatory agencies will consider the site characterization data and risk assessment along with an analysis of factors including protectiveness, compliance with applicable or relevant and appropriate requirements (ARARs), cost, and implementability.*

As noted in the Supplemental HHRA Work Plan and the Supplemental HHRA Report, Spring U1-301 was not included in the Supplemental HHRA. Because this spring has not stopped flowing, the actions stipulated in the ROD have not been triggered, and, therefore, the Air Force is in compliance with ROD requirements.

The commenter is correct that the arsenic in soil is not considered a secondary source that could result in further degradation of groundwater. This is because of the high dissolved-oxygen content of rain or surface water, which makes dissolution and mobilization of surface or near-surface arsenic in soil unlikely. The absence of significant migration of arsenic from soil to groundwater in this area demonstrates that this mechanism is not occurring. Language explaining why this migration pathway is insignificant will be added to the Supplemental HHRA Report.

Paragraph #9

The Final Supplemental Human Health Risk Assessment Work Plan (page 1-2) states, “*Arsenic-impacted sediment has also been identified at Spring U1-301, which is located approximately 1,800 feet east of the OU 1 site; however, the flow from this spring has not been affected by the OU 1 groundwater extraction and treatment system.*” The fact that it is still flowing is used to omit it from the analysis. One would think this is a red flag to HAFB. If U1-301 continues to flow, is contaminated by arsenic and other compounds, the rationale used by HAFB for arsenic migration would surely lead one to conclude that this contamination is escaping from the Source Areas and an investigation would ensue to determine the source and remediate the problem.

Response: *See previous response. The lack of effect from the extraction/treatment system on the flow in Spring U1-301 is important to Hill AFB because it raises questions about whether a hydraulic connection exists between U1-301 and the OU 1 source areas upgradient of the extractions trenches. The Air Force continues to assess this issue.*

Paragraphs #10 and 11

I have been concerned about the North and East portion of the Source Area with its detections of Vinyl chloride, the soil gas plumes on the hillside and the lack of a confining layer at the base of the slope. That seep (or spring) U1-301 continues to flow, contains arsenic which HAFB deems originates from changes in redox potential due to capping the landfills, indicates to me that the site is still leaking this contamination from the Source Area. HAFB contends the arsenic is naturally occurring and only migrated due to changes in chemical or physical conditions in the Source Area. So, if this is the case, why is HAFB ignoring this spring in its evaluations? The fact that it flows does not negate the presence of contaminants.

The SOW set in motion a process of elimination of all considerations except a small part of the arsenic present, while ignoring all other sources of human health risk. The HHRA appears to have successfully met this goal of narrowing the scope by its incremental and fragmented approach to risk.

Response: *Vinyl chloride was not detected in soil samples collected on the hillside (see Table 2-1 of the draft Supplemental HHRA Report). The commenter’s remarks regarding Spring U1-301 and fragmentation of analysis have been addressed in previous responses.*

Paragraphs #12 - 14

Regarding the presence of arsenic in the springs, seeps and soils in the non-Source areas, the Draft HHRA states, “Arsenic wastes were not specifically managed at OU 1. Rather, the most plausible explanation for the presence of arsenic on the hillside is that geochemically reduced groundwater conditions, exacerbated by disposal of wastes in the OU 1 landfills, mobilized arsenic occurring naturally in the subsurface soil.” (page ES-1). It is curious that HAFB has not done research to determine if arsenic was used at the Ogden Arsenal, in its weapons

manufacturing or as a preservative and dismisses it as naturally occurring. I did a simple Google search and found in Wikipedia some interesting information on arsenic:

- In the 1950s a process of treating wood with chromated copper arsenate was invented, and for decades this treatment was the most extensive industrial use of arsenic.
- Organoarsenic compounds were used as chemical warfare agents after WWI.
- It was used in bronzing and pyrotechnics (flares?).
- Up to 2% of arsenic is used in lead alloys for lead shots and bullets
- During the Vietnam War the United States used Agent Blue to destroy crops

It would seem strange, given HAFB's role in WWII, the Ogden Arsenal operating for decades, and its other large role in managing weaponry over time that no arsenic would have been used in these various military or industrial activities. At least the HHRA should have acknowledged these probable uses on HAFB. Regardless, HAFB owns the arsenic as it admits it's own remedial actions and waste disposal have caused arsenic to migrate from the Source Areas.

In another step of this process of elimination to study only arsenic, at just two locations, while ignoring all other factors of risk or damage to property and its potential uses, iron was also found in high concentrations, being "mobilized" along with arsenic and manganese by the reducing conditions in the Source Area. As stated in the Draft HHRA, *"The reducing conditions resulted in the mobilization of naturally occurring metals (including iron, manganese, and arsenic)"* (Draft HHRA page 1-2) (emphasis added).

Response: *The available hydrogeological and geochemical evidence support the conclusion that naturally occurring arsenic in soil was the primary source of arsenic found precipitated along the hillside. This information was provided in the Supplemental HHRA documents for the purpose of establishing the conceptual site model.*

The commenter's suggestions about other sources of arsenic are speculative. The mobilization of naturally-occurring arsenic remains the most plausible explanation for its occurrence in soil and sediment associated with springs and seeps along the hillside. However, the source of arsenic would not affect the quantitative estimates of exposure or risk provided in the Supplemental HHRA Report, which are based on measurements of actual arsenic concentrations in soil and sediment on the hillside. The question of other metals is addressed in response to the next paragraphs.

Paragraphs #15 - 17

The Draft HHRA (page 2-4) then goes on to eliminate iron by the following rationale. *"This screening-level review found that only arsenic and iron exceeded their respective RSLs. Per EPA Region 8 risk assessment guidance (EPA, 1994), iron is a commonly occurring and essential nutrient. It comprises approximately 5 percent of the earth's crust and is commonly detected at relatively high concentrations in soil. Minimum levels are necessary to ensure good nutrition. Therefore, the concentrations of iron detected at OU 1 present, at most, a de minimis risk. Since the non-arsenic contaminants present de minimis risk (i.e., maximum concentrations are less than the RSL based on an incremental excess lifetime cancer risk of 10⁻⁶ or hazard quotient of 1),*

broader delineation of their concentrations in soil is not warranted at Sites 1 and 2, and the existing dataset is suitable for use in the supplemental HHRA and subsequent remedial action decision making. Therefore, arsenic was the only COC evaluated quantitatively in the supplemental HHRA.”

In another Google search, and also because I am dealing with iron in a well on my property, I found the following information from a water treatment company discussing the health effects of iron². *“Iron may cause conjunctivitis, choroiditis, and retinitis if it contacts and remains in the tissues. Chronic inhalation of excessive concentrations of iron oxide fumes or dusts may result in development of a benign pneumoconiosis, called siderosis, which is observable as an x-ray change. No physical impairment of lung function has been associated with siderosis. Inhalation of excessive concentrations of iron oxide may enhance the risk of lung cancer development in workers exposed to pulmonary carcinogens. LD50 (oral, rat) =30 gm/kg.” “Iron (III)-Oarsenite, pentahydrate may be hazardous to the environment; special attention should be given to plants, air and water. It is strongly advised not to let the chemical enter into the environment because it persists in the environment.”* So, the Draft HHRA explains away iron even though it exceeds the RSL. Yet, once again, one has to wonder why there is an RSL if it is to be ignored.

² <http://www.lenntech.com/periodic/elements/fe.htm>

The EPA guidance cited in the SOW regarding these Regional Screening Levels was for the Mid-Atlantic Region. That document noted that it is *“recommended, but not mandatory* to employ these RSLs.”³ It further states, *“Alternative approaches for risk assessment may be found to be more appropriate at specific sites (e.g., where site circumstances do not match the underlying assumptions, conditions and models of the guidance).* The Guidance cautions, *“Users within and outside the CERCLA program should use the tables or calculator results at their own discretion and they should take care to understand the assumptions incorporated in these results and to apply the SLs appropriately.”* Finally, *whether these generic SLs or site specific screening levels are used, it is important to clearly demonstrate the equations and exposure parameters used in deriving SLs at a site. A discussion of the assumptions used in the SL calculations should be included in the documentation for a CERCLA site.* I don’t recall HAFB evaluating the guidance for its appropriateness. I don’t recall seeing any evaluation of the potential cumulative effects of the multiple compounds present, multiple sites, ambient conditions such as Wasatch Front Air Quality, residential or workplace exposures that when added, can confound the result. For example, the Draft HHRA Table 2-1 provided a list of analytes, of which 25, including arsenic, were detected in the sediment/soil samples used in this analysis. Because these were below the RSL, their effects were not included in the analysis. At what point does the presence of multiple hazardous compounds, their synergistic and/or cumulative effects become an issue?

³ http://www.epa.gov/reg3hwm/risk/human/rb-concentration_table/usersguide.htm

Response: *With respect to iron, this element was specifically considered and eliminated as a contaminant of potential concern based on it being an essential nutrient, consistent with the EPA guidance cited in the Supplemental HHRA Work Plan and the Supplemental HHRA Report. The appropriateness of this instruction in the guidance can be checked via the following analysis.*

The 95 percent upper confidence limit on the mean of the 19 iron detections in the Site 1 and Site 2 soil samples is approximately 55,000 milligrams per kilogram (5.5 percent by weight) (see “Iron Data and Statistics for Soil and Sediment” immediately following these responses). The range of incidental soil ingestion rates applied in the Supplemental HHRA range from 50 to 200 milligrams per day (mg/day). Multiplying the intake rates by the concentration and dividing by 10^6 for conversion of milligrams to kilograms yields iron intake rates ranging from approximately 3 to 11 mg/day. These intake estimates are roughly 25 percent or less of the National Academy of Sciences (NAS) Dietary Reference Intakes/Tolerable Upper Intake Levels for iron, which range from 40 to 45 mg/day (NAS, 2000). The NAS defines these values as follows:

A Tolerable Upper Intake Level (UL) is the highest level of daily nutrient intake that is likely to pose no risk of adverse health effects to almost all individuals in the general population.

This analysis confirms two things: (1) the 5 percent concentration of iron detected at Site 1 and Site 2 are consistent with iron’s overall occurrence in the earth’s crust, and (2) the intake estimates for iron are below nutritional levels the NAS considers safe for the general population.

With respect to Iron (III)-Oarsenite, pentahydrate, the commenter provides no basis for his listing of hazards for this chemical, which is not known to exist at OU 1 and is therefore not relevant to the Supplemental HHRA.

Regarding the commenter’s comments on the use of regional screening levels (RSLs), the assumptions and equations contained in the residential RSL applied for screening OU 1 soil analytes are appropriate and conservative for the site. While the specific website included in the references pointed to the EPA’s mid-Atlantic region, the RSLs are widely applied across the United States including EPA Region 8, which includes Utah.

Consistent with EPA guidance, analytes with maximum detected concentrations below these conservative screening levels were appropriately screened out from further consideration because they are unlikely to contribute significantly to human health risks or hazards. If multiple contaminants of potential concern (COPCs) had been identified, their potential health effects would have been considered cumulatively (additively), as was done in the OU 1 Baseline Risk Assessment contained in the Remedial Investigation Report (Montgomery Watson, 1995) and elsewhere at Hill AFB.

The commenter’s objections expressed in this comment appear to have more to do with the EPA’s overall CERCLA risk assessment framework as opposed to specific application of these methods to OU 1. The commenter is encouraged to engage in the public comment process that occurs when agencies assess new risk assessment methods and their applications. In the meantime, the Air Force will continue to conduct

risk assessments and manage sites in accordance with established EPA and Utah guidance, policies, and regulations.

Paragraphs #18 - 22

In my September 30, 2010 comments on the Draft Supplemental Human Health Risk Assessment Work Plan for Operable Unit 1 Hillside, I attached my April 11, 2003 comments on the ATSDR Public Health Assessment. That ATSDR assessment pointed out studies that have documented health risks based on proximity to waste sites. Those would be instructive to review as they indicate just living near a Superfund site can result in birth defects, cancer of various types, low birth weights, eczema, ulcers, hay fever and other health issues. Further, some studies cited indicate that there are no threshold values for cancer-causing agents and that exposure to low doses of these substances produces some increased risk of developing cancer. An interesting and counter-intuitive study showed that vinyl chloride has a cancer potency at low doses 30 times higher than at the highest dose. Yet, as cited below, the HHRA used linear functions to estimate health effects, while apparently effects do not necessarily follow a linear function.

The concept of excess lifetime risk which is used in the Draft HHRA (page 3-11) is described as, *“The dose-response relationship for cancer effects is expressed as a cancer slope factor that converts estimated intake directly to the incremental excess lifetime cancer risk (ELCR).”* The discussion then goes on to state, *“However, because risk at low intake levels cannot be directly measured in animal or human epidemiological studies, a number of mathematical models and procedures have been developed to extrapolate from the high doses used in the studies to the low doses typically associated with environmental exposures. This modeling leads to uncertainty. The EPA typically assumes linearity at low doses and primarily uses the linearized multistage procedure when uncertainty exists about the mechanism of action of a carcinogen and when information suggesting nonlinearity is absent.”* Then, *“The EPA has stated that cancer risks estimated by this method produce estimates that “provide a rough but plausible upper limit of risk.” In other words, it is not likely that the true risk would be much more than the estimated risk, but “the true value of the risk is unknown and may be as low as zero” (EPA, 1996c).*

The following quote is from a paper dealing with risk determinations relative to radiation exposures: *“As a measure of excess cancer deaths, the excess lifetime risk has several drawbacks largely related to the fact that since everybody must die, excess cancer mortality can only occur by decreasing the mortality to other causes; this has important implications for calculation of site-specific excess lifetime risks after wholebody exposure. In particular, if it had been found that radiation increases the rate of all major causes of death by the same factor, then there would be no excess lifetime cancer risk at all (but, of course, the life expectancy would be shortened).”*⁴ This appears to me to say that other detrimental health effects or shortened lifespan can occur but not be represented by the calculations and generic screening levels contained in risk assessments. The bottom line for an individual is that they either do (probability of 1) or do not (probability of zero) suffer an adverse effect.

⁴ Vaeth, Michael and Donald A. Pierce. 1990. Calculating excess lifetime risk in relative risk models. Env. Health Perspectives vol. 87:83-94.

The SOW prescribed use of EPA/540/R/99/005⁵ for the risk assessment. This guidance applies to dermal exposures by water and soil, but excludes vapors and other routes of exposure. A

disclaimer on the title page states, “Some of the statutory provisions described in this document contain legally binding requirements. However, this document does not substitute for those provisions or regulations, nor is it a regulation itself. Thus, it cannot impose legally-binding requirements on EPA, states, or the regulated community, and may not apply to a particular situation based upon the circumstances. Any decisions regarding a particular remedy selection decision will be made based on the statute and regulations, and EPA decisionmakers retain the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate. EPA may change this guidance in the future.” In addition, Chapter 1, page 1-1 states, “ This guidance is considered interim, pending release of any update to the DEA from ORD. As more data become available, RAGS Part E may be updated.” Chapter 2, page 2-1 discussing use of screening of compounds, states, “ However, risk assessors may decide not to use the screening and proceed to a quantitative assessment of all chemicals at a site.” It also notes, “Very limited data exist in the literature for the dermal absorption of chemicals from soil.”

⁵EPA. 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment – Final.

This describes a process that is continuing to evolve, with many compounds lacking specific exposure data. It also does not limit HAFB in its ability to remediate the sites at OU1. For example, the exclusion of seep/spring U1-301 from any assessment because it is still flowing appears inappropriate given there are exposure factors for water and soil/sediment. This guidance provided for evaluation of dermal exposure from compounds in both soil and water. By the time one reviews this manual, it becomes clear there are many possible outcomes based on the decisions made by the risk assessor, choice of statistics, choice of exposure factors, and the many other decisions that have to be made to come up with a final numerical risk. I note that a single factor, skin adherence for soils ranges over an order of magnitude between the geometric mean and 95th percentile (Exhibit 3-3, page 3-15 RAGS Part E). The Draft HHRA (Page 3-11) states, “In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.” So, here is another order of magnitude range. How many of these are necessary until the output of a risk assessment becomes meaningless? I could not find a methodology in the EPA reference cited above for addressing the cumulative effects of exposure to multiple compounds. Exhibit 3-4 indicates that the dermal exposure factors from soil are experimental.

Response: These paragraphs appear to raise two primary issues: (1) the potential for generalized adverse health effects from living in proximity to waste sites, and (2) the appropriateness of the cancer toxicity factors applied in the Supplemental HHRA.

With respect to the first issue, important clarifications are needed regarding the commenter’s comment where he states:

That ATSDR assessment pointed out studies that have documented health risks based on proximity to waste sites. Those would be instructive to review as they indicate just living near a Superfund site can result in birth defects, cancer of various types, low birth weights, eczema, ulcers, hay fever and other health issues.

A review of the Agency for Toxic Substances and Disease Registry (ATSDR) Public Health Assessment, Hill Air Force Base, Davis and Weber Counties, Utah (<http://www.atsdr.cdc.gov/hac/pha/pha.asp?docid=795&pg=0>) shows that this document **does not** “point out” these studies. Rather, a comment referring to these studies was included in the Community Health Concerns section. The ATSDR’s response to the comment was as follows:

The studies mentioned above make no determination of whether the people have contact with any chemicals. ATSDR used studies about actual chemical exposures to make conclusions as to whether the people living in the areas surrounding Hill AFB are likely to get sick from exposure to chemicals that have come from the base. We believe using direct studies conducted of people and animals exposed to the actual chemicals at the relevant exposure levels as is present in the communities is more appropriate. The studies mentioned above are statistical reviews of two separate parameters 1) people living near a hazardous waste sites and 2) illness; they are indirect and coincidental occurrences which may or may not be related.

The very first sentence of the ATSDR report summarizes ATSDR’s overall conclusions:

*After conducting a thorough evaluation of available environmental monitoring data and potential exposures situations, ATSDR concluded that exposure to contaminated groundwater, soil, residential indoor air, surface water, and fruits and vegetables do **not** pose a health hazard to residents and workers of Hill AFB or the surrounding communities.*

Regarding the selection and use of cancer toxicity factors, the Air Force adhered to the EPA’s hierarchy (EPA, 2003) when selecting toxicity factors and to RAGS methodology in their application. This hierarchy is also embodied in the RSL tables. The Supplemental HHRA Report would have been found deficient by the regulators if any other approach had been selected.

Regarding the paragraph starting “I could not find a methodology in the EPA reference cited above for addressing the cumulative effects,” assuming that the commenter is referring to RAGS Part E, it is correct that this document does not provide guidance on assessing cumulative effects. The commenter is referred to RAGS Part A, Section 8, for the EPA’s guidance on this matter.

Paragraphs #23 - 24

The SOW instructed the Contractor to not address ecological risks. The Final HHRA Workplan cited the National Contingency Plan (40CFR300) as a governing document. Paragraph 300.415(b) of the NCP, “Authorizes the lead agency to initiate appropriate removal action in the event of a hazardous substance release. Decisions of action will be based on threats to human or animal populations, contamination of drinking water supplies or sensitive ecosystems, high levels of hazardous substances in soils, weather conditions that may cause migration or release of hazardous substances, the threat of fire or explosion, or other significant factors effecting the health or welfare or the public or the environment.” (emphasis added).

The aerial photograph in Figure 2-1 of the Final HHRA Workplan appears to show numerous animal or other trails through the contaminated areas. Given the loss of habitat due to development in other nearby areas, this hillside may constitute a local wildlife concentration area. It would seem an omission to refuse to address the ecosystem impacts from continued releases or leaving contaminants in place. Further, the NCP mentions human health or welfare. I didn't see any discussion of welfare in the documents I reviewed. It would seem this should cover the physical and psychological impacts of residing in or adjacent to a contaminated area, having your property values compromised due to the contaminations, deed recordings, loss of springs and use of the property. HAFB is the PRP, responsible for the chemical releases that have contaminated these adjacent properties. Leaving arsenic and other contaminants in the land is not restoring the land to its former uses. These are real effects to residents. They remain unaddressed and lack any final resolution so residents must live with this condition for an undetermined length of time, or perhaps forever, in terms of a human lifespan.

Response: *Regarding ecological risk, the Remedial Investigation Report adequately addressed ecological risks including specific reference to the hillside (see Montgomery Watson, 1995, Appendix A, Section 6). Further evaluation of this topic was not necessary.*

The remainder of this paragraph relays the commenter's other ideas regarding physical, psychological, economic, and legal impacts related to site contamination. These considerations are outside of the scope of a human health risk assessment conducted within the RAGS framework.

Paragraph #25

I have questioned the determination of background values for arsenic and chromium in past comments. It appears from the ROD that the maximum arsenic value may have been chosen from the background samples taken. I have never seen a report, maps or the complete data set obtained when these samples were taken. Please request HAFB to provide the following:

- Location of all soil samples used for determining background for heavy metals, including
- GPS coordinates, aerial photographs, maps, field notes.
- Results of chemical analysis for these samples for all compounds analyzed. Include
- speciation results, complexes of metals with other metals or other compounds.
- Rationale for selecting the background concentration for both arsenic and chromium.

Response: *References to the documents containing the analytical results for background soil/sediment samples will be added to the Section 1.2.0 of the Supplemental HHRA Report. The available arsenic speciation results are already provided as Appendix A of the Supplemental HHRA Work Plan (CH2M HILL, 2010).*

The other information requested in this comment is not relevant to the Supplemental HHRA Report because the analysis and conclusions are not based on comparison with background concentrations. Background concentrations of arsenic are discussed but

only in the context of providing site history. The added references will provide adequate support for that discussion.

Paragraph #26

I note also that 40CFR302 provides that arsenic has a reportable quantity of 1 lb for a release. Has HAFB determined the relationship of continued releases of numerous listed compounds to its reporting obligation for arsenic and other compounds under various laws such as Community Right to Know?

Response: *The requirement to report a release of a “reportable quantity” of substances identified under section 102(a) of CERCLA is not applicable to ongoing remediation activities being conducted under CERCLA. In 40 Code of Federal Regulations (CFR) 302.8, it specifically states that no reporting is required for releases that are “continuous and stable in quantity and rate” and “incidental to normal ...treatment processes.” The CERCLA process includes the ARARs of the other laws the commenter referenced.*

Paragraphs #27 - 33

A review of the ROD provides some points of significance. For example, in examining alternatives, SA1, the No Action alternative was *“not considered protective of public health and the environment because it allows continued releases of contaminants to groundwater and their migration offsite.”* Likewise, for the Non-Source Area, NSA1, No Further Action, was not considered protective. How it was made “protective” was the use of institutional controls to prevent potable use of springs and groundwater while remedial actions were to resolve the issue within 5 to 12 years (ROD page 6-3). We now know that the time needed was badly underestimated according to the 2008 Five Year Review. While MNA was selected, other action alternatives were not. The present worth costs estimated for these actions were small in the overall picture. Plume cut-off was estimated at \$3.8 million; hydraulic containment was \$2.8 million; groundwater collection throughout the plume was \$3.3 million. The accepted action of Monitored Natural Attenuation had a present worth of \$1.5 million. Now that we near the 12th year since the remediation was activated, with continued leakage from the Source Areas perhaps explaining the length of time the plume has remained, HAFB apparently has no contingency plan to implement the other alternatives for both Source and Non-Source Areas.

The EPA 2008 Five Year Review noted (Table OU1-1, page 3 of 6) noted that, *“The ROD indicates that other remedies will be implemented if concentrations do not attenuate in a reasonable time frame.”* Table OU1-3 (page 1 of 3) states, *“The PSVReport indicates that the non-source area plume will likely not naturally attenuate in the 12 years estimated in the OU 1 ROD (Hill AFB CEVR, 2008). In addition, although the off-Base dissolved VOC plume appears to be shrinking in most areas, the PSVR indicated that elevated concentrations at monitoring well U1-1602 need to be investigated further (Hill AFB CEVR, 2008). The natural attenuation calculations are being reevaluated to incorporate more refined depth constraints on estimates of MNA timeframe, and to establish bounds on the timeframe.”* Does this bode for another

simplification that discounts the reality in order to justify MNA and the leaky condition of the Source Area remedy?

The ROD was signed on 9/29/98, while the following guidance document from EPA was published in April, 1999, “Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites”⁶. A look at that guidance document might be instructive. In the Purpose, EPA states, “*EPA remains fully committed to its goals of protecting human health and the environment by remediating contaminated soils, restoring contaminated groundwaters to their beneficial uses, preventing migration of contaminant plumes, and protecting groundwaters and other environmental resources.*” EPA goes on to qualify the use of MNA as to whether it: is the most “*appropriate*” technology; will meet site remediation objectives within a timeframe that, “*is reasonable compared to that offered by other methods*”; incorporate “*contingency measures*” into the remedy; and, “EPA expects that **source control and long-term performance monitoring will be fundamental components of any MNA remedy.**” (emphasis EPA’s).

⁶Directive 9200.4-17P, April 1999

In the Background section, EPA states, “*When relying on natural attenuation processes for site remediation, EPA prefers those processes that degrade or destroy contaminants. Also, EPA generally expects that MNA will only be appropriate for sites that have a low potential for contaminant migration.*” In the first statement, we have seen that dilution is the principal mechanism at work to reduce pollutants in the non-Source area. Regarding the second statement, OU1 has extreme topographic relief with its Source Areas on top of the hill and leaky geology. So, the potential for migration to Non-Source Areas is great and as we have seen, continues in spite of remedial measures taken to date. The valley below, where MNA is applied, has no apparent confining layer and a downward groundwater gradient. These are ideal conditions for dilution in what should otherwise be uncontaminated groundwater.

Regarding chlorinated solvents such as trichloroethylene, the Directive states (page 7), “the hydrologic and geochemical conditions favoring significant biodegradation of chlorinated solvents sufficient to achieve remediation objectives within a reasonable timeframe are anticipated to occur only in limited circumstances.” The Directive goes on with further points regarding these compounds, but this is sufficient. I don’t recall an analysis that documents that these conditions exist in the Non-Source Area.

The Directive discusses MNA applied to inorganics as well. Given the possibility that HAFB will elect to leave the current arsenic contamination in place with no further remediation, it is important to see what EPA has to say, “*Changes in a contaminant’s concentration, pH, redox potential, and chemical speciation may reduce a contaminant’s stability at a site and release it into the environment. Determining the existence, and demonstrating the irreversibility, of these mechanisms is important to show that a MNA remedy is sufficiently protective.*” If, HAFB determines to leave in place the arsenic contamination it has documented, it would appear to have the burden of showing that the arsenic currently there would remain there and not, through physical, chemical or biological means, migrate further, change states, or become accessible for human or animal consumption or exposure. On this steep slope, which HAFB claims is unstable, surely there will be erosion and slumps to move, expose or change the environment in which the

arsenic and other contaminants reside. Of course, this assumes there is no further leakage of arsenic or other compounds off-site. EPA further summarizes by saying, *“Therefore, natural attenuation of inorganic contaminants is most applicable to sites where immobilization or radioactive decay is demonstrated to be in effect and the process/mechanism is irreversible.”* While HAFB may contend that it is not relying on natural attenuation for the arsenic-contaminated soils and sediments, if left in place, it is relying on this concept of natural attenuation. Whether it will be MNA is another question.

Without going further in analysis of the Directive, my conclusion is that the MNA alternative applied at OU1 is inconsistent with the guidance document and we should be discussing how to accelerate remediation, through the necessary contingency measures, rather than dealing with this HHRA. HAFB should evaluate its MNA against this document which came into effect shortly after the ROD was signed.

Yours truly,
John Carter
TAG Advisor

Response: *The comments contained in these paragraphs pertain to the commenter’s broader concerns regarding the OU 1 remedy and are not directly applicable to the Supplemental HHRA, but may be more appropriate during the next Five-Year Review.*

Iron Data and Statistics for Soil and Sediment

			Iron Results (mg/kg)										
5,290	6,770	6,840	9,850	11,400	11,400	12,700	15,200	15,400	16,700	29,700	30,600		
49,200	50,400	56,300	75,000	75,300	101,000	121,000							
			General UCL Statistics for Full Data Sets										
User Selected Options													
From File			WorkSheet.wst										
Full Precision			OFF										
Confidence Coefficient			95%										
Number of Bootstrap Operations			2000										
Iron													
General Statistics													
Number of Valid Observations				19		Number of Distinct Observations				18			
Raw Statistics						Log-transformed Statistics							
				Minimum		5290		Minimum of Log Data				8.574	
				Maximum		121000		Maximum of Log Data				11.7	
				Mean		36845		Mean of log Data				10.07	
				Median		16700		SD of log Data				0.986	
				SD		34704							
				Std. Error of Mean		7962							
				Coefficient of Variation		0.942							
				Skewness		1.193							
Relevant UCL Statistics													
Normal Distribution Test						Lognormal Distribution Test							
Shapiro Wilk Test Statistic				0.83		Shapiro Wilk Test Statistic				0.938			
Shapiro Wilk Critical Value				0.901		Shapiro Wilk Critical Value				0.901			
Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level							
Assuming Normal Distribution						Assuming Lognormal Distribution							
95% Student's-t UCL				50651		95% H-UCL				70456			
95% UCLs (Adjusted for Skewness)						95% Chebyshev (MVUE) UCL						78072	
95% Adjusted-CLT UCL (Chen-1995)				52269		97.5% Chebyshev (MVUE) UCL				95739			
95% Modified-t UCL (Johnson-1978)				51014		99% Chebyshev (MVUE) UCL				130443			
Gamma Distribution Test						Data Distribution							
k star (bias corrected)				1.112		Data Follow Appr. Gamma Distribution at 5% Significance Level							
Theta Star				33139									
MLE of Mean				36845									
MLE of Standard Deviation				34943									
nu star				42.25									
Approximate Chi Square Value (.05)				28.35		Nonparametric Statistics							
Adjusted Level of Significance				0.0369		95% CLT UCL				49941			
Adjusted Chi Square Value				27.35		95% Jackknife UCL				50651			
						95% Standard Bootstrap UCL				49756			
Anderson-Darling Test Statistic				0.642		95% Bootstrap-t UCL				53368			
Anderson-Darling 5% Critical Value				0.762		95% Hall's Bootstrap UCL				53148			
Kolmogorov-Smirnov Test Statistic				0.21		95% Percentile Bootstrap UCL				49842			
Kolmogorov-Smirnov 5% Critical Value				0.203		95% BCA Bootstrap UCL				51351			
Data follow Appr. Gamma Distribution at 5% Significance Level						95% Chebyshev(Mean, Sd) UCL				71549			
						97.5% Chebyshev(Mean, Sd) UCL				86565			
Assuming Gamma Distribution						99% Chebyshev(Mean, Sd) UCL				116062			
95% Approximate Gamma UCL				54912									
95% Adjusted Gamma UCL				56908									
Potential UCL to Use						Use 95% Approximate Gamma UCL				54912			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.													
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)													
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.													