Remedial Action Work Plan

Waste Oil Dump Site

NASA Wallops Flight Facility

Wallops Island, Virginia

National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility

September 2009

CERTIFICATION

The enclosed document was prepared, and is being submitted, in accordance with the requirements of the Administrative Agreement On Consent between the United States Environmental Protection Agency and the National Aeronautics and Space Administration [U.S. EPA Docket Number RCRA-03-2004-0201TH].

I certify that the information contained in or accompanying this document is true, accurate, and complete.

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

Signature: Theodore J. Meyer

Name: Mr. Theodore J. Meyer

Title: NASA Project Coordinator

REMEDIAL ACTION
WORK PLAN

WASTE OIL DUMP SITE

NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

Submitted to:
National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility
Code 250.W
Building F-160
Wallops Island, Virginia 23337

Submitted by:
Tetra Tech NUS, Inc.
234 Mall Boulevard Suite 260
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N62472-03-D-0057
Contract Task Order 012

September 2009

PREPARED UNDER THE DIRECTION OF:	APPROVED FOR SUBMISSION BY:
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NUSNORFP1/c-docs/CTO 12/WOD RA WP-F

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FIGURES

ACRONYMS

AOC	Area of Concern
bgs	Below Ground Surface
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Constituents of Concern
CTO	Contract Task Order
DO	Dissolved Oxygen
DPT	Direct Push Technology
EPA	United States Environmental Protection Agency
FOL	Field Operations Leader
ft	Feet or Foot
GSFC	Goddard Space Flight Center
HASP	Health and Safety Plan
HSA	Hollow-stem Auger
HSM	Health and Safety Manager
IDW	Investigation-Derived Waste
MSDS	Material Safety Data Sheet
NASA	National Aeronautics and Space Administration
NELAP	National Environmental Laboratory Accreditation Program
ORC®	Oxygen Releasing Compounds
ORP	Oxidation-Reduction Potential
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
Regenesis	Regenesis Bioremediation Products
ROD	Record of Decision
Slurry	ORC® and water mixture
TtNUS	Tetra Tech NUS, Inc.
VOC	Volatile Organic Compound
WFF	Wallops Flight Facility
WOD	Waste Oil Dump Site

1.0 INTRODUCTION

This Remedial Action Work Plan (Work Plan) has been prepared by Tetra Tech NUS, Inc. (TtNUS) for the National Aeronautics and Space Administration (NASA) under Contract Task Order (CTO) 0012 issued by the Naval Facilities Engineering Command Mid-Atlantic under the Comprehensive Long-Term Environmental Action Navy (CLEAN III) contract number N62472-03-D-0057. This work plan has been developed to detail the procedures to be used during the implementation of enhanced bioremediation as the remedial technology for the Waste Oil Dump (WOD) Site at the NASA Goddard Space Flight Center (GSFC) Wallops Flight Facility (WFF) located in Accomack County, Virginia. The objective of the Remedial Action is to reduce the concentrations of the volatile organic compound (VOC) benzene in site groundwater by increasing oxygen levels to encourage growth of native microorganisms and increase the rate of biodegradation and create favorable conditions to break down benzene into non-toxic forms, create an oxygen-rich environment to cause arsenic to transform from soluble to non-soluble forms, and restore the groundwater to drinking water standards and cleanup goals identified in the Record of Decision (ROD). This Work Plan incorporates the results of a pilot study conducted at the Site from December 2008 through January 2009.

1.1 DOCUMENT ORGANIZATION

Section 1.0 of this Work Plan presents this introduction, a brief site description, a summary of the pilot test results, and the project scope. Section 2.0 describes the proposed field operations. Section 3.0 describes management aspects of the project such as management structure, reporting requirements, and quality assurance (QA) activities. The Pilot Study Report is presented as Appendix A. Post-injection groundwater sampling will be addressed in a report under separate cover.

1.2 SITE OPERATIONS AND HISTORY

WFF is located in Accomack County on the Eastern Shore of the Commonwealth of Virginia, see Figure 1-1. The WOD is located at the northern end of Runway 17-35 on a peninsula-like feature adjacent to Little Mosquito Creek (see Figure 1-2). The WOD was reportedly used for the disposal of waste oils and possibly solvents from the 1940s through the 1950s. Reportedly, the site was used to dispose of excess waste oil that could not be used for fire training activities. No records are available to determine the types and quantities of materials disposed or the duration of this activity at the site. NASA conducted a removal action in the area from November 12 to December 30, 1986 that included the excavation and removal of approximately 180 cubic yards of impacted soils in four separate areas of the site.

The southern half of the site is basically flat, with little slope, and is grass covered. The central portion of the site slopes to the north and east, with slopes ranging from 1 to 3 percent. The northern, eastern, and western boundaries of the site are steeply sloped. These slopes direct surface water runoff into low-lying marshes that border an unnamed tributary to Little Mosquito Creek and Little Mosquito Creek. The northern portion of the site is vegetated by bushes, conifer saplings, and tall grasses. There are no surface water bodies within or immediately adjacent to the disposal area at the WOD.

The geology immediately underlying the study area consists of the lithologic unit called the Columbia Group. Regionally, the Columbia Group is approximately 50 feet thick and is underlain by a 20 to 40 feet thick clay and silt aquitard which isolates the Columbia from the underlying Yorktown Aquifer. The geologic materials encountered at the site consist of fine-to medium-grained quartz sand with some silt, and the lithology did not differ significantly throughout the site. A sandy clay layer was consistently encountered at depths ranging from 10 to 27 feet below ground surface (bgs), or (considering the differences in site topography) at an elevation near sea level. The thickness of this clay at the WOD is reported to be as much as 5 feet.

Investigative activities have been conducted at the site and documented in the Supplemental Remedial Investigation Report (TtNUS, 2004), Feasibility Study (TtNUS, 2005), and ROD (TtNUS, 2008). Constituents of Concern (COCs) have been identified based on analytical data, risk drivers from the human health and ecological risk assessments, and exceedances of regulatory standards and criteria. The COCs for groundwater have been identified as benzene and arsenic, with cleanup goals of 5 μg/L and 10 μg/L, respectively, having been established. Biostimulation was selected as a component of the remedy for the WOD, as documented in the ROD. A pilot study, consisting of the injection of Oxygen Releasing Compound (ORC®), a proprietary formulation of phosphate intercalated magnesium peroxide manufactured by Regenesis Bioremediation Products (Regenesis), was conducted at the WOD to evaluate its potential use in implementing the final remedy for the Site.

1.3 PILOT STUDY RESULTS

A pilot study was conducted from December 2008 to January 2009 at the WOD Area of Concern (AOC), (see Appendix A for the full Pilot Study Report). The purpose of the pilot study was to determine if the application of ORC® could significantly reduce the impact of volatile organic compounds (VOC) in site groundwater. The objective of the study was to determine the number and spacing of ORC® injection points required for full scale remediation. In addition, the pilot study data were to be used to determine the amount of ORC® required for full scale implementation provided it proved successful. The study was to be determined successful if the dissolved oxygen (DO) levels in Site monitoring wells increased after ORC® injection.

Baseline and post-injection monitoring and sampling were performed in accordance with the approved Pilot Study Work Plan (TtNUS, 2008a). The data, as presented in Appendix A, indicate that DO and oxidation-reduction potential (ORP) increased in the study area after the injection of ORC®. Field measurements were collected prior to and two days, one week and one month after the injection. DO and ORP levels measured in the study area wells are presented in Figures 1-3 and 1-4. As a result of the injection of ORC®, DO and ORP levels in the temporary monitoring wells were observed to significantly increase immediately after the injection and then decrease over the following month. These results suggest that the oxygen released within the contamination zone were rapidly consumed. In addition, analytical results indicate that COC concentrations in the monitoring wells decreased over the same time period (see Appendix A).

These and other findings presented in the Pilot Study Report, indicate that full scale implementation of ORC® injection should be conducted at the WOD. However, due to the decline of DO recorded between the one week and one month sampling events, it is recommended that ORC Advanced® be used instead of ORC®. ORC Advanced® releases oxygen slower and is 70% more efficient than ORC®. As a result of using ORC Advanced®, oxygen will be released at a more constant rate and thereby provide a more constant source for enhancing the bioremediation process.

1.4 OBJECTIVES AND SCOPE

The objective of the Remedial Action (RA) is to conduct a full-scale application of ORC Advanced® to the impacted AOC at the WOD. ORC Advanced® is a proprietary formulation of calcium oxyhydroxide that, when hydrated, produces a controlled release of oxygen for periods of up to 12 months on a single application. ORC Advanced® is produced by Regenesis, of San Clemente, California (Regenesis website, 2007). The injection of ORC Advanced® is expected to result in an increase of DO in the injection area. The elevated levels of DO will facilitate an aerobic bioremediation reaction with benzene in the affected groundwater. Elevated dissolved arsenic levels in the groundwater will not be addressed directly by ORC Advanced®, but it is believed that the arsenic contamination is associated with the reduced environment created by the natural degradation of the organic COCs. It is anticipated that the increase in DO resulting from the injection of the ORC Advanced® will allow for the transfer of arsenic from soluble compounds to insoluble oxidized compounds with limited mobility.

This RA will be comprised of one injection event. During the event, an ORC Advanced® and water mixture (slurry) will be injected into 52 points placed in the vicinity of monitoring wells WFF16-GW2 and WFF15-GW7. The slurry will be injected via direct push technology (DPT) equipment; the injection will take place throughout the vertical extent of contamination, from approximately 20 feet to 30 feet below ground surface (bgs). It is anticipated that the injected slurry will enhance aerobic microbial activity in groundwater containing COC concentrations above the established cleanup levels.

Permanent and temporary monitoring wells in the area of the WOD that were sampled prior to the pilot study injection of ORC® will serve as baseline levels for the RA. The post-injection sampling of monitoring wells will be addressed in a report under separate cover.

Prior to the commencement of RA activities, the temporary monitoring wells that were installed as a part of the pilot study will be plugged and abandoned in accordance with Tetra Tech standard methods.

2.0 FIELD OPERATIONS

2.1 FIELD OPERATIONS SUMMARY

The RA consists of the following field activities:

- Plugging and Abandonment of the 6 temporary monitoring wells that were installed during the pilot study.
- Collection of groundwater elevation measurements from the monitoring wells in the vicinity of the WOD AOC prior to the injection of ORC Advanced®.
- Installation of 52 DPT soil borings in the area upgradient and downgradient of monitoring well WFF15-GW7, and upgradient of monitoring well WFF16-GW2. These DPT locations will be used to inject ORC Advanced®.

The six temporary monitoring wells installed prior to the pilot study will be plugged and abandoned using Tetra Tech standard methods prior to the injection of ORC Advanced®.

The RA will be completed in one injection event; which includes the installation of 52 injection borings to an anticipated approximate total depth of 30 ft bgs. The injection borings will be spaced on 15-foot centers in an upgradient radius perpendicular to the direction of groundwater flow. A detailed plan view of the proposed DPT/injection point spacing is presented as Figure 2-1. The injection locations are intended to actively treat the majority of the area suspected to contain concentrations of COC above cleanup criteria and to create an oxygen-enriched barrier and an aerobic reaction zone to reduce residual benzene concentrations in the treatment area.

Based on calculations made using Regenesis software, it is estimated that during the injection event 6 pounds of ORC Advanced® will be applied per foot of each borehole below the water table (a thickness of approximately 10 feet in each borehole). Therefore, a total of 3,120 pounds of ORC Advanced® will be required. Approximately 884 gallons of water will be required for mixing of the ORC®, approximately 17 gallons per injection point, and 1.7 gallons per foot. ORC Advanced® requirement calculations are presented in Appendix B.

2.2 MOBILIZATION/DEMOBILIZATION

Following approval of this work plan, TtNUS will procure the required subcontractors and begin mobilization activities. Mobilization/demobilization may include multiple events and each event will include the following as needed:

- Approval of all subcontractors by the TtNUS Health and Safety Department
- Utility clearances in the proposed boring areas.
- Mobilization of subcontractors, equipment, and materials to the site.
- Receipt of drilling and/or well permits via subcontractor.
- Conducting an approximately 1-hour long site-specific health and safety review meeting.
- Delineation of the work zones (exclusion zone, contamination reduction zone, and support zone) as required by the Health and Safety Plan (HASP) (See Appendix E).
- Arrangement of an area to perform decontamination procedures.
- Demobilization of equipment and materials from the site.
- Performance of general site clean-up and removal of trash.

Field team members will review the Work Plan and the HASP. Mobilization includes attendance at a site-specific health and safety kick-off meeting during the initiation of on-site activities. This meeting will also include field team orientation in order to familiarize personnel with the scope of the field activities.

The Field Operations Leader (FOL) will coordinate the mobilization activities. These activities include responsibilities such as initiating and conducting equipment inventories to ensure equipment is available, purchasing equipment as required, staging equipment for efficient loading and transport from the TtNUS office to the site, and after field activities are completed, demobilizing the equipment.

The drilling subcontractors will furnish a DPT rig, support crew, all necessary tools required, personal protective equipment (PPE) for their crew, and any miscellaneous equipment and materials required to complete the described activities. The down-hole equipment, sampling tools, and the rear of the rig will be steam-cleaned prior to arrival on site. Safety shut-off equipment will be in full working condition and will be tested by the FOL prior to initiating DPT activities.

2.3 BASELINE GROUNDWATER SAMPLING

A baseline groundwater monitoring event was performed prior to the Pilot Study (see Appendix A). The data collected from the baseline sampling event will serve as the baseline data for the site, with no additional baseline sampling being required prior to commencing RA field activities. However, water level and DO and ORP levels will be measured in permanent monitoring wells WFF16-GW8, WFF15-MW3R, WFF15-GW7, WFF15-GW1, WFF15-GW2, WFF16-GW2S, WFF16-GW2D, and WFF16-GW5 prior to the injection event.

2.4 INJECTION POINT INSTALLATION

Fifty two injection points will be installed via DPT to a depth of 30 feet bgs on 15-feet centers in an upgradient radius perpendicular to groundwater flow direction, as depicted on Figure 2-1. Groundwater contamination is assumed to extend to a depth of approximately 30 feet bgs, based on the data collected during the construction of WFF15-GW7.

2.5 ORC ADVANCED® MIXING AND INJECTION

The ORC Advanced® powder will be shipped to the site from the Regenesis manufacturing facility in Inwood, New York. For each injection boring, 17 gallons of water will be mixed with 60 pounds of ORC Advanced® using a standard environmental slurry mixer or grout pump. The slurry will be injected from the bottom of the borehole to one foot above the water table through the DPT rig's pump or a slurry/grout pump. Mixing and injection will be performed in general accordance with the Regenesis instructions in Appendix C. As with any chemical compound, proper health and safety procedures must be followed when handling ORC Advanced® Material Safety Data Sheets (MSDS) for the ORC Advanced® is provided in Appendix D.

2.6 POST-INJECTION GROUNDWATER SAMPLING

Following the ORC Advanced® injection, a Long-Term Monitoring (LTM) Program will be implemented in accordance with the requirements of the ROD. The LTM Pan will be prepared and submitted for review and approval under separate cover.

2.7 DECONTAMINATION

The field team's PPE will be disposed as required. These items, such as Tyvek™ suits, disposable latex gloves, and paper towels will be disposed of using procedures required by the HASP. Personnel will also perform decontamination procedures as required by the HASP. The equipment involved in field sampling activities will be decontaminated prior to and upon completion of drilling and sampling activities. This equipment includes down-hole tools, augers, and all non-dedicated sampling equipment. Drilling rigs will not require decontamination because surface soils do not present a risk and they will be positioned on undisturbed ground. The rigs will be inspected and any loose debris removed prior to traversing the runway area.

<u>Major Equipment</u>

All down-hole HSA/DPT equipment and sampling tools will be decontaminated by the subcontractor prior to beginning work. HSA/DPT equipment will be decontaminated at the completion of the installation/injection program (due to the nature of this study and previous delineation of impacted groundwater, the DPT equipment will not be decontaminated between injection points). The decontamination procedures will consist of high pressure wash with laboratory-grade detergent solution and clean water rinse completed in a 55-gallon drum. The drum will be used to capture and contain the decon water that will be treated as IDW.

<u>Sampling Equipment</u>

Sampling equipment used for collecting the groundwater samples will be disposable equipment. Therefore, no decontamination of this equipment will be required. Field analytical equipment such as water level probes, and water quality meters will be first wiped down with laboratory-grade detergent solution, then rinsed with a isopropanol and distilled water mix, and then with a final rinse of distilled water.

2.8 INVESTIGATION-DERIVED WASTE (IDW) MANAGEMENT

All IDW accumulated during HSA/DPT installation, well purging and sampling, and decontamination proceedings will be collected, containerized, and stored in Department of Transportation (17C)/UN (1A2)-approved, 55-gallon drums. The drums will be labeled and temporarily stored in the NASA hazardous material consolidation area pending receipt of analytical results.

Upon receipt of the analytical results (approximately 35 days after completion of sampling), TtNUS will provide the results to NASA, who will be responsible for off site disposal. NASA personnel will sign all manifests and bills of lading for transportation off site. TtNUS will coordinate with NASA personnel for completion of this activity.

3.0 PROJECT MANAGEMENT

The management and technical aspects of this project are the ultimate responsibility of TtNUS. Each contractor assigned to individual tasks has the responsibility to fulfill the objectives of that task and to ensure the quality of the data generated by the task. At the direction of NASA, TtNUS has overall responsibility for the activities to be performed at the WOD Site.

3.1 PROJECT ORGANIZATION

The various quality assurance and management responsibilities of key TtNUS project personnel are defined in the following paragraphs.

Project Manager - The Project Manager is responsible for project performance, budget, and schedule, and for ensuring the availability of necessary personnel, equipment, subcontractors, and services. He/she will direct the development of the field program, evaluation of findings, determination of conclusions and recommendations, and preparation of technical reports. The TtNUS Project Manager is Mr. Garth Glenn.

FOL - The FOL is responsible for providing on-site supervision of day-to-day activities on the project. The FOL serves as the primary on-site contact with the client and subcontractors. In addition, the FOL is responsible for all field QA/QC and safety-related issues as defined in the HASP. The FOL for this project will be designated later by the Project Manager.

Health and Safety Manager (HSM) - The Program HSM will review and internally approve the HASP tailored to the specific needs of the investigation. In consultation with the Project Manager/FOL, the HSM will ensure that an adequate level of personal protection exists for anticipated potential hazards for all field personnel. As the HSM does not report to either the Program or Project Manager, his/her actions are not dictated by Program or project constraints (such as budget and schedule) other than the assurance of appropriate safeguards while conducting investigation activities. The TtNUS HSM is Mr. Matthew Soltis, Certified Industrial Hygienist.

QA Manager/Sampling Coordinators - The Project Manager/FOL will coordinate the schedule of field sampling activities with the schedule and capacity requirements of the selected analytical laboratory. All sampling will be coordinated to assure that environmental sampling is conducted in a manner that complies with all QA/QC requirements and is in compliance with holding time and analytical procedure requirements. All Program-wide, QA issues are the responsibility of the QA Manager. The TtNUS QA Manager for NASA activities will be designated later by the Project Manager.

Project Laboratory – The project laboratory will be identified prior to the field sampling event and will be selected from the list of Navy and NELAP certified laboratories approved under the Administrative Agreement on Consent between EPA and NASA [USEPA Docket Number RCRA-03-2004-0201TH].

3.2 PROJECT RESPONSIBILITIES

Throughout the field activities, NASA personnel, as described below, will provide various support functions:

- Locate and mark underground utilities and issue digging or other required permits prior to the commencement of digging or drilling operations.
- Take custody of all drill cuttings, well development fluids, decontamination fluids, or drill cuttings.
- Secure staging areas for decontamination operations and for storing equipment and supplies. It is anticipated that access can be gained to the WOD Site.
- Supply electricity and potable water for equipment cleaning, slurry mixing, etc.

3.3 CONTINGENCY PLAN

In the event of problems that may be encountered during the injection activities, the TtNUS Project Manager will notify the NASA Project Manager and the NASA WFF Point of Contact. The TtNUS Project Manager will determine a course of action so as to minimize impacts to the project schedule and/or budget. Contingency plans will be approved through the NASA Project Manager and the NASA WFF Point of Contact before being enacted.

3.4 REPORTING

Upon completion of the full scale injection, a Remedial Action Completion Report will be prepared and submitted for review and approval. The report will describe the ORC Advanced® installation procedures, document the pounds of ORC Advanced® and volume of water injected, present the field data collected, and summarize the injection activities performed at the Site.

REFERENCES

TtNUS, 2004. Supplemental Remedial Investigation Report. NASA Wallops Flight Facility, Wallops Island, Virginia. December.

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TtNUS, 2008. Record of Decision Former Fire Training Area NASA Wallops Flight Facility, Wallops Island, Virginia. December.

TtNUS, 2008a. Pilot Study Work Plan for Waste Oil Dump Site, NASA Wallops Flight Facility. Wallops Island, Virginia. October.

Regenesis, 2007. Regenesis Bioremediation Products website, **www.regenesis.com**, 2007.

FIGURES

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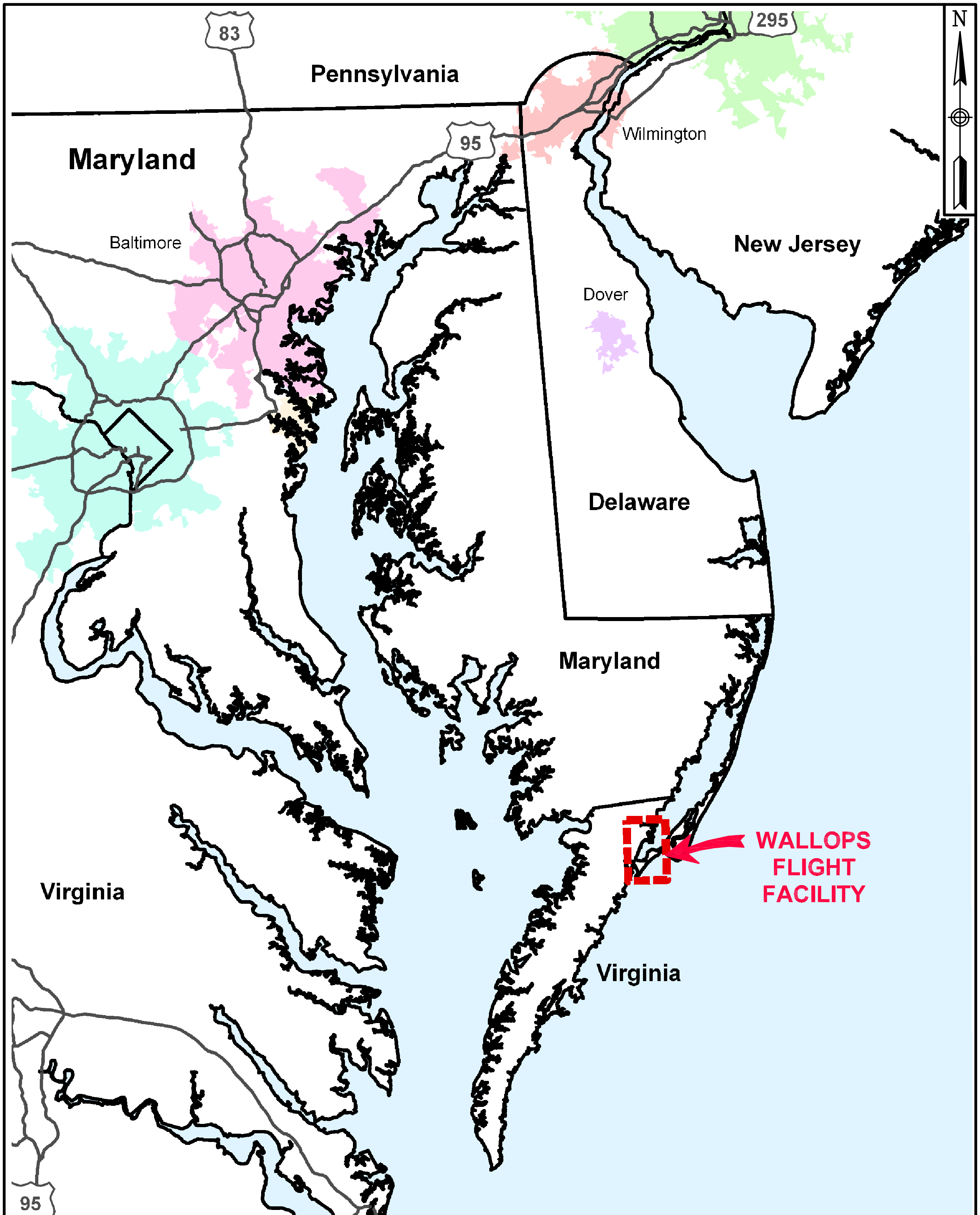

TETRA TECH NUS, INC.

SITE LOCATION MAP
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

SCALE AS NOTED	
FILE 1612BM01.DWG	
REV 0	DATE 03/19/08
FIGURE NUMBER FIGURE 1–1	

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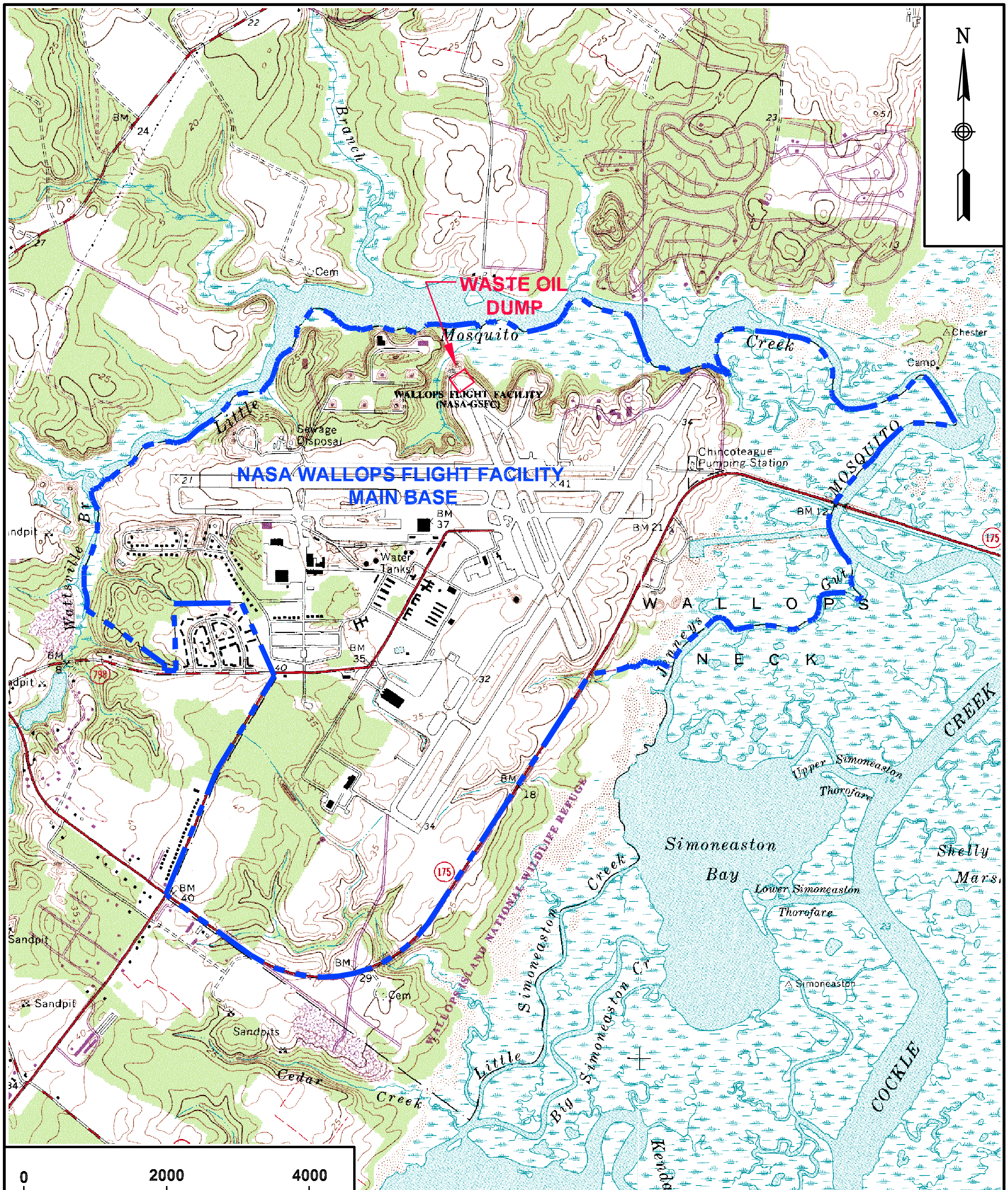


0 2000 4000

SCALE IN FEET

SOURCE: U.S.G.S. 7.5' QUADRANGLE MAPS, WALLOPS ISLAND, VA.
(37075–G4), AND BLOXOM, VA. (37075–G5).

TETRA TECH NUS, INC.

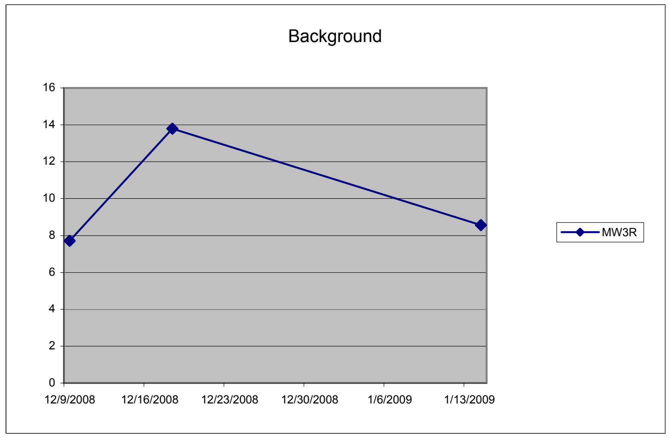
STUDY AREA LOCATION MAP
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

SCALE	AS NOTED
FILE:	112G00086BM02
REV	
DATE	03/19/08
FIGURE NUMBER	FIGURE 1–2

Figure 1-3
Field Geochemical Results - Dissolved Oxygen
Waste Oil Dump (WOD)
NASA Wallops Flight Facility
Wallops Island, Virginia

D.O.

	baseline 12/9/2008	2 day 12/12/2008	1 week 12/18/2008	1 month 1/14/2009
TW1	3.65	5.68	0.58	0.81
TW2	0.92	4.6	2.81	0
TW3	0.4	6.68	1.28	0.77
TW4	1.16	5.65	2.37	0
TW5	2.27	19.99	10.65	4.82
TW6	2.44	0.5	3.32	0.94
15-GW7	0.73	----	0.85	4.12
MW3R	7.72	----	13.79	8.56



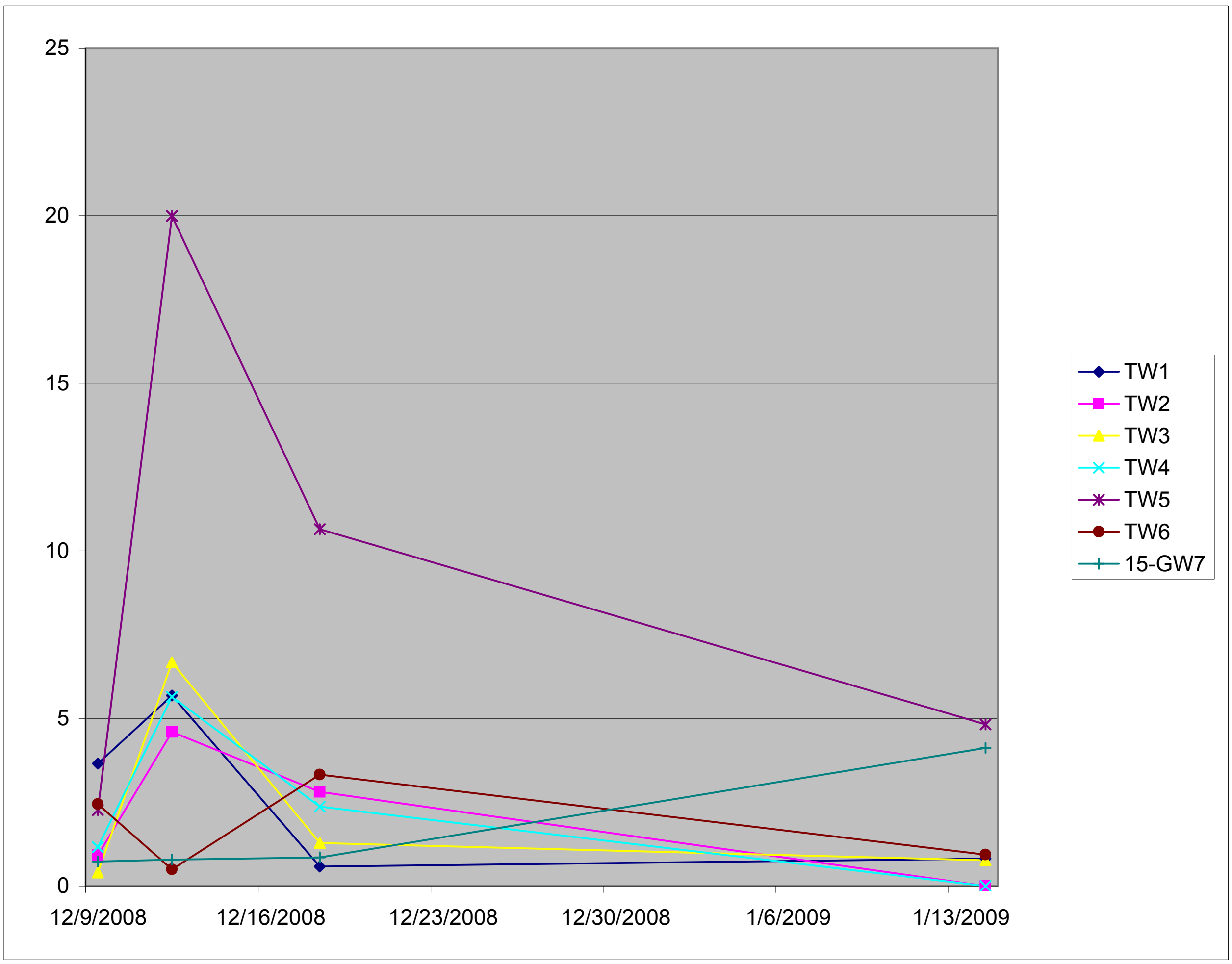
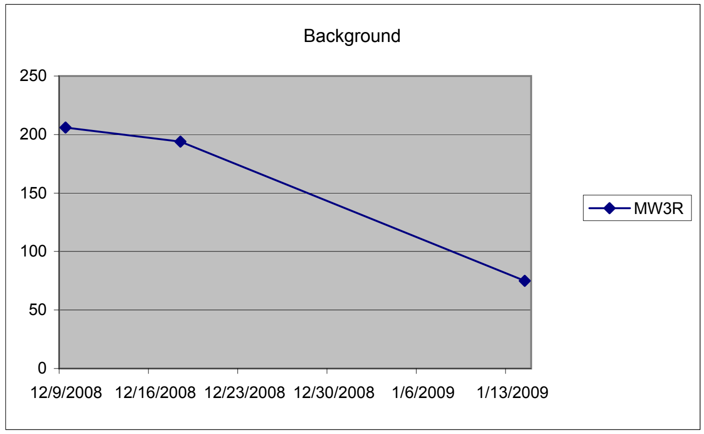
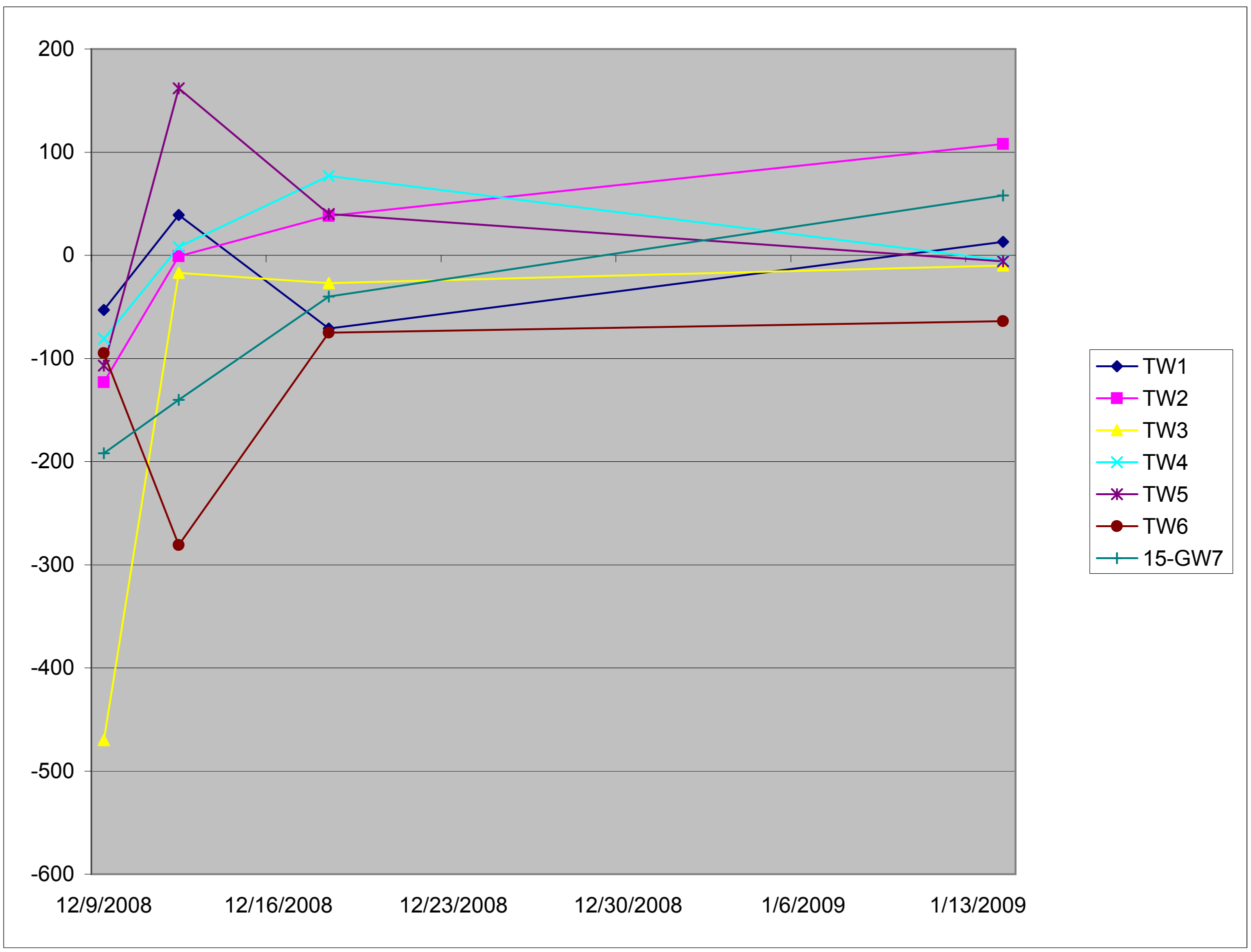


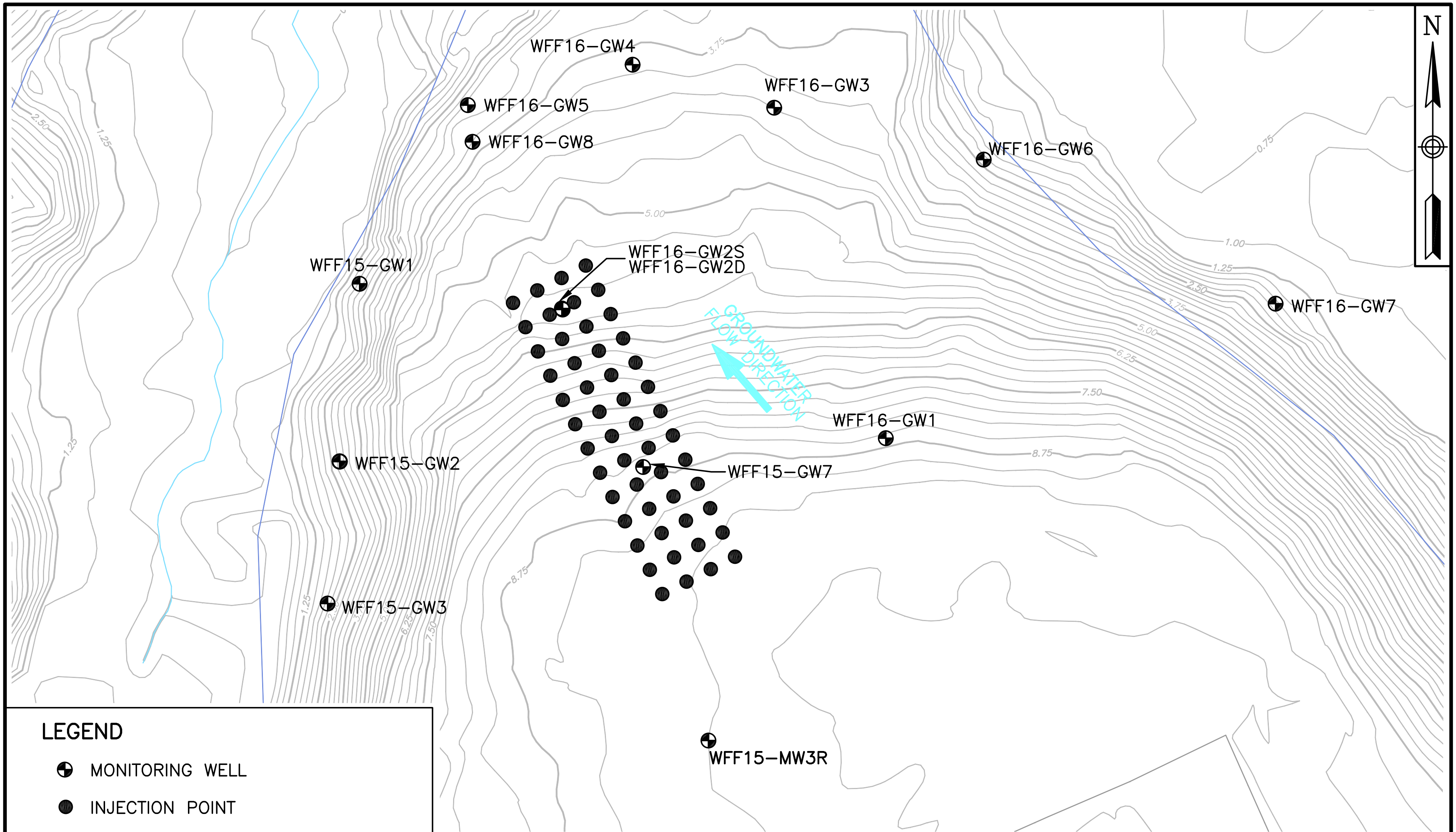
Figure 1-4
Field Geochemical Results - Oxidation Reduction Potential
Waste Oil Dump (WOD)
NASA Wallops Flight Facility
Wallops Island, Virginia

ORP

	baseline 12/9/2008	2 day 12/12/2008	1 week 12/18/2008	1 month 1/14/2009
TW1	-53	39	-71	13
TW2	-123	-1	38	108
TW3	-470	-17	-27	-10
TW4	-81	8	77	-5
TW5	-107	162	40	-6
TW6	-95	-281	-75	-64
15-GW7	-192	----	-40	58
MW3R	206	----	194	75







NOTE
1. WFF16–GW8 NOT YET SURVEYED, LOCATION IS APPROXIMATE.
2. ELEVATION CONTOURS ARE METRIC

0 80 160

SCALE IN FEET

TETRA TECHNUS, INC.

WASTE OIL DUMP
PROPOSED MONITORING WELL/DPT/
INJECTION POINT LOCATIONS
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

SCALE	
AS NOTED	
FILE	
112G01959GM01	
REV	DATE
0	09/25/09
FIGURE NUMBER	
FIGURE 2–1	

APPENDIX A

PILOT STUDY REPORT

1.0 INTRODUCTION

This Pilot Study Report has been prepared by Tetra Tech NUS, Inc. (TtNUS) for the National Aeronautics and Space Administration (NASA) under Contract Task Order (CTO) 0012 issued by the Naval Facilities Engineering Command Mid-Atlantic under the Comprehensive Long-Term Environmental Action Navy (CLEAN III) contract number N62472-03-D-0057. The purpose of this report is to summarize the field activities conducted and present the data collected during implementation of the remedial action Pilot Study at Waste Oil Dump (WOD) Site at the NASA Goddard Space Flight Center (GSFC) Wallops Flight Facility (WFF) located in Accomack County, Virginia.

The purpose of the Pilot Study was to determine if the application of Oxygen Releasing Compound (ORC®), a proprietary formulation of phosphate intercalated magnesium peroxide manufactured by Regenesis Bioremediation Products (Regenesis), could significantly reduce the impact of volatile organic compounds (VOC) in site groundwater. The objective of the Pilot Study was to determine the number and spacing of ORC® injection points required for full scale remediation. In addition, the Pilot Study data were to be used to determine the amount of ORC® required for full scale implementation provided it proved successful. The Pilot Study was to be determined successful if the dissolved oxygen (DO) levels in monitoring well WFF15-GW7 increased after ORC® injection. The concentrations of contaminants of concern (COC) were also to be reviewed.

2.0 FIELD INVESTIGATION

The Pilot Study at the WOD site was conducted from December 8, 2008 through January 14, 2009. Field activities were conducted in accordance with the approved Pilot Study Work Plan (TtNUS, 2008) with minor deviations as presented in Section 2.1

2.1 Deviations

According to the WOD Pilot Study Work Plan, the 6 temporary wells, WFF15-GW7, and WFF15-MW3R were to be characterized using field geochemical test kits 1 day after the ORC® slurry was added. The ORC® injection event was conducted on December 10, 2008, and on December 11 a lightning advisory was issued, causing the airstrip and adjacent areas (e.g., the WOD) to be closed to all outdoor operations. Due to the inclement weather, the 1 day sampling event at the WOD was conducted on December 12, 2008, 2 days after the ORC® injection event.

The Work Plan called for six temporary monitoring wells to be installed at the WOD site. Each of these wells was to be completed flush with the ground, with no sand pack added, and protected by steel well head covers. The proposed layout of these wells can be found in the Pilot Study Work Plan on Figure 2-1 (TtNUS, 2008). During field activities, the temporary wells were installed with PVC riser pipes extending approximately two feet above ground surface and without protective steel head covers, and with sand pack added due to the incomplete collapse of the sediment around the screen. Additionally the proposed temporary monitoring well layout was adjusted to ensure that the injection points and monitoring wells were installed perpendicular to the apparent groundwater flow direction (Figure 2-1).

Field Task Modification Request Forms can be found in Attachment 1.

2.2 Field Activities

Monitoring Well Installation

On December 8 and 9, 2008, one permanent monitoring well (WFF16-GW8) was installed at the WOD using a hollow-stem auger (HSA) with a 4-inch borehole diameter. A 2-inch diameter schedule 40 polyvinyl chloride (PVC) pipe with a 0.10-inch x 10-foot PVC screen and a 2-foot riser was assembled, and lowered down the borehole through the auger to a total depth of approximately 28 ft bgs. A clean medium grained sand pack was added around the screen interval as the auger was raised in increments. Once the sand was added to approximately 3 feet above the top of the screen, the borehole was backfilled with bentonite to a few inches below the ground level. At the surface, a 4-inch diameter steel surface casing, sticking up approximately 2.5-feet, was mounted into a cement grout surface seal. The location of this well is down gradient of the known extent of the impacted groundwater and was installed to expand the groundwater monitoring network in the deeper zone of the Columbia aquifer.

After completion of WFF16-GW8, the well was developed using a peristaltic pump and a whale pump, and was surged as necessary to remove the fines accumulated during well installation. Boring logs, well construction details, and well development records for WFF16-GW8 are presented in Attachment 2.

On December 9 and 10, 2008, in addition to the installation of WFF16-GW8, 6 direct-push technology (DPT) soil borings were installed as temporary monitoring wells up gradient of WFF15-GW7 to a depth of approximately 30 feet bgs. All of the temporary wells were installed using a 3-inch diameter drive casing with a disposable tip, in which a 1.5-inch diameter schedule 40 PVC pipe was inserted with 10 feet of 0.02-inch slotted screen and a 2-foot riser pipe. After installation, the sediment was allowed to collapse around the screened interval and so a sand pack was added as necessary to fill voids. A bentonite seal was placed above the sandpack to ground surface.. Unlike WFF16-GW8, these 6 temporary wells were left undeveloped.

Baseline Groundwater Sampling

Baseline sampling for the WOD began on December 8, 2008 and concluded on December 10, 2008 prior to the ORC® injection. In total 14 wells were sampled at the WOD. Low flow sampling techniques were utilized, as per USEPA Region 3 protocol and guidelines, using a standard peristaltic pump, and medical grade silicone tubing. An in-line flow-through meter and separate turbidity meter were used during purging to collect field readings for turbidity, dissolved oxygen, pH, specific conductivity, temperature, and oxidation reduction potential (ORP). Groundwater sampling was not initiated until stabilization of pH, ORP, and specific conductivity parameters occurred, at which time the flow through cell was disconnected. For each well the following samples were collected: 3-40 milliliter VOA vials with a hydrochloric acid preservative for VOCs, 2-1liter amber glass containers for SVOCs, and a 1-125 milliliter polyethylene bottle with a nitric acid preservative for dissolved metals. If the turbidity was over 10 NTU an additional 125 milliliter sample was filtered using an inline 0.45-micron filter, preserved, and submitted for dissolved metals analysis. Samples collected from WFF15-GW7, WFF15-MW3R, and the 6 temporary wells at the WOD site were analyzed for a quick turnaround (7 day) analysis, while the remaining 6 were analyzed on a standard (21) day turn around. Once sampling was completed at each well, field geochemical kits were used to measure dissolved oxygen, alkalinity, dissolved carbon dioxide, ferrous iron, and hydrogen sulfide. Detailed groundwater sample log sheets, low-flow purge sheets, and field analytical log sheets were completed for each well to document sampling conditions. Low-flow purge data sheets and groundwater sample log sheets are included in Attachment 3.

The purge water generated during the sampling event was collected in 5 gallon buckets and consolidated into 55-gallon drums that were transported to the NASA temporary storage facility (B-29) and transferred to NASA for ultimate disposal.

All groundwater samples were sent to Katahdin Laboratories in Scarborough, Maine and analyzed for benzene, tetrachloroethene, xylenes (total), m+p-xylenes, o-xylene, 1,2,4-trimethylbenzene, 3&4-methylphenol, naphthalene, total arsenic, and dissolved arsenic.

ORC® Injection

On December 10, 2008, 3 DPT soil boring injection points were used to inject the Regenesis ORC® slurry. At the WOD, each well received a slurry consisting of 35 gallons of water and 124 lbs of ORC® for a final ratio of 3.5 gallons of slurry per foot. In total, 372 lbs of ORC® and 105 gallons of water were injected at the WOD. The process consisted of pumping the ORC® through a standard Geoprobe® rod inserted at the target depth of 30' bgs and incrementally raised to 20' bgs. After completion of the injection, the injection points were backfilled with bentonite and capped with a plug of coarse sand up to the ground surface.

Mixing and injection of the ORC® was performed in general accordance with the Regenesis instructions (TtNUS, 2008).

Post Injection Groundwater Sampling

1 Day Sampling Event

The first groundwater sampling event after the injection of the ORC® slurry was conducted on December 12, 2008. As detailed in Section 2.1 this event took place 2 days after injection at the WOD. As a result of this delay and time constraints only the 6 temporary wells (TW1-TW6) were characterized, with each well having the equivalent of 1 well volume of water purged from it while the field parameters were recorded from the Horiba® U-22 flow through cell and Turbidity Meter. After the required amount of water was purged, the flow through cell was disconnected and the geochemical kits were used to measure the concentrations of dissolved oxygen, carbon dioxide, alkalinity, hydrogen sulfide, and ferrous iron in the groundwater.

1 Week Sampling Event

On December 18, 2008, the 1 week sampling event took place. Low flow sampling procedures, as described for the baseline event, were used and samples were collected from the six temporary wells and permanent monitoring wells WFF15-GW7 and WFF15-MW3R at the WOD. Field analytical log sheets and low flow purge sheets were used to note geochemical conditions measured by the flow through cell, turbidity meter, and geochemical field kits (see Attachment 3)

Groundwater Level Measurements

A synoptic round of groundwater level measurements was conducted from 19 WOD site monitoring wells on January 12, 2009. Groundwater level measurement and elevation data is provided in Table 2-1 and presented in Figure 2-2. The projected groundwater contour lines and flow direction noted in January 2009 is consistent with previous findings, and indicate a radial flow from the higher elevation at the southern end of the Site.

1 Month Sampling Event

From January 13 to January 15, 2009, the 1 month sampling event took place. The previously described low flow sampling procedure was carried out with the same equipment as the baseline sampling event. Samples were collected from 8 monitoring wells and shipped to Katahdin Laboratories in Scarborough, Maine to be analyzed for the VOCs, SVOCs, and dissolved metals parameters. Then geochemical field kits were used to measure dissolved oxygen, alkalinity, dissolved carbon dioxide, ferrous iron, and hydrogen sulfide. Detailed groundwater sample log sheets, low-flow purge sheets, and field analytical log sheets were completed for each well to document sampling conditions. Low-flow purge data sheets and groundwater sample log sheets are included in Attachment 3.

2.3 Field Observations

As referenced above, log sheets were completed for well installation, development, and groundwater sampling activities and are presented in Attachment 3. The following bulleted items summarize the notable field observations made during the investigation.

- Turbidity readings remained high in all 6 temporary monitoring wells. Samples were collected for total and dissolved arsenic from all 6 wells.
- 4.35 inches of rainfall was recorded at Wallops Island, VA for the period of December 11 through the early morning of December 12, 2008, approximately 1 day after the ORC® injections.

3.0 FIELD AND ANALYTICAL RESULTS

3.1 Field Geochemical Results

Field parameters were collected at eleven monitoring wells prior to and following the ORC® injection event using low-flow sampling techniques and test kits. Table 3-1 presents a summary of the field geochemical analyses performed during all groundwater monitoring events (baseline, two day, one week, and one month events).

An analysis of the field geochemical data shows several trends in the parameters that were collected. At all but one (TW-6) of the six temporary monitoring wells, the DO readings collected during the Day 2 sampling event were higher than the values recorded during the baseline sampling event. Wells 15-GW7 and MW3R were not sampled on day two. For the one week sampling event, all but one (TW1) locaton contained DO above the baseline results, however, the majority of the DO values had declined significantly from the Day 2 results. The one month DO readings showed additional decline in DO, with only three of the seven down gradient locations reporting DO levels higher than the baseline readings. Background sample MW3R showed an increase in DO at the one week sampling event, and subsequent decline at the one month event to a level still higher than baseline. Results from the test kit samples showed similar trends when compared to the data from the in-line flow-through meter samples.

ORP values collected at the study area wells during the two day event showed an increase from baseline at all but one (TW6) location. For the one week samples, all but one (TW1) sample reported an ORP value higher than the baseline level. Wells 15-GW7 and MW3R were not sampled on day two. For the one week sampling event, all but one (TW1) location had ORP values above the baseline results, with some sample values still increasing. The one month ORP readings showed mixed results, with some samples reporting increasing levels of ORP, while some wells had decreasing values. However, all seven down gradient wells reported values at the one month sampling event higher than the baseline values. Background sample MW3R showed a decrease in ORP at the one week sampling event, and continued decline at the one month event.

Turbidity readings were high in the temporary wells, with readings of 790 NTU or higher reported in the wells. The temporary wells were installed without sand pack, and this is thought to be the reason for the high turbidity readings. By the time the one month sampling event was conducted, all but one (TW1) temporary well had readings below 50 NTU, with two of the wells (TW2 and TW4) below 10 NTU.

Groundwater measurements collected for pH showed an overall trend of decreasing values, especially at the one month sampling event. For 15-GW7 and the six temporary wells, the initial ph readings ranged between 5.37 and 6.52. For the two day and one week sampling events the ph readings were mixed, but the results of the one month sampling event reported all locations having decreased pH values when compared to baseline values.

3.2 Analytical Results

A total of fourteen groundwater monitoring wells were sampled prior to the ORC® injection event, with eight of the wells samples again a month after the injection event. The samples were analyzed by a Navy-certified laboratory as mention above in section 2.2 in accordance with the approved work plan (TtNUS, 2008). Laboratory analytical results were not validated and laboratory reports are presented in Attachment 4. Table 3-2 presents a summary of the analytical data for constituents analyzed in the groundwater samples.

Benzene is the only organic COC at the WOD for which a cleanup goal (5 μg/L) has been established. For the wells in the area of the Pilot Study injection, benzene decreased at five of the seven locations, with minor increases reported at TW3 and TW6. At TW1, benzene decreased from 32 μg/L to 2 μg/L, below the cleanup goal. Significant decreases were reported at TW2, where benzene decreased from 120 μg/L to 12 μg/L, and at TW4, where benzene decreased from 250 μg/L to 120 μg/L.

All other VOCs (tetrachloroethene, xylenes (total), m+p xylenes, o-xylene and 1,2,4-trimethylbenzene) reported decreased values from the baseline sample to the one month sample with the exception of the o-xylene sample at TW 3.

Reported values of naphthalene decreased from the baseline sampling to the one month sampling event in all seven monitoring wells in the area of the WOD Pilot Study. The constituent 3&4 methylphenol was only detected in the baseline sample of TW4. Analysis was not conducted for other SVOC constituents.

Based on the analytical results, arsenic was detected at elevated concentrations at the site. Total arsenic was detected in the baseline samples at all seven Pilot Study wells at levels above the cleanup goal of 10 μg/L. Five of the wells reported a decrease in arsenic at the one month sampling event compared to the baseline analytical data, with 15GW7 reporting a one month value (9.7 μg/L) below the cleanup goal. Values for dissolved arsenic were reported for the six temporary monitoring wells for the baseline study, with four of the temporary wells being resampled for dissolved arsenic at the one month sampling event. Of the four wells that were resampled for dissolved arsenic, three reported a decrease compared to the baseline values. It two of the wells (TW3 and TW7) the values for the dissolved arsenic reported for the one month sampling event were higher than the reported values for total arsenic (59 μg/L dissolved vs. 56.4 μg/L total, and 117 μg/L dissolved vs. 116 μg/L total respectively).

4.0 CONCLUSIONS AND RECOMMENDATIONS

The Pilot Study conducted at the Waste Oil Dump Site has adequately addressed the objectives set out for this study, including determining if the application of ORC® could significantly reduce the impact of volatile organic compound (VOC) in site groundwater. The Pilot Study is considered a success due to the dissolved oxygen (DO) levels in monitoring well WFF15-GW7 increased after ORC® injection.

Based on the Pilot Study Investigation findings, the following conclusions can be made for groundwater:

- As a result of the injection of ORC®, the level of DO increased in the Pilot Study wells, although it decreased rapidly following the initial increase,
- Concentrations of VOCs and SVOCs were reduced following the ORC® injection,
- Reported concentrations of arsenic were reduced following the ORC® injection.

Based on these conclusions, it is recommended that a full scale implementation of ORC® injection be conducted at the WOD, with four rows, each containing thirteen injection points at fifteen foot spacings. However, due to the decline of DO recorded between the one week and one month sampling events, it is recommended that ORC Advanced® be used instead of ORC®. ORC Advanced® releases oxygen slower and is 70% more efficient than ORC®, As a result of using ORC Advanced®, less material will need to be injected, and the cost of the full scale injection event will be less.

REFERENCES

TtNUS, 2008. Pilot Study Work Plan for Waste Oil Dump Site, NASA Wallops Flight Facility. Wallops Island, Virginia. October.

TABLES

Table 2-1
Groundwater Level Measurements From January 12, 2009
Waste Oil Dump (WOD)
NASA Wallops Flight Facility
Wallops Island, Virginia

Monitoring Well	Monitoring Well (actual)	Screened Interval (ft bgs)	Total Depth BTOC (ft)	Surveyed Elevation Top of Casing (ft)	Static Water Level Measurement BTOC (ft)	Water Level Elevations (ft MSL)
WFF09-GW1	09-MW001	---	30.22	28.58	18.59	9.99
WFF09-GW2	WFF9-MW2	---	12.35	8.94	2.52	6.42
WFF09-GW3	WFF9-MW3	---	12.12	14.16	5.15	9.01
MW-4	WOD-MW004-1	3-23	24.82	10.33	6.65	3.68
15-MW3R	WOD-MW003R	21-31	32.33	32.42	26.58	5.84
15-GW1	15-MW001	1-5	10.33	6.27	3.12	3.15
15-GW2	15-MW002	1-5	8.75	9.21	4.7	4.51
15-GW3	15-MW003	7-12	10.35	8.7	3.79	4.91
15-GW7	15-MW007	15-30	---	30.58	25.02	5.56
16-GW1	WOD-MW001	17-22	26.54	30.39	25.23	5.16
16-GW2D	WOD-MW002D	23-28	---	21.36	16.73	4.63
16-GW2S	WOD-MW002S	9-19	---	21.26	16.31	4.95
16-GW3	WOD-MW003	7-12	12.20	16.18	11.67	4.51
16-GW4	WOD-MW004-2	6-11	13.88	14.94	10.68	4.26
16-GW5	WOD-MW005	3-8	11.56	12.47	8.36	4.11
16-GW6	WOD-MW006	4-9	10.97	9.66	6.05	3.61
16-GW7	WOD-MW007	4-9	11.52	8.96	5.46	3.5
16-GW8	WOD-MW008	18-28	30.80	---	9.05	---
FTA-MW104S	FFTA-MW104S	3-13	15.40	8.92	5.82	3.1

Notes
MSL: Mean Sea Level
BTOC: Below Top of Casing
UK: Unknown
bgs: below ground surface
--- : Date Unavailable

TABLE 3.1
FIELD GEOCHEMICAL PARAMETERS
WASTE OIL DUMP
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

	TW 1 Baseline 12/9/2008	TW 1 2 Day 12/12/2008	TW 1 1 Week 12/18/2008	TW 1 1 Month 1/14/2009	TW 2 Baseline 12/10/2008	TW 2 2 Day 12/12/2008	TW 2 1 Week 12/18/2008	TW 2 1 Month 1/14/2009	TW 3 Baseline 12/10/2008	TW 3 2 Day 12/12/2008
Horiba Readings										
pH (S.U.)	6.33	5.85	5.77	4.93	5.98	6.02	5.73	4.36	6.16	5.76
Sp. Cond. (mS/cm)	0.382	0.247	0.377	0.25	0.569	0.393	0.982	0.385	0.61	0.58
D.O. (mg/L)	3.65	5.68	0.58	0.81	0.92	4.6	2.81	0	0.4	6.68
Temp. (°C)	15.94	15.67	15.86	13.9	18.08	16.35	16.37	15.8	16.91	17.16
ORP (mV)	-53	39	-71	13	-123	-1	38	108	-470	-17
Test Kits										
D.O. (mg/L)	2.5	4	0.3	1	0.9	3	1	0.8	0	3.5
CO_2 (ppm)	160	70	100	70	250	200	70	130	50	250
Alk. (ppm)	200	110	200	70	225	250	110	<10	250	250
Fe^{2+} (ppm)	2.9	1.8	2.4	1.6	2.8	3.1	2.6	1.8	2.6	1.8
H_2S (ppm)	0	0	0	0	0	0	0	0	0	0
LaMotte										
Turbid (NTU)	1060	550	1000	764	(+1000)	750	55	3.61	(+1000)	Er2

NOTES
Er2 will be displayed when measured turbidity is over range (1100 NTU).

TABLE 3.1
FIELD GEOCHEMICAL PARAMETERS
WASTE OIL DUMP
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

	TW 3 1 Week 12/18/2008	TW 3 1 Month 1/14/2009	TW 4 Baseline 12/9/2008	TW 4 2 Day 12/12/2008	TW 4 1 Week 12/18/2008	TW 4 1 Month 1/14/2009	TW 5 Baseline 12/10/2008	TW 5 2 Day 12/12/2008	TW 5 1 Week 12/18/2008	TW 5 1 Month 1/14/2009
Horiba Readings										
pH (S.U.)	5.56	5.18	5.97	6.01	4.92	4.97	6.46	6.82	6.67	5.14
Sp. Cond. (mS/cm)	0.49	99.4	0.602	0.513	0.301	0.406	0.999	1.31	0.69	0.52
D.O. (mg/L)	1.28	0.77	1.16	5.65	2.37	0	2.27	19.99	10.65	4.82
Temp. (°C)	16.25	15.3	16.51	?	15.65	14.2	16.26	16.93	17.54	13.8
ORP (mV)	-27	-10	-81	8	77	-5	-107	162	40	-6
Test Kits										
D.O. (mg/L)	2	1.5	0.5	3.5	1	0.6	2	9	5.5	8
CO_2 (ppm)	160	70	225	180	200	200	230	30	120	70
Alk. (ppm)	250	150	250	225	110	100	250	400	260	150
Fe^{2+} (ppm)	2.5	1.8	2.1	2.1	1	1.2	2	0.8	2.8	2
H_2S (ppm)	0	0	0	0	0	0	0	0	0	0
LaMotte										
Turbid (NTU)	520	13.5	758	790	19	2.78	Er2	270	320	25.5

NOTES
Er2 will be displayed w

TABLE 3.1
FIELD GEOCHEMICAL PARAMETERS
WASTE OIL DUMP
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

	TW 6 Baseline 12/10/2008	TW 6 2 Day 12/12/2008	TW 6 1 Week 12/18/2008	TW 6 1 Month 1/14/2009	15-GW7 Baseline 12/8/2008	15-GW7 2 Day	15-GW7 1 Week 12/18/2008	15-GW7 1 Month 1/14/2009	MW3R Baseline 12/8/2008	MW3R 2 Day
Horiba Readings										
pH (S.U.)	6.52	6.16	6.5	5.38	5.37	-	5.48	4.18	6.28	-
Sp. Cond. (mS/cm)	0.999	0.658	0.668	0.69	0.0173	-	0.317	0.1	0.093	-
D.O. (mg/L)	2.44	0.5	3.32	0.94	0.73	-	0.85	4.12	7.72	-
Temp. (°C)	15.96	16.58	15.62	15.2	16.38	-	16.44	15.7	14.02	-
ORP (mV)	-95	-281	-75	-64	-192	-	-40	58	206	-
Test Kits										
D.O. (mg/L)	0.3	0.05	0.3	0.1	0.9	-	0.7	3.5	6	-
CO_2 (ppm)	160	125	55	80	100	-	170	70	16	-
Alk. (ppm)	200	260	140	250	150	-	225	40	20	-
Fe^{2+} (ppm)	1.9	2.2	2.5	3.8	3.8	-	1.6	2.4	0	-
H_2S (ppm)	0	0	0	0	0.4	-	0	1.5	0	-
LaMotte										
Turbid (NTU)	290	800	230	42.2	9.15	-	11	4.46	4.8	-

NOTES
Er2 will be displayed

TABLE 3.1
FIELD GEOCHEMICAL PARAMETERS
WASTE OIL DUMP
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

	MW3R 1 Week 12/18/2008	MW3R 1 Month 1/14/2009
Horiba Readings		
pH (S.U.)	4.86	5.65
Sp. Cond. (mS/cm)	0.093	0.17
D.O. (mg/L)	13.79	8.56
Temp. (°C)	16.29	15.3
ORP (mV)	194	75
Test Kits		
D.O. (mg/L)	7	5.5
CO_2 (ppm)	18	10.5
Alk. (ppm)	32	22
Fe^{2+} (ppm)	0.2	0
H_2S (ppm)	0	0
LaMotte		
Turbid (NTU)	17	1.18

NOTES
Er2 will be displayed

TABLE 3.2
LAB ANALYTICAL RESULTS
WASTE OIL DUMP
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

Parameter	Cleanup Goal (µg/L)	WOD-15GW1-1		WOD-15GW2-1		WOD-15MW3R-1		WOD-15MW3R-4		WOD-15GW7-1		WOD-15GW7-4		WOD-16GW2D-1	
Sample Date		12/5/2008		12/5/2008		12/8/2008		1/14/2009		12/8/2008		1/14/2009		12/5/2008	
VOCs (ug/L)															
Benzene	5	1	U	1	U	1	U	1	U	**32**		2		3	
Tetrachloroethene	NA	1	U	1	U	1	U	1	U	3		2		1	U
Xylenes (total)	NA	3	U	3	U	3	U	3	U	330		120		3	U
m+p-Xylenes	NA	2	U	2	U	2	U	2	U	240		74		2	U
o-Xylene	NA	1	U	1	U	1	U	1	U	95		50		1	U
1,2,4-Trimethlybenzene	NA	1	U	1	U	1	U	1	U	73		54		1	U
SVOCs (ug/L)															
3&4-Methylphenol	NA	10	U	11	U	11	U	9	U	11	U	11	U	11	U
Naphthalene	NA	10	U	11	U	11	U	9	U	96		55		11	U
Metals (ug/L)															
Total Arsenic	10	3.3		4.8	B	1.45		1.45	U	**27**		9.7		**12.3**	
Dissolved Arsenic	NA	NA		4.1	B	NA		NA		NA		NA		NA	
Field Parameters															
pH (S.U.)		4.66		5.49		6.28		5.65		5.37		4.18		6.17	
S. Conductivity (mS/cm)		0.191		0		0.093		0.17		0.0173		0.1		0.168	
Dissolved Oxygen (mg/L)		0.32		9.01		7.72		8.56		0.73		4.12		1.84	
Temperature (°C)		14.56		12.61		14.02		15.3		16.38		15.7		15.16	
Oxygen Reduction Potential (mV)		41		52		206		75		-192		58		-19	
Turbidity (NTU)		0.79		16		4.8		1.18		9.15		4.46		0.7	

NA - not analyzed
J - Estimated Value
U - Compound was analyzed for bu not detected above the lab Practical Quantitation Limit (PQL)
U* - Analyte was not detected in the sample at a level greater than the instument detection limit or greater than the Method Detection Limit (MDL)
B - The analyte was detected in the sample at a concentration greater than the instrunment detection limit or greater than the MDL, but less than the lab PQL

TABLE 3.2
LAB ANALYTICAL RESULTS
WASTE OIL DUMP
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

Parameter	WOD-16GW2S-1		WOD-16GW5-1		WOD-16GW8-1		WOD-TW1-1		WOD-TW1-4		WOD-TW2-1		WOD-TW2-4		WOD-TW3-1		WOD-TW3-4	
Sample Date	12/5/2008		12/5/2008		12/10/2008		12/9/2008		1/14/2009		12/10/2008		1/14/2009		12/10/2008		1/14/2009	
VOCs (ug/L)																		
Benzene	**5**		1	U	1	U	**90**		**36**		**120**		**12**		**87**		**93**	
Tetrachloroethene	1	U	1	U	1	U	2		1	J	0.5	J	1	J	0.7	J	0.6	J
Xylenes (total)	3	U	3	U	3	U	700		360		1200		590		1300		870	
m+p-Xylenes	2	U	2	U	2	U	560		270		930		420		1000		670	
o-Xylene	1	U	1	U	1	U	140		89		270		160		180		200	
1,2,4-Trimethlybenzene	1	U	1	U	1	U	140		81		190		140		170		120	
SVOCs (ug/L)																		
3&4-Methylphenol	13	U	11	U	9	U	4	J	11	U	11	U	12	U	6	J	10	U
Naphthalene	13	U	11	U	9	U	190		51		210		130		200		110	
Metals (ug/L)																		
Total Arsenic	**18.4**		2.2	B	6.3		**51.8**		**22.3**		**103**		**10.3**		**65.7**		**56.4**	
Dissolved Arsenic	16		1.45	U*	NA		42		19.3		72.6		NA		63.9		59	
Field Parameters																		
pH (S.U.)	6.44		4.79		5.77		6.33		4.93		5.98		4.36		6.16		5.18	
S. Conductivity (mS/cm)	0.233		0.689		0.12		0.382		0.25		0.569		0.385		0.61		99.4	
Dissolved Oxygen (mg/L)	5.73		3.36		1.98		3.65		0.89		0.92		0		0.4		0.77	
Temperature (°C)	13.95		15.42		15.17		15.94		13.9		18.08		15.8		16.91		15.3	
Oxygen Reduction Potential (mV)	-14		104		84		-53		13		-123		108		-470		-10	
Turbidity (NTU)	19		36.5		7.1		1060		764		>1100		3.61		>1100		13.5	

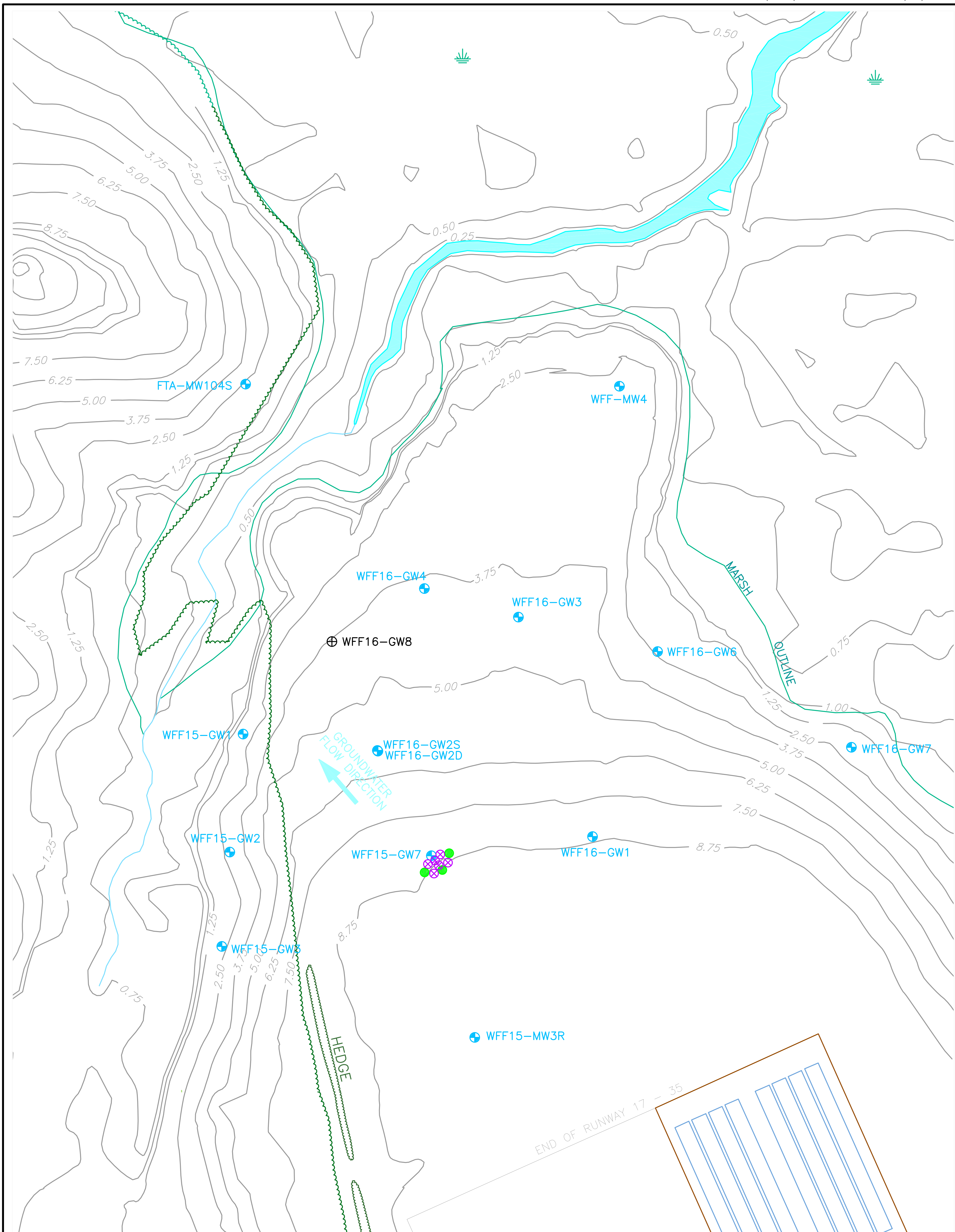
NA - not analyzed
J - Estimated Value
U - Compound was analyzed for bu
U* - Analyte was not detected in th
limit or greater than the Method
B - The analyte was detected in the
detection limit or greater than th

TABLE 3.2
LAB ANALYTICAL RESULTS
WASTE OIL DUMP
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

Parameter	WOD-TW4-1		WOD-TW4-4		WOD-TW5-1		WOD-TW5-4		WOD-TW6-1		WOD-TW6-4	
Sample Date	12/9/2008		1/14/2009		12/10/2008		1/14/2009		12/10/2008		1/14/2009	
VOCs (ug/L)												
Benzene	**250**		**120**		**92**		**20**		**44**		**46**	
Tetrachloroethene	1	U	0.4	J	1	U	0.4	J	1		0.3	J
Xylenes (total)	1400		900		1700		440		1600		1200	
m+p-Xylenes	1000		660		1400		310		1200		840	
o-Xylene	390		250		320		130		430		340	
1,2,4-Trimethlybenzene	170		110		300		85		170		160	
SVOCs (ug/L)												
3&4-Methylphenol	31		11	U	2100	U	10	U	10	U	11	U
Naphthalene	320		83		20000		73		400		280	
Metals (ug/L)												
Total Arsenic	**135**		**203**		**102**		**72.8**		**27.7**		**116**	
Dissolved Arsenic	138		NA		95.5		62		16.2		117	
Field Parameters												
pH (S.U.)	5.97		4.97		6.46		5.14		6.52		5.38	
S. Conductivity (mS/cm)	0.602		0.406		0.999		0.52		0.999		0.69	
Dissolved Oxygen (mg/L)	1.16		0		2.27		4.82		2.44		0.94	
Temperature (°C)	16.51		14.2		16.26		13.8		15.96		15.2	
Oxygen Reduction Potential (mV)	-81		-5		-107		-6		-95		-64	
Turbidity (NTU)	758		2.78		>1100		25.5		290		42.2	

NA - not analyzed
J - Estimated Value
U - Compound was analyzed for bu
U* - Analyte was not detected in th
limit or greater than the Method
B - The analyte was detected in the
detection limit or greater than th

FIGURES



80' = 24.384m

0 80 160

SCALE IN FEET

LEGEND

APPROXIMATE EXTENT OF BRUSHLINE/WETLAND

MONITORING WELL

PROPOSED MONITORING WELL

TEMPORARY MONITORING POINT

INJECTION POINT

NOTE: ELEVATION CONTOURS ARE METRIC.

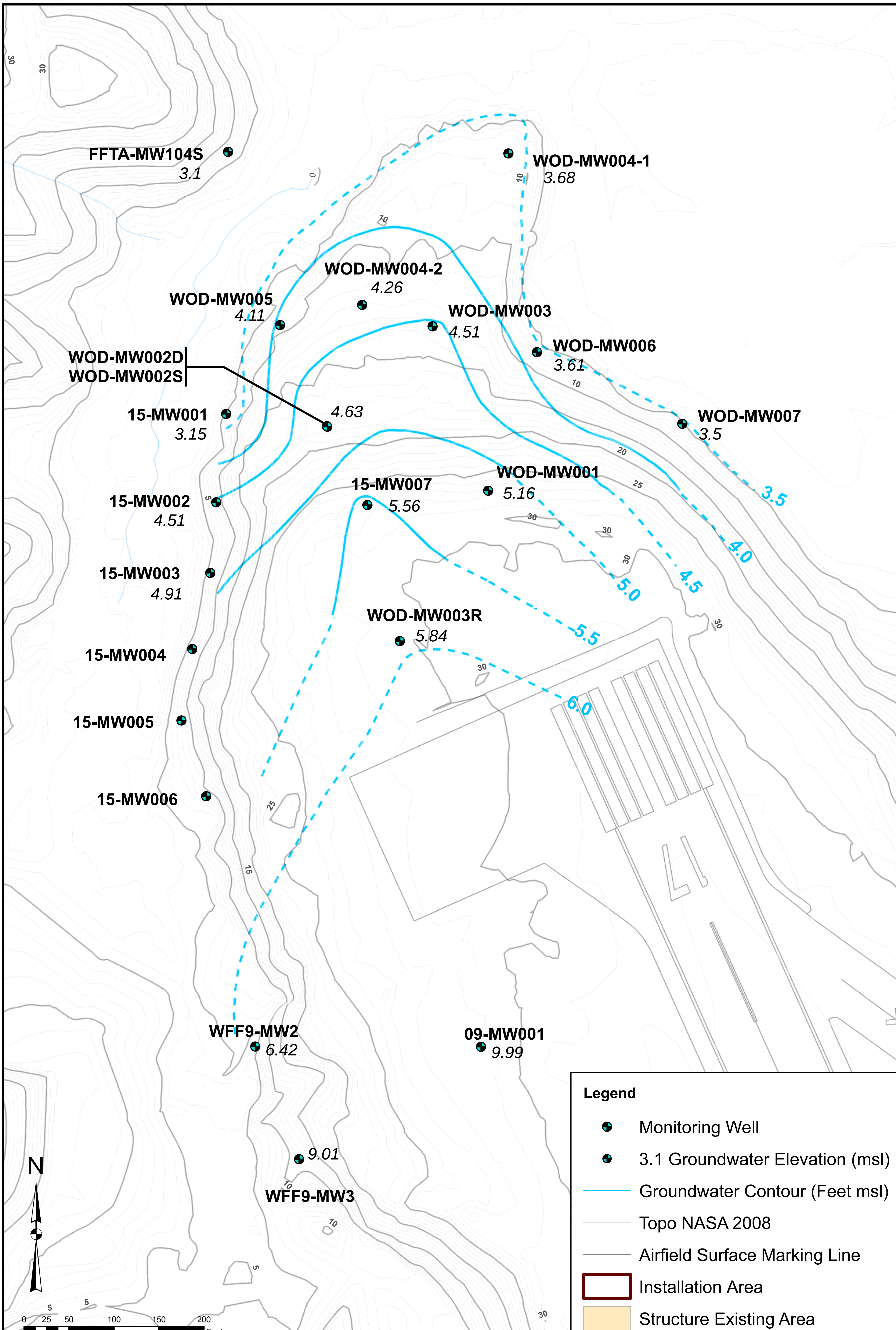
TETRA TECH NUS, INC.

WASTE OIL DUMP
PROPOSED MONITORING WELL/DPT/
INJECTION WELL LOCATIONS
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

FILE	SCALE
112G00086GM32	AS NOTED

FIGURE NUMBER	REV	DATE
FIGURE 2-1	0	05/07/08

P:\MW_mainbase 11x17_land.MXD MMC 03122009



DRAWN BY MMC	DATE 03122009	TETRA TECH	Waste Oil Dump	CONTRACT NUMBER 112GN1612	
CHECKED BY ___	DATE ___		Potentiometric Map of Active Wells (January 12, 2009)	APPROVED BY ___	DATE ___
REVISED BY ___	DATE ___		NASA Wallops Flight Facility	APPROVED BY ___	DATE ___
SCALE AS NOTED			Wallops Island, Virginia	FIGURE NO. 2-2	REV 0

ATTACHMENT 1

Field Task Modification Request Forms

TETRA TECH NUS
FIELD TASK MODIFICATION REQUEST FORM

Project/Installation Name: NASA WFF FFTA+WOD Pilot Study

CTO & Project Number: CTO 012 Project #112GN1612

Task Mod. Number:

Modification To (e.g. Work Plan): Work Plan

Site/Sample Location: FFTA+WOD

Date: 12/8/2008

Activity Description: Rearranged Temp. Well + Injection Well set up from proposed pilot Study workplan.

Reason for Change: Revised set up allows temporary wells to be directly up gradient and down gradient of groundwater flow. Labeling was coordinated by on site geologist.

Recommended Disposition: New set up allows the ORC injection to be more properly monitored with known ground water flow

Field Operations Leader (Signature): [signature]

Date: 12/9/08

Approved Disposition:

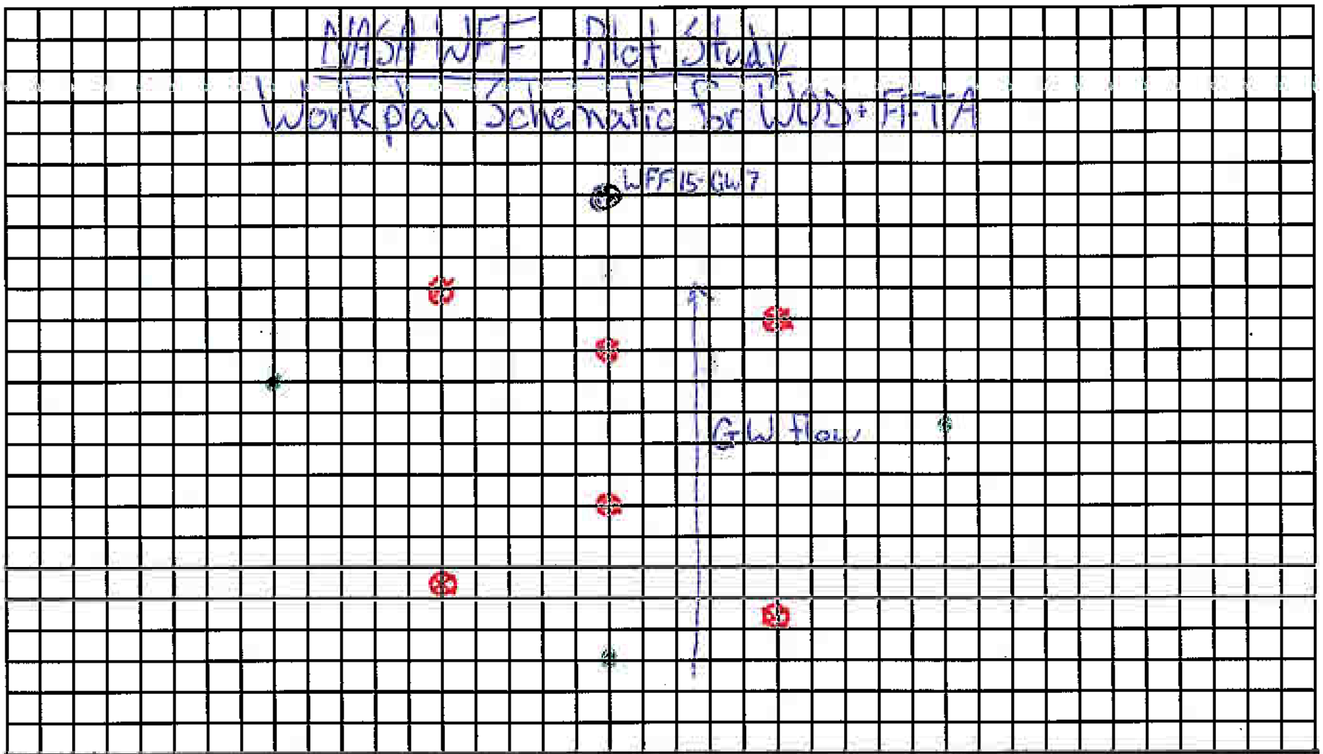
Project/Task Order Manager (Signature): [signature]

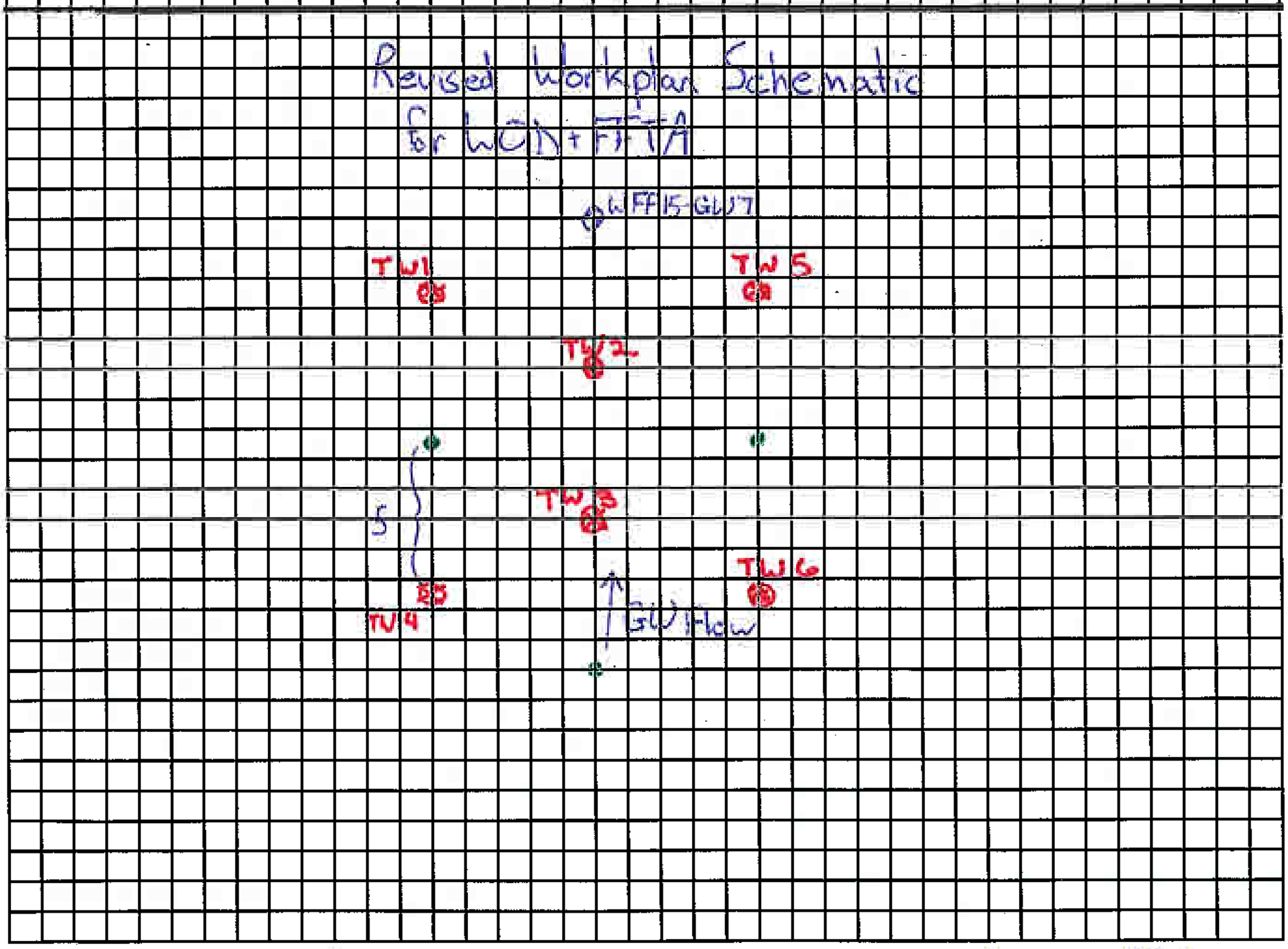
Date: 12/8/08

Distribution:

Program/Project File –
Project/Task Order Manager –
Field Operations Leader –

Other: [signature]





1 square = 1 Foot

Legend
- Temporary Well
- Injection Point
- Monitoring Well

TETRA TECH NUS
FIELD TASK MODIFICATION REQUEST FORM

NASA WFF
Project/Installation Name

CTO 012 Project #112GN1612
CTO & Project Number

Task Mod. Number

Work plan
Modification To (e.g. Work Plan)

~~EFTA~~+WOD (BB 12/12/2008)
Site/Sample Location

12/11/2008
Date

Activity Description: 1 day post ORC injection sampling for WOD postponed 1 day due to inclement weather which made it impossible to mobilize on site. Hence a 2 day post injection sampling event occured on 12/12/2008

Reason for Change: NASA WFF tower control denied access down runway 17 due to a lightning advisory in the area.

Recommended Disposition: 1 day sampling event changed to a 2 day sampling event for NASA WFF WOD.

Field Operations Leader (Signature)

Date 12/11/08

Approved Disposition:

Project/Task Order Manager (Signature)

Date 12/12/08

Distribution:

Program/Project File –
Project/Task Order Manager –
Field Operations Leader –

Other:

ATTACHMENT 2

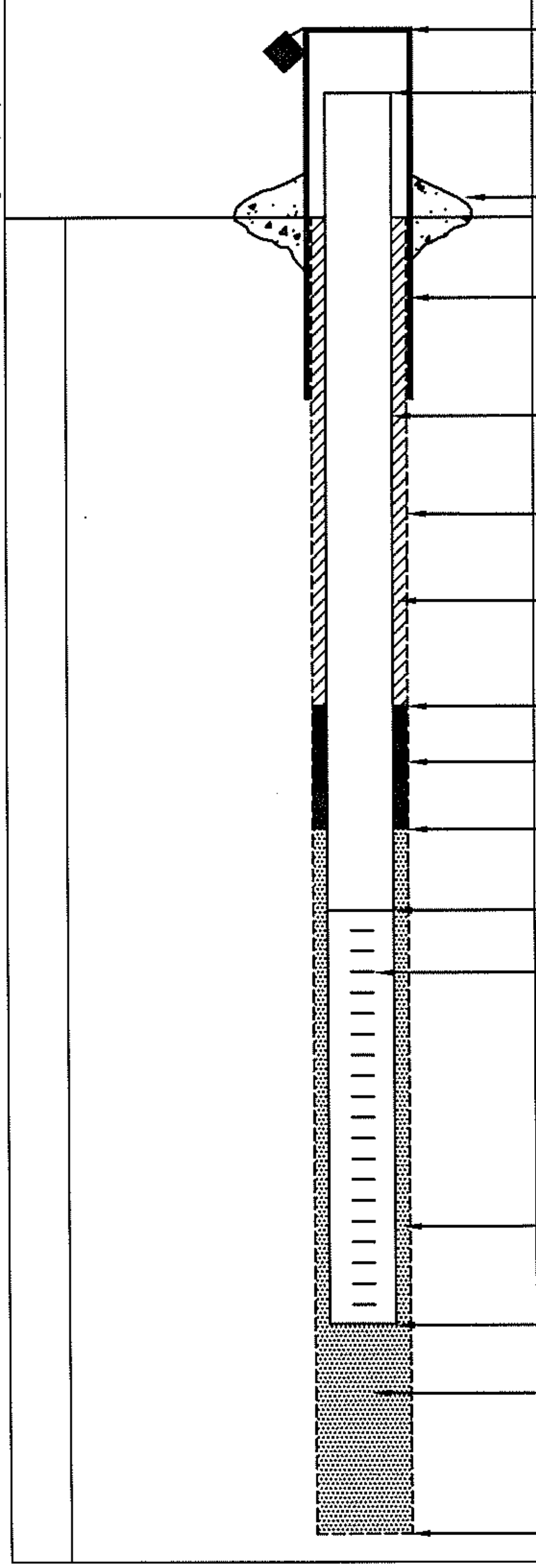
Soil Boring, Monitoring Well Construction, and Development Log Sheets

WELL NO.: WFF16-GW8

Tetra Tech NUS, Inc.

OVERBURDEN MONITORING WELL SHEET STICK-UP

PROJECT: WFF PilOT STUDY	LOCATION: WFF WASTE oil/Dump	DRILLER: ZEBRA
PROJECT NO.: 112GN1612	BORING: WFF16-GW8	DRILLING METHOD: Hollow STEM AUGER
DATE BEGUN: 12/8/08	DATE COMPLETED: 12/9/08	
FIELD GEOLOGIST: J.S., TomalAVAGE		DEVELOPMENT METHOD: pumping
GROUND ELEVATION:	DATUM:	



ELEVATION/HEIGHT OF TOP OF SURFACE CASING: / 2.5'

ELEVATION/HEIGHT OF TOP OF RISER PIPE: / 2'

TYPE OF SURFACE SEAL: CEMENT GROUT

I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: STEEl

RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: PVC

BOREHOLE DIAMETER: 4"

TYPE OF BACKFILL: BENTONITE

ELEVATION/DEPTH TOP OF SEAL: / 4'

TYPE OF SEAL: BENTONITE

DEPTH TOP OF SAND PACK: /5'

ELEVATION/DEPTH TOP OF SCREEN: / 18'

TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 0.10" x 10'
I.D. OF SCREEN: 2"

TYPE OF SAND PACK: clEAN MEDIUM GRAIN SAND

ELEVATION/DEPTH BOTTOM OF SCREEN: / 28

ELEVATION/DEPTH BOTTOM OF SAND PACK: / 30
BACKFILL MATERIAL BELOW SAND: SAND

ELEVATION/DEPTH OF HOLE: / 30'

ACAD:FORM_MWSU.dwg 07/20/99 INL

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: WFF PILOT STUDY
PROJECT NUMBER: 112GN1612
DRILLING COMPANY: ZEBRA
DRILLING RIG: GEOPROBE 6620DT

BORING No.: WFF16-GW8
DATE: 12/8/08
GEOLOGIST: J.S. TAMALANAGE
DRILLER: D. FERRELL

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	0			0	LOOSE	BRN	F. SAND				0	0	0
				9									
									WATER @ 9'				
	10			9	LOOSE	LT. TAN	F. SAND, WET						
					TO								
					FIRM								
									STIFF @ 17'				
	20			22		LT. GREY	SANDY CLAY						
				22	FIRM	TO							
						TAN							
				30									
	30												
	40												

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks: USED 5 X 50 LBS BAGS SAND BACKFILL
2 X 50 LBS BAGS BENTONITE

Converted to Well: Yes X No ____ Well I.D. #: WFF16-GW8

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Well: WFF16-GW8
Site: WFF WASTE oil Dump
Date Installed: 12/8/08
Date Developed: 12/9/08
Dev. Method: pump
Pump Type: ~~whale~~ PERISTALTIC pump

Depth to Bottom (ft.): 28.30
Static Water Level Before (ft.): 8.65
Static Water Level After (ft.): 8.80
Screen Length (ft.): 10
Specific Capacity:
Casing ID (in.): 2

Responsible Personnel: J.S, TOMALAVAGE
Drilling Co.: ZEBRA
Project Name: NASA WFF PILOT STUDY
Project Number: 112GN1612

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units ____)	Turbidity (NTU)	Remarks (odor, color, etc.)
0740	0.10	0	8.65	—	—	—	—	
0800	—	1	10.70	—	—	—	—	
0810	—	2	13.35	—	—	—	—	
0900	—	15	20.40	—	—	—	—	SWITCHED TO WHALE PUMP
0927	—	25	22.65	—	—	—	—	
0945	0	30	22.30	—	—	—	—	VISUALLY CLEAR
1015	—	—	8.80	—	—	—	—	

ATTACHMENT 3

Low Flow Purge, Field Analytical, and Groundwater Sample Log Sheets

Tetra Tech NUS, Inc.

QA SAMPLE LOG SHEET

Project Site Name: FFTA + WDD
Project Number: 112GN1612
Sample Location: NASA-WFF
Sample ID Number: TB01
Sampled By: LAB
C.O.C. Number:

QA Sample Type:

[X] Trip Blank
[] Source Water Blank
[] Rinsate Blank
[] Other Blank

SAMPLING DATA:

Date: 11/26/08
Time: 1305
Method: LAB prepared

WATER SOURCE:

[X] Laboratory Prepared
[] Purchased
[] Other
[] Tap
[] Fire Hydrant

PURCHASED WATER INFORMATION (If Applicable as Source or Rinsate Water):

Product Name:
Supplier:
Manufacturer:
Order Number:
Lot Number:
Expiration Date:

RINSATE INFORMATION (If Applicable):

Media Type:
Equipment Used:
Equipment Type:

[] Dedicated
[] Reusable

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Volatiles	Cool 4°C & HCl	3 x 40ml Vials	YES / NO
Semivolatiles	Cool 4°C		YES / NO
Pesticide / PCB	Cool 4°C		YES / NO
Metals	Cool 4°C & HNO_3		YES / NO
Cyanide	Cool 4°C & NaOH		YES / NO

OBSERVATIONS / NOTES:

LAB Prepared Trip Blank for shipping VOC samples collected @ WDD + FFTA (NASA-WFF)
Shipped 12/5/08

Signature(s):

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-15-GW1-1 ~~WFF-WOD-GW1~~ JBB 12/5
Project No.:	112GN1612	Sample Location:	WFF-WOD
		Sampled By:	JBB
		C.O.C. No.:	

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 12/5/2008	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Time: 1019								
Method: Low Flow	clear	4.66	0.191	14.56	0.79	0.32	0.6	

PURGE DATA:

Date: 12/5/2008	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: low flow								
Monitor Reading (ppm):								
Well Casing Diameter & Material								
Type: 2" PVC								
Total Well Depth (TD): 10.18								
Static Water Level (WL): 4.79								
One Casing Volume(gal/L): 0.88 gal								
Start Purge (hrs): 0931								
End Purge (hrs): 1014								
Total Purge Time (min): 43 min								
Total Vol. Purged (gal/L): 1.59 gal								

see low flow purge sheet

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOCs	HCl	(3) 40mL VOA	yes
TAL metals	HNO_3	(1) 125mL poly	yes
TCL SVOCs		(2) 1L ambers	yes

OBSERVATIONS / NOTES:

see field analytical log sheet for geochemical parameters

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	[signature]

LOW FLOW PURGE DATA SHEET

15-GWI-1

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD15-GWI-1
DATE: 12/5/2008

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0931	3.71									Horiba battery dead
0942	3.951	180	4.60	0.207	10.67	1.48	11.59	69	0.0	replaced
0946	4.07	160	4.62	0.193	5.38	1.14	13.28	63	0.0	
0950	4.13		4.62	0.194	4.01	0.98	13.43	60	0.0	
0953	4.21		4.62	0.195	3.95	0.81	13.60	58	0.0	
0956	4.29	150	4.62	0.193	3.49	0.69	13.84	56	0.0	2.5 L purged
0959	4.42		4.61	0.194	2.71	0.61	14.10	54	0.0	
1003	4.55		4.63	0.192	1.83	0.51	14.25	47	0.0	3.75 L purged
1006	4.63	120	4.64	0.192	1.36	0.41	14.31	43	0.0	
1010	4.70		4.65	0.191	1.22	0.38	14.40	44	0.0	
1014	4.79		4.66	0.191	0.79	0.32	14.56	41	0.0	6 L total purged
	? Stable @ ~4.8									
	Slowed down →	~100								
1100	4.45 After field-test kits / Recharged a little									
	TD: 10.18									

SIGNATURE(S): [signature]

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612
Sampled By: JBB RS
Field Analyst: JBB RS
Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.: WFF-WOD-15-GW1-1
Sample Location: WFF-WOD
Duplicate: ☐
Blank: ☐

SAMPLING DATA:

Date: 12/5/08 Time: 1019 Method: Low Flow	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
	clear	4.66	0.191	14.56	0.79	0.32	0.0	41

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model: ____________

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Range Used:	Range	Method	Concentration ppm
☒	0 to 1 ppm	K-7510	1.6
☒	1 to 12 ppm	K-7512	1.6

Concentration: 1.6 ppm

Analysis Time: 1037

Equipment: HACH Digital Titrator OX-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Analysis Time: ____________

Titration Count	Multiplier		Concentration
________	x 0.01	=	mg/L
________	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	60
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Concentration: 60 ppm

Analysis Time: 1050

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
________	x 0.1	=	mg/L
________	x 0.2	=	mg/L
________	x 1.0	=	mg/L
________	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ____________ (time)

End stripper at ____________ (time)

Total stripper time ____________ .

Pump rate ____________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-15-GW1-1
Project No.:	112GN1612	Sample Location:	WFF-WOD
Sampled By:	JBB RS	Duplicate:	☐
Field Analyst:	JBB RS	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 50 ppm

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-9810	50
☐	50 to 500 ppm	K-9815	
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1042

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:_______ Digits Required: 1st.:_______ 2nd.:_______ 3rd.:_______

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 3.9 ppm

Analysis Time: 1043

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ____________

Concentration: 0.0 ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: 1050

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NASA WFF WOD
Project No.: 112GN1612

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: WFF-WOD-15GW2-1
Sample Location: 15GW2
Sampled By: EW
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (^0C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Date: 12/5/08								
Time: 1310								
Method: LOW FLOW	clear	5.49	0.000	12.61	16	9.01	0.0	

PURGE DATA:

	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 12/5/08								
Method: LOW FLOW	SEE	LOW	FLOW	PURGE	SHEET			
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 8.5								
Static Water Level (WL): 5.2								
One Casing Volume(gal/L): 0.54 gal								
Start Purge (hrs): 1230								
End Purge (hrs): 1300								
Total Purge Time (min): 30 min								
Total Vol. Purged (gal/L):								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOC	HCL	(3) 40 ml glass	yes
TCL SVOC	—	(2) 1 L Amber	yes
TAL METALS	HNO_3	250 ml POLY	yes
Filtered Metals	HNO_3	250 ml POLY	yes

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFFWOD-15-GW2
DATE: 12/5/08

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
1230	5.20	175	4.93	0.000	120	9.76	11.33	153	0.0	
1235	5.47	150	5.30	0.000	53	9.44	11.94	137	0.0	
1240	5.96	150	5.48	0.000	40	9.20	12.56	70	0.0	
1246	6.28	150	5.49	0.000	17	9.13	12.55	49	0.0	
1250	6.37	150	5.49	0.000	14	9.07	12.59	50	0.0	
1255	6.40	150	5.50	0.000	14	9.06	12.61	51	0.0	
1300	6.46	150	5.49	0.000	16	9.01	12.61	52	0.0	

SIGNATURE(S):

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF WOD
Project No.: 112GN1612
Sampled By: EW
Field Analyst: ~~Jacob Birkett~~ EW/RS
Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.: WFFWOD-15GW2-I
Sample Location: 15GW2
Duplicate: ☐
Blank: ☐

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
Date: 12/5/08								
Time: 1310								
Method: Low Flow	Clear	5.44	0.000	12.61	16	9.01	0.0	52

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) 52

Electrode Make & Model: Horiba U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 1.5 ppm

Analysis Time: 1327

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-7510	
☑	1 to 12 ppm	K-7512	1.5

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ______

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 0.45 ppm

Analysis Time: 1330

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-1910	0.45
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ______ (time)

End stripper at ______ (time)

Total stripper time ______

Pump rate ______ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF
Project No.: 112GN1612
Sampled By: EW
Field Analyst: ~~Jacob Birkett~~ EW / RS

Sample ID No.: WFFWOD-15GW2-I
Sample Location: 15GW2
Duplicate: ☐
Blank: ☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 14.5 ppm

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-9810	14.5
☐	50 to 500 ppm	K-9815	
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1335

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:____ Digits Required: 1st.:____ 2nd.:____ 3rd.:____

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 4.8 ppm

Analysis Time: 1335

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ____

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: ____ ppm

Analysis Time: ____

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ____ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ____

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: WFF-WOD GW Pilot Study
Project No.: 112G01062

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: WFF-WOD-15-MW38-1
Sample Location: WFF-WOD
Sampled By: JBB
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 12/8/2008	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1010, 1136	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	
Method: Low Flow	clear	6.28	0.075	14.02	4.8	7.72	0.0	

PURGE DATA:

Date: 12/8/2008	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow								
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 32.33ft			see low flow purge sheet					
Static Water Level (WL): 27.65ft								
One Casing Volume(gal/L): 0.76gal								
Start Purge (hrs): 1017								
End Purge (hrs): 1103								
Total Purge Time (min): 46								
Total Vol. Purged (gal/L): 2.5gal								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOC	HCl	(3) 40 mL VOA vials	yes
TAL Metals	HNO_3	(1) 125 mL poly	yes
TCL SVOCs	—	(2) 1L Amber	yes

OBSERVATIONS / NOTES:

see field analytical log sheet for geochemical parameters

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s): [signature]

LOW FLOW PURGE DATA SHEET

WFF-WOD-15-MW3R-1

PROJECT SITE NAME: NASA WFF-WOD

PROJECT NUMBER: 112GN1612 TD 32.33

WELL ID.: ~~WFF-16-MW3R~~ [illegible]

DATE: 12/8/2005

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
1017	27.45	260	6.23	0.096	6.9	8.00	12.72	215	0.0	
1025	27.62	220	6.20	0.095	7.2	7.96	12.98	216	0.0	
1033	27.65		6.17	0.094	7.1	9.04	13.17	216	0.0	a few air bubbles through tubing
1037			6.18	0.094	5.0	7.94	13.17	215	0.0	
1041		220	6.21	0.094	4.3	7.87	13.14	213	0.0	
1045			6.19	0.093	4.2	7.84	13.22	213	0.0	
1049	27.65		6.20	0.094	4.3	7.72	13.54	213	0.0	no bubbles
1053			6.22	0.094	4.5	7.66	13.81	210	0.0	
1058			6.27	0.094	5.0	7.70	14.01	207	0.0	
1103			6.28	0.093	4.8	7.72	14.02	206	0.0	purge 2.5 gal

SIGNATURE(S): [signature]

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: WFF-WOD GW Pilot Study
Project No.: 112GN1612
Sampled By: JBB
Field Analyst: Jacob Birkett
Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.: WFF-WOD-15-MW3P-1
Sample Location: WFF-WOD
Duplicate: ☐
Blank: ☐

SAMPLING DATA:

Date: 12/13/2005 Time: 1136 Method: Low Flow	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
	clear	6.23	0.093	14.02	4.8	7.72	0.0	206

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model:

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 6 ppm

Analysis Time: 1152

Range Used:	Range	Method	Concentration ppm
☒	0 to 1 ppm	K-7510	>1
☒	1 to 12 ppm	K-7512	6

Equipment: HACH Digital Titrator OX-DT

Analysis Time:

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01 =	mg/L
______	x 0.02 =	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 16 ppm

Analysis Time: 1158

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	16
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1 =	mg/L
______	x 0.2 =	mg/L
______	x 1.0 =	mg/L
______	x 2.0 =	mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at __________ (time)

End stripper at __________ (time)

Total stripper time __________

Pump rate __________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: WFF-WOD GW Pilot Study
Sample ID No.: WFF-WOD-15-MW3-1
Project No.: 112GN1612
Sample Location: WFF-WOD
Sampled By: JSB
Duplicate: ☐
Field Analyst: Jacob Birkett
Blank: ☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 20 ppm

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-9810	20
☐	50 to 500 ppm	K-9815	
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1141

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 6 ppm

Analysis Time: 1148

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ______

Concentration: 0 ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: 1136

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ______ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ______

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Page 1 of 1

Project Site Name: NASH WFF WOD

Project No.: 112GN1612

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: ~~15~~ WFF.WOD-15GW7-1

Sample Location: 15GW7

Sampled By: EW

C.O.C. No.:

Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (^{0}C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Date: 12/8/08								
Time: 1120								
Method: Low Flow	Clear	5.37	0.173	16.38	9.15	0.73	0.0	

PURGE DATA:

Date: 12/8/08	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow	See	low	flow	purge	log	Sheet		
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 30								
Static Water Level (WL): 26.04								
One Casing Volume(gal/L): 0.65 gal								
Start Purge (hrs): 1040								
End Purge (hrs): 1120								
Total Purge Time (min): 40 min								
Total Vol. Purged (gal/L):								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOC	HCL	(3) 40ml glass	yes
TCL SVOC	—	(2) 1L Amber glass	yes
TAL Metals	HNO3	(1) 250ml Poly	yes

OBSERVATIONS / NOTES:

Slight petroleum odor

Circle if Applicable:

MS/MSD —

Duplicate ID No.: —

Signature(s): [signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-15-GW7
DATE: 12/8/08

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
1040	26.04	250	5.06	0.216	152	1.96	15.67	-165	0.0	
1052	26.77	250	4.91	0.184	32.6	1.11	15.99	-169	0.0	
1056	27.21	250	5.33	0.153	13.8	0.61	16.71	-197	0.0	
1100	27.28	250	5.29	0.143	12.0	0.63	16.67	-195	0.0	
1105	27.36	200	5.27	0.139	10.43	0.71	16.52	-197	0.0	
1110	27.74	200	5.32	0.151	10.12	0.72	16.63	-193	0.0	
1115	27.79	200	5.35	0.166	9.67	0.73	16.40	-194	0.0	
1120	27.83	200	5.37	0.173	9.15	0.73	16.38	-192	0.0	

SIGNATURE(S):

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page 1 of 2

Project Site Name: NASA WFF WOD
Sample ID No.: WI-WOD-15GW7-1

Project No.: 112GN1612
Sample Location: 15GW7

Sampled By: EW
Duplicate: ☐

Field Analyst: ~~Jacob Birkett~~ EW
Blank: ☐

Field Form Checked as per QA/QC Checklist (initials):

SAMPLING DATA:

Date: 12/8/08 / Time: 1120 / Method: low flow	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
	Clear	5.37	0.173	16.38	7.15	0.73	0.0	

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) -192

Electrode Make & Model: Horiba U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 0.9 ppm

Analysis Time: 1140

Range Used:	Range	Method	Concentration ppm
☑	0 to 1 ppm	K-7510	0.9
☑	1 to 12 ppm	K-7512	out of range

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ______

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
______	x 0.01	=	mg/L
______	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 100 ppm

Analysis Time: 1148

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-1910	100
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
______	x 0.1	=	mg/L
______	x 0.2	=	mg/L
______	x 1.0	=	mg/L
______	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at __________ (time)

End stripper at __________ (time)

Total stripper time __________

Pump rate __________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF WOOD
Project No.: 112GN1612
Sampled By: EW
Field Analyst: ~~Jacob Birkett~~ EW

Sample ID No.: WI-WOD-15GW7-1
Sample Location: 15GW7
Duplicate: ☐
Blank: ☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 150 ppm

Analysis Time: 1153

Filtered: ☐

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☑	50 to 500 ppm	K-9815	150
☐	100 to 1000 ppm	K-9820	

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:____ 2nd.:____ 3rd.:____

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 3.8 ppm

Analysis Time: 1145

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ______

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0.4 ppm

Analysis Time: 1153

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: _____ ppm

Analysis Time: _____

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Page 1 of 1

Project Site Name: WOD	Sample ID No.: W~~F~~WOD-16GW2D-1
Project No.: 112GV1612	Sample Location: GW2D
	Sampled By: EW
[] Domestic Well Data	C.O.C. No.:
[X] Monitoring Well Data	Type of Sample:
[] Other Well Type:	[] Low Concentration
[] QA Sample Type:	[] High Concentration

SAMPLING DATA:

Date: 12/5/08	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1005	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	Temp
Method: Low Flow	Clear	6.17	0.168	~~0.7~~	0.7	1.84	0.0	15.16

PURGE DATA:

Date: 12/5/08	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow	SEE	LOW	FLOW	PURGE	DATA	SHEET		
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 28								
Static Water Level (WL): 17.31								
One Casing Volume(gal/L): 1.74 gal								
Start Purge (hrs): 0930								
End Purge (hrs): 1005								
Total Purge Time (min): 35								
Total Vol. Purged (gal/L): 10 L								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOC	HCL	(3) 40 ml Glass	yes
TCL SVOC	—	(2) 1L Amber Glass	yes
TAL Metals	HNO3	~~3F~~ 250 Poly	yes

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):
—	WI-WOD-16GW10-1 (Time 0900)	[signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD GW-2D
DATE: 12/5/08

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0930	17.31	250	6.29	0.169	17	2.51	13.36	-6	0.0	
0935	17.60	250	6.19	0.150	6.3	2.01	14.63	-4	0.0	
0940	17.61	250	6.19	0.155	5.2	1.91	14.97	-7	0.0	
0945	17.63	250	6.19	0.180	1.2	1.88	15.14	-13	0.0	
0950	17.63	250	6.18	0.178	0.9	1.85	15.21	-15	0.0	
0955	17.64	250	6.17	0.167	1.1	1.84	15.17	-19	0.0	
1000	17.64	250	6.17	0.168	0.7	1.84	15.16	-19	0.0	

SIGNATURE(S):

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-FFTA	Sample ID No.:	WFF-WOD-16GW2D-I
Project No.:	112GN1612	Sample Location:	GW-2D
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 12/5/08	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time: 1005	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: Low Flow	CLEAR	6.17	0.168	15.16	0.7	1.84	0.0	-19

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) -19

Electrode Make & Model: HORIBA U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 0.25 ppm

Analysis Time: 1036

Range Used:	Range	Method	Concentration ppm
☑	0 to 1 ppm	K-7510	0.25
☑	1 to 12 ppm	K-7512	out of Range

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ______

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 40 ppm

Analysis Time: 1039

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-1910	40
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ______ (time)

End stripper at ______ (time)

Total stripper time ______

Pump rate ______ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-FFTA	Sample ID No.:	WFF-WOD-16GW20-1
Project No.:	112GN1612	Sample Location:	~~M~~-GW-20
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 30 ppm

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-9810	30
☐	50 to 500 ppm	K-9815	
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1043

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 2.15 ppm

Analysis Time: 1033

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ________

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0 ppm

Analysis Time: 1047

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Page 1 of 1

Project Site Name: NASA WFF WOD
Project No.: 112GN1612

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: ~~WFFWOD-16W~~ GW25-1
Sample Location: GW-25
Sampled By: EW
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity * (NTU)	DO (mg/l)	Salinity (%)	Other
Date: ~~12/4/~~ 12/5/08								
Time: 1110								
Method: low flow	clear	6.44	0.233	13.95	19	5.73	0.0	

PURGE DATA:

	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 12/5/08								
Method: low flow	see	low	flow	sheet				
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 19								
Static Water Level (WL): 17.09								
One Casing Volume(gal/L): 0.31 gal								
Start Purge (hrs): 0815								
End Purge (hrs): 0830								
Total Purge Time (min): 15 min								
Total Vol. Purged (gal/L): 2L								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
~~TA~~ TCL VOC	HCL	(3) 40 ml glass	yes
TCL SVOC	—	(2) 1 L Amber glass	yes
TAL Metals	HNO_3	250 POLY	yes
Dissolved Metals	HNO_3	250 POLY	yes

OBSERVATIONS / NOTES:

MW went dry allow to recharge from approx 0930 till 1110
* field parameters at sampling were from last purge reading except for Turb. Turb 19 so field filter for metals

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):
—	—	[signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD

PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-GW 2S-1

DATE: 12/5/08

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0815	17.09	300	6.58	0.224	85	2.19	14.82	10	0.0	
0820	19.08	200	6.58	0.217	60	2.15	14.90	10	0.0	
0825	21.42	150	6.55	0.268	51	2.14	14.75	9	0.0	
0830	22.75	100	6.44	0.223		5.73	13.95	-14	0.0	

SIGNATURE(S): [signature]

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Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-FFTA	Sample ID No.:	WFFWCD-16GW2S-1
Project No.:	112GN1612	Sample Location:	GW-2S
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 12/5/08 Time: 1110	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
Method: low flow	Clear	6.44	0.233	13.95	19	5.73	0.0	-14

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) -14

Electrode Make & Model: Horiba U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 0.45 ppm

Range Used:	Range	Method	Concentration ppm
☑	0 to 1 ppm	K-7510	0.45
☐	1 to 12 ppm	K-7512	

Analysis Time: 1140

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ____________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
________	x 0.01	= mg/L
________	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 30 ppm

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-1910	30
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Analysis Time: 1143

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
________	x 0.1	= mg/L
________	x 0.2	= mg/L
________	x 1.0	= mg/L
________	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ____________ (time)

End stripper at ____________ (time)

Total stripper time ____________

Pump rate ____________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-FFTA	Sample ID No.:	WI-W00-16GW2S-1
Project No.:	112GN1612	Sample Location:	GW-2S
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 100 ppm

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-9810	100
☐	50 to 500 ppm	K-9815	
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1146

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 __ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 1.6 ppm

Analysis Time: 1150

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ~~0~~

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0 ppm

Analysis Time: 1156

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ______ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ______

Filtered: ☐

Equipment: DR-850 DR-8 __ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-16-GW51
Project No.:	112GN1612	Sample Location:	WFF-WOD
		Sampled By:	JSB
[] Domestic Well Data		C.O.C. No.:	
[X] Monitoring Well Data		Type of Sample:	
[] Other Well Type:		[] Low Concentration	
[] QA Sample Type:		[] High Concentration	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 12/5/2008	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	
Time:								
Method: Low Flow	slightly brown	4.79	0.689	15.42	36.5	3.36	0.0	

PURGE DATA:

Date: 12/5/2008	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow								
Monitor Reading (ppm):								
Well Casing Diameter & Material								
Type: 2" PVC								
Total Well Depth (TD): 11.56ft								
Static Water Level (WL): 8.60ft								
One Casing Volume(gal/L): 0.48gal								
Start Purge (hrs): 0819 1135								
End Purge (hrs): 0908 1254								
Total Purge Time (min): 49min 79min	128 min total							
Total Vol. Purged (gal/L): 0.79gal								

See low flow purge sheet

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOCs	HCl	(3) 40mL VOA vials	yes
TAL Metals (filtered+unfiltered)	HNO3	(1) filter (1) unfiltered 125mL poly	yes
TCL SVOCs	—	(2) 1L Amber	yes

OBSERVATIONS / NOTES:

See field analytical log sheet for geochemical parameters

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	[signature]

LOW FLOW PURGE DATA SHEET

TD 11.5 ct

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-16-GW5-1
DATE: 12/5/2008

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0819	8.60	280								
0835	10.75	220								Slow rate
0841		220								Floating suspended organics of clay 2 L pu
0845	Dry down to TD									went dry slowed rate
0847	11.42									shut off pump let recharge
0858	10.53									
0902	10.26						* no outlet in Horiba is allowing water to flow back into well through pump			
0908	9.6									
	moved to 15GW1 to sample and let GW5 recharge									
	8.61									
1135										Start up pump
1140	10.26	200	4.79	0.089	365	3.36	15.42	104	0.0	
1150	11.30									
	Drawdown is rapid, collecting sample @ 1146 *									
1152	11.3									
1153	went dry 1/3 full amber									
1155	start up flow get full amber									
1200	Flow stopped it due to drawdown (1 amber + 1 filtered metal left to collect)									let recharge
1216	10.68									1L purged since 1140
1231	9.87									
1245	9.45									
1249	Fill up second 1L amber									
1252	11.53									
1254	Shut off flow due to drawdown									3L total purged

SIGNATURE(S): [signature]

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Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF-WOD	Sample ID No.: WFF-WOD-16-GW5-1
Project No.: 112GN1612	Sample Location: WFF-WOD
Sampled By: JBB	Duplicate: ☐
Field Analyst: JBB	Blank: ☐
Field Form Checked as per QA/QC Checklist (initials):	

SAMPLING DATA:

Date: 12/5/2008	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time: 1300	(Visual)	(S.U.)	(mS/cm)	(^{o}C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: Low Flow								

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model: ____________

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 2.5 ppm

Analysis Time: 1317

Range Used:	Range	Method	Concentration ppm
☒	0 to 1 ppm	K-7510	2.5
☐	1 to 12 ppm	K-7512	

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ____________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
________	x 0.01	= mg/L
________	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 55 ppm

Analysis Time: 1324

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	55
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
________	x 0.1	= mg/L
________	x 0.2	= mg/L
________	x 1.0	= mg/L
________	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ____________ (time)

End stripper at ____________ (time)

Total stripper time ____________

Pump rate ____________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-16-GW5-1
Project No.:	112GN1612	Sample Location:	WFF-WOD
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 256 ppm

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-9810	<100
☒	50 to 500 ppm	K-9815	256
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1320

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	______ & ______	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	______ & ______	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	______ & ______	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	______ & ______	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	______ & ______	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	______ & ______	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 1.0 ppm

Analysis Time: 1310

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ____________

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0 ppm

Analysis Time: 1315

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Page 1 of 1

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: WFF WOD-16GW8
Sample Location: GW8
Sampled By: RMS
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (^{0}C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Date: 12/10/08								
Time: 0900								
Method: Low flow	clear	5.77	0.120	15.17	7.10	1.98	0.0	

PURGE DATA:

	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 12/10/08								
Method: Low flow								
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 2" PVC			SEE PURGE SHEET FOR DETAILS					
Total Well Depth (TD): 25								
Static Water Level (WL): 9.41								
One Casing Volume(gal/L): 2.54 gal								
Start Purge (hrs): 0804								
End Purge (hrs): 0855								
Total Purge Time (min): 51								
Total Vol. Purged (gal/L): 2 1/2 gal								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOCs	HCl	(3) 40mL VOA vials	yes
TCL SVOCs	—	(2) 1L Amber glass	yes
TAL Metals	HNO_3	(1) 125mL poly	yes

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): [signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WOD-16GW8
DATE: 12/10/08

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0804	9.41	220								Start
0810	9.81	220	5.41	0.146	22.9	4.85	15.08	120	0.0	
0815	9.77	200	5.35	0.139	19.5	4.05	15.03	123	0.0	
0820	9.80	200	5.45	0.130	26.9	3.57	15.09	117	0.0	
0825	9.70	170	5.57	0.123	24.0	3.21	15.14	108	0.0	
0830	9.69	170	5.66	0.122	21.5	3.00	15.15	103	0.0	
0835	9.70	170	5.68	0.121	18.1	2.70	15.11	99	0.0	
0843	9.71	170	5.75	0.120	9.55	2.19	15.16	87	0.0	
0850	9.71	170	5.78	0.120	7.81	1.99	15.18	83	0.0	
0855	9.71	170	5.77	0.120	7.10	1.98	15.17	84	0.0	
	Sample collected @ 0900									
Total	2½ gallons or 8L purge									

SIGNATURE(S):

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page __ of __

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF WOD 16GW8
Project No.:	112GN1612	Sample Location:	GW8
Sampled By:	RMS	Duplicate:	☐
Field Analyst:		Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
Date: 12/10/08								
Time: 0900								
Method: Low Flow	clear	5.77	0.126	15.17	7.16	1.98	0.0	84

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model:__________

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 2.0 ppm

Analysis Time: 0903

Range Used:	Range	Method	Concentration ppm
☒	0 to 1 ppm	K-7510	>1.0
☒	1 to 12 ppm	K-7512	2.0

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
______	x 0.01	=	mg/L
______	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 23 ppm

Analysis Time: 0918

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	23
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
______	x 0.1	=	mg/L
______	x 0.2	=	mg/L
______	x 1.0	=	mg/L
______	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ________ (time)

End stripper at ________ (time)

Total stripper time ________

Pump rate ________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page __ of __

Project Site Name:	NASA WFF-WOD	Sample ID No.:	V00 16GW8
Project No.:	112GN1612	Sample Location:	
Sampled By:	RMS	Duplicate:	☐
Field Analyst:		Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 35 ppm

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-9810	35
☐	50 to 500 ppm	K-9815	
☐	100 to 1000 ppm	K-9820	

Analysis Time: 0914

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier		Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	______ & ______	x 0.1	=	mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	______ & ______	x 0.4	=	mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	______ & ______	x 1.0	=	mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	______ & ______	x 2.0	=	mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	______ & ______	x 5.0	=	mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	______ & ______	x 10.0	=	mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 3.9 ppm

Analysis Time: 0908

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ____________

Concentration: ________ ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: ________

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NASA WFF-FFTA
Project No.: 112GN1612

[] Domestic Well Data
[] Monitoring Well Data
[X] Other Well Type: Temporary
[] QA Sample Type:

Sample ID No.: WFF-WOD-TW1-1
Sample Location: NASA-WFF
Sampled By: JBB
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (^0C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Date: 12/9/2008 Time: 1505 Method: Low Flow	light murky brown	6.33	0.382	15.94	1060	3.65	0.0	slight oil sheen

PURGE DATA:

Date: 12/9/2008	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow								
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 1½" PVC								
Total Well Depth (TD): 30 Ft								
Static Water Level (WL): 27.0			see low flow purge sheet					
One Casing Volume(gal/L): 0.276 gal								
Start Purge (hrs): 13:40								
End Purge (hrs): 1500								
Total Purge Time (min): 80								
Total Vol. Purged (gal/L): 2.5 gal								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOCs	HCl	(3) 40 mL VOA vials	yes
TAL Metals	HNO_3	(1) 125 mL poly	yes
TCL SVOCs	—	(2) 1L Amber	yes

OBSERVATIONS / NOTES:

See field analytical log sheet for geochemical parameters

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):
		[signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-TW1-1
DATE: 12/9/2008

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
1340	22.8	200	6.41	0.373	Er 3	2.38	17.22	-67	0.0	muddy too turbid to measure
1404	24.7		6.42	0.361	Er 3	2.20	17.11	-73	0.0	
1407	25.68		6.39	0.377	Er 3	2.16	17.06	-73	0.0	
1411	26.05	130	6.38	0.409	Er 3	2.15	17.08	-74	0.0	
1415			6.36	0.448	Er 3	2.13	17.06	-75	0.0	
1418	26.62		6.34	0.490	Er 3	2.28	16.89	-77	0.0	cleared 2/3 horiba
1423			6.32	0.573	Er 3	2.35	16.70	-76	0.0	cleared all horiba
1431	27.00		6.32	0.374	Er 3	3.38	16.12	-59	0.0	
1435			6.32	0.378	Er 3	3.33	16.08	-59	0.0	
1439			6.33	0.411	Er 3	3.47	16.04	-58	0.0	
1443			6.33	0.326	Er 3	3.42	16.02	-56	0.0	
1447			6.32	0.382	Er 3	3.46	16.00	-56	0.0	
1451			6.33	0.384	Er 3	3.64	16.00	-54	0.0	
1455	27.05		6.33	0.386	Er 2	3.60	15.96	-54	0.0	
1500			6.33	0.382	1060	3.65	15.94	-53	0.0	2 1/2 gal purged
1505		collect	samples							* some petroleum sheen seen
										on samples
										smells like petroleum

trouble getting flow

Er 3 = too turbid

SIGNATURE(S): [signature]

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Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW1-1
Project No.:	112GN1612	Sample Location:	NASA WFF
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
Date: 12/9/2008								
Time: 1550								
Method: Low Flow	murky lt. brown	6.33	0.382	15.94	1060	3.65	0.0	-53

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model: ____________

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 2.5 ppm

Analysis Time: 1600

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-7510	
☒	1 to 12 ppm	K-7512	2.5

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ____________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: ~~350~~ JBB 160 ppm

Analysis Time: 1622

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	>100
☒	100 to 1000 ppm	K-1920	160
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ____________ (time)

End stripper at ____________ (time)

Total stripper time ____________

Pump rate ____________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW1-1
Project No.:	112GN1612	Sample Location:	NASA - WFF
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 200 ppm

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-9810	>100
☒	50 to 500 ppm	K-9815	200
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1610

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 2.9 ppm

Analysis Time: 1550

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ______

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0 ppm

Analysis Time: 1555

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ______ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ______

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW2-1
Project No.:	112GN1612	Sample Location:	WOD-TW2
		Sampled By:	EW
[] Domestic Well Data		C.O.C. No.:	
[X] Monitoring Well Data		Type of Sample:	
[] Other Well Type:		[] Low Concentration	
[] QA Sample Type:		[] High Concentration	

SAMPLING DATA:

Date: 12/10/08	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1010	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	ORP
Method: low flow	Turbid	5.98	0.569	18.08	+100	0.92	0.0	-123

PURGE DATA:

Date: 12/10/08	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow	See	Low	Flow	purge	log			
Monitor Reading (ppm):								
Well Casing Diameter & Material								
Type: 1.5" PVC								
Total Well Depth (TD): 30								
Static Water Level (WL): 25.47								
One Casing Volume(gal/L): 0.42gal								
Start Purge (hrs): 0910								
End Purge (hrs): 0930								
Total Purge Time (min): 20min								
Total Vol. Purged (gal/L): 2L								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOC	HCL	(3) 40ml glass	yes
TCL SVOC	—	(2) ~~Am~~ 1L Amber glass	yes
TAL Metals	HNO_3	(1) 250 ml POLY	yes
Filtered TAL Metals	HNO_3	" "	yes

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):
—	—	[signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WOD - TW2
DATE: 12/10/08

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0910 ~~0900~~	25.47	100	5.95	0.514	+100	0.57	18.21	-135	0.0	very turbid
0920			5.92	0.547	+100	0.77	18.17	-203	0.0	very turbid
0930	27.36		5.98	0.569	+100	0.92	18.08	-123	0.0	" "

SIGNATURE(S):

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TWZ-1
Project No.:	112GN1612	Sample Location:	WOD-TWZ-
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 12/10/08	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time:	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: Low Flow	turbid	5.98	0.569	18.08	+100	0.92	0.0	-123

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) -123

Electrode Make & Model: Horiba U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 0.9 ppm

Range Used:	Range	Method	Concentration ppm
☑	0 to 1 ppm	K-7510	0.9
☑	1 to 12 ppm	K-7512	out of range

Analysis Time: 1100

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ____

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
____	x 0.01	=	mg/L
____	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 250 ppm

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-1910	out of range
☑	100 to 1000 ppm	K-1920	250
☐	250 to 2500 ppm	K-1925	

Analysis Time: 1113

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
____	x 0.1	=	mg/L
____	x 0.2	=	mg/L
____	x 1.0	=	mg/L
____	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity:____ Digits Required: 1st.:____ 2nd.:____ 3rd.:____

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ________ (time)

End stripper at ________ (time)

Total stripper time ________

Pump rate ________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW2-1
Project No.:	112GN1612	Sample Location:	WOD-TW2-1
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 225 ppm

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-9810	out of range
☑	50 to 500 ppm	K-9815	225
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1118

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier		Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	______ & ______	x 0.1	=	mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	______ & ______	x 0.4	=	mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	______ & ______	x 1.0	=	mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	______ & ______	x 2.0	=	mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	______ & ______	x 5.0	=	mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	______ & ______	x 10.0	=	mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 2.8 ppm

Analysis Time: 1124

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ____________

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0 ppm

Analysis Time: 1128

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-TW3-1
DATE: 12/10/08

Time	Water Level	Flow	pH	S. Cond.	Turb.	DO	Temp.	ORP	Salinity	Comments
(Hrs.)	(Ft. below TOC)	(mL/Min.)	(S.U.)	(mS/cm)	(NTU)	(mg/L)	(Celcius)	mV	% or ppt	
1020	23.4	low/<100	6.09	0.582	>100	0.46	17.55	-413	0.0	Turbidity in
1030	26.4	<100	6.16	0.599	>100	0.48	17.13	-433	0.0	well is high (very)
1035	27.27	<100	6.15	0.600	>100	0.48	17.02	-450	0.0	
1040	27.82	<100	6.14	0.595	>100	0.39	16.91	-440	0.0	SWL drops no
1045	28.01	<100	6.16	0.610	>100	0.40	16.91	-470	0.0	matter how slow you
										purge well
	Well ~30' Deep going to collect sample prior to going dry									
	@ 1050									
	Went dry during sampling / Waited 15 min to recharge to collect 2nd SVOC & filtered metals									

SIGNATURE(S): [signature]

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page __ of __

Project Site Name:	NASA WFF ~~EETA~~ W00	Sample ID No.:	WFF W00 - TW3 - 1
Project No.:	112GN1612	Sample Location:	
Sampled By:		Duplicate:	☐
Field Analyst:		Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Date: 12/10/08								
Time: 1050	(Visual)	(S.U.)	(mS/cm)	(^oC)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: Low Flow								

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model:______________

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 0.0 ppm

Range Used:	Range	Method	Concentration ppm
☒	0 to 1 ppm	K-7510	
☐	1 to 12 ppm	K-7512	

Analysis Time: 1130

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ______

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 50 ppm

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Analysis Time: 1145

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at __________ (time)

End stripper at __________ (time)

Total stripper time __________

Pump rate __________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page __ of __

Project Site Name:	NASA WFF ~~[illegible]~~ WOD	Sample ID No.:	
Project No.:	112GN1612	Sample Location:	
Sampled By:		Duplicate:	☐
Field Analyst:		Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 250 ppm

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☒	50 to 500 ppm	K-9815	250
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1150

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:_________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 2.6 ppm

Analysis Time: 1135

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ____________

Concentration: 0.0 ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: 1140

Notes: ? 0.1 / Hard to read, it may be 0.1 ppm (at most)

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NASA WFF-~~FFTA~~ WOD
Project No.: 112GN1612

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: WFFWOD-TW4-1
Sample Location: TW4
Sampled By: EW
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 12/9/08	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1510	(Visual)	(S.U.)	(mS/cm)	(^{0}C)	(NTU)	(mg/l)	(%)	
Method: Low FLOW	Turbid	5.97	0.602	16.51	758	1.16	0.0	

PURGE DATA:

Date: 12/9/08	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: low flow	See	low	flow	log	Sheet			
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 1 1/2" PVC								
Total Well Depth (TD): 29.81'								
Static Water Level (WL): 24.99'								
One Casing Volume(gal/L): 0.44 gal								
Start Purge (hrs): 1415								
End Purge (hrs): 1510								
Total Purge Time (min): 55								
Total Vol. Purged (gal/L): 8L								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOC	HCL	(3) 40 ml glass	yes
TCL SVOC	—	(2) 1 L Amber glass	yes
TAL Metals	HNO3	(1) 250 ml POLY	yes
TAL Metals Filtered	HNO3	(1) 250 ml Poly	yes

OBSERVATIONS / NOTES:

- Slight sheen in purge water
~~slight~~

Circle if Applicable:		Signature(s):
MS/MSD —	Duplicate ID No.: —	

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD

PROJECT NUMBER: 112GN1612

WELL ID.: WFF WOD - TW4-1 (TD 29.81')

DATE: 12/9/08

Time	Water Level	Flow	pH	S. Cond.	Turb.	DO	Temp.	ORP	Salinity	Comments
(Hrs.)	(Ft. below TOC)	(mL/Min.)	(S.U.)	(mS/cm)	(NTU)	(mg/L)	(Celcius)	mV	% or ppt	
1415	24.99	150	5.99	0.598	+ 100*	1.12	17.43	-69	0.0	very turbid
1420	26.27	150	5.99	0.592	+ 100*	0.64	17.22	-76	0.0	GW clearing but still turbid
1430	27.26	150	5.82	0.568	661	1.07	16.69	-61	0.0	
1435	27.86	150	5.86	0.571	735	0.77	16.64	-76	0.0	
1440	28.02	150	5.89	0.578	817	0.81	16.59	-84	0.0	
1445	28.54	150	5.91	0.580	8.32	0.92	16.51	-84	0.0	
1450	~~29.47~~	150	5.94	0.601	732	1.05	16.42	-83	0.0	
1455	29.47	150	5.96	0.595	743	1.12	16.53	-85	0.0	
1500	29.48	150	5.97	0.602	758	1.16	16.51	-81	0.0	

SIGNATURE(S): [signature]

* Error reading

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612
Sampled By: EW
Field Analyst: EW
Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.: WI-WOD-TW4-1
Sample Location: TW4
Duplicate: ☐
Blank: ☐

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (^{0}C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
Date: 12/9/08								
Time: 1510								
Method: low flow	Turbid	5.57	0.602	16.51	758	1.16	0.0	243

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) 243

Electrode Make & Model: Horiba U-22
Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 0.5 ppm

Analysis Time: ~~1457~~ 1557

Range Used:	Range	Method	Concentration ppm
☒	0 to 1 ppm	K-7510	0.5
☒	1 to 12 ppm	K-7512	out of range

Equipment: HACH Digital Titrator OX-DT

Analysis Time:

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 225 ppm

Analysis Time: 1608

Range Used:	Range	Method	Concentration ppm
~~☐~~	10 to 100 ppm	K-1910	out of range
☒	100 to 1000 ppm	K-1920	225
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at __________ (time)

End stripper at __________ (time)

Total stripper time __________

Pump rate __________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WI-WOD-TW4-1
Project No.:	112GN1612	Sample Location:	TW 4
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 250 ppm

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-9810	out of range
☑	50 to 500 ppm	K-9815	250
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1613

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	______ & ______	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	______ & ______	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	______ & ______	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	______ & ______	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	______ & ______	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	______ & ______	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 2.1 ppm

Analysis Time: ~~1440~~ 1604

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S): Range: 0 - 5 mg/L

Equipment: HS-C Other: ________

Concentration: 0 ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: 1620

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD- ~~WFF MW~~-TWS-1
Project No.:	112GN1612	Sample Location:	NASA- WFF
		Sampled By:	JBB
[] Domestic Well Data		C.O.C. No.:	
[] Monitoring Well Data		Type of Sample:	
[X] Other Well Type:	Temp Well	[] Low Concentration	
[] QA Sample Type:		[] High Concentration	

SAMPLING DATA:

Date: 12/10/2008 Time: 1125 Method: Low Flow	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
	lt. brown	6.46	0.999	16.26	—	2.27	0.0	

PURGE DATA:

Date: 12/10/2008	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow								
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 1/2" PVC								
Total Well Depth (TD): 30								
Static Water Level (WL): 26.6								
One Casing Volume(gal/L): ~~0.55 gal~~ 0.3128 gal		See low flow purge sheet						
Start Purge (hrs): 1050								
End Purge (hrs): 1125								
Total Purge Time (min): 35 min								
Total Vol. Purged (gal/L): 1/2 gal								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOCs	HCl	(3) 40mL VOA vials	yes
TAL Metals	HNO_3	(1) filtered, (1) unfiltered 125mL poly	yes
TCL SVOCs	—	(2) 1L Amber	yes

OBSERVATIONS / NOTES:

See field analytical log sheet for geochemical parameters

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	[signature]

LOW FLOW PURGE DATA SHEET

WFF-WOD-TWS-1
JBB
~~WFF-WOD-MW-TW~~

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: JBB ~~WFF-MW-TWS-1~~
DATE: 12/10/2008

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
1050	23.69									
1055	26.60	150	6.48	0.448	too turbid	6.10	16.39	-85	0.0	gray brown turbid water
1058		<50	6.52	0.488		2.37	16.29	-98	0.0	
1100	27.92	80	6.49	0.523		2.35	16.28	-99	0.0	too turbid Sp. Cond. bad
1104	26.15		6.48	0.917		2.30	16.31	-104	0.0	pump stopped briefly
1110	26.61		6.41	0.999		2.26	16.44	-105	0.0	
1114			6.42	0.90		2.35	16.42	-105	0.1	~~2/4s~~ 1/2 gal purged
1120			6.46	0.999		2.27	16.26	-167		
1125	Start Sampling									

SIGNATURE(S): [signature]

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Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TWS-1
Project No.:	112GN1612	Sample Location:	NASA WFF
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
Date: 12/10/2002 Time: 1150 Method: Low Flow	lt. brown	6.46	0.999	16.26	—	2.27	0.0	-107

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model: ________

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 2 ppm

Analysis Time: 1238

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-7510	
☒	1 to 12 ppm	K-7512	2

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
______	x 0.01	=	mg/L
______	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 230 ppm

Analysis Time: 1209

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	>100
☒	100 to 1000 ppm	K-1920	230
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
______	x 0.1	=	mg/L
______	x 0.2	=	mg/L
______	x 1.0	=	mg/L
______	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity: ______ Digits Required: 1st.: ______ 2nd.: ______ 3rd.: ______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ________ (time)

End stripper at ________ (time)

Total stripper time ________

Pump rate ________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TWS-1
Project No.:	112GN1612	Sample Location:	NASA WFF
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 250 ppm

Analysis Time: 1200

Filtered: ☐

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-9810	>100
☒	50 to 500 ppm	K-9815	250
☐	100 to 1000 ppm	K-9820	

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 2 ppm

Analysis Time: 1220

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ________

Concentration: 0 ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: 1215

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Analysis Time: ________

Filtered: ☐

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW6-1
Project No.:	112GN1612	Sample Location:	NASA WFF
		Sampled By:	JBD
[] Domestic Well Data		C.O.C. No.:	
[] Monitoring Well Data		Type of Sample:	
[X] Other Well Type:	Temp. Well	[] Low Concentration	
[] QA Sample Type:		[] High Concentration	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 12/10/2008								
Time: 0855	(Visual)	(S.U.)	(mS/cm)	(^{0}C)	(NTU)	(mg/l)	(%)	
Method: low Flow	lt brown	6.52	0.999	15.96	290	2.44	0.0	

PURGE DATA:

	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 12/10/2008								
Method: low flow								
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 30 Ft								
Static Water Level (WL): 26.96 Ft								
One Casing Volume(gal/L): 0.5 gal								
Start Purge (hrs): 0740								
End Purge (hrs): 0855								
Total Purge Time (min): 75								
Total Vol. Purged (gal/L): 3/4 gal								

See low flow purge sheet

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOCs	HCl	(3) 40 mL VOA vials	yes
TAL Metals	HNO_3	(1) Filtered + (1) unfiltered 125 mL poly	yes
TCL SVOCs	—	(1) 1L Amber	yes

OBSERVATIONS / NOTES:

see Field analytical log sheet for geochemical parameters

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):
—	—	[signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD

PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-TW6-1

DATE: 12/10/2008

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0740	25.52	inconsistent flow	6.36	0.548	Er 3	5.26	16.46	-113	0.0	muddy
0750	26.97							+		lost flow, pullup tubing and readjust
0757	26.96	50	6.58	0.680	Er 3	2.31	15.83	-120	0.0	oil smell; lots of air in tubing
0801			6.50	0.856	Er 3	2.28	15.64	-116	0.0	oil sheen in sediment
0805		<50	6.46	0.898	Er 3	2.29	15.53	-111	0.0	DO reading probably inaccurate
0811			6.43	0.819	Er 3	2.31	15.42	-107	0.0	sediment accumulating at bottom of horiba
0815			6.43	0.795	Er 3	2.38	15.43	-105	0.0	1/4 gal purged
0817	Dumped Horiba	to clear	out	accumulated		sediment	and then	reconnected	tubes (kept pumping)	
0824			6.46	0.536	—	2.97	15.73	-85	0.0	no outflow yet
0828		<50	6.48	0.588	400	2.81	15.72	-88	0.0	floating fibrous organics (1-2mm)
0832	26.96		6.50	0.738	360	2.69	15.76	-91	0.0	
0837			6.57	0.999	330	2.55	15.84	-94	0.0	
0841			6.46	0.999	310	2.50	15.91	-95	0.1	
0845			6.52	0.999	290	2.44	15.96	-95	0.0	
0855	Start Sampling									

SIGNATURE(S): [signature]

PAGE 1 OF ___

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW6-1
Project No.:	112GN1612	Sample Location:	WOD-TW6-1
Sampled By:	# JB	Duplicate:	☐
Field Analyst:	EW	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 12/10/08	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time:	(Visual)	(S.U.)	(mS/cm)	(^0C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: low flow								

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model: Horiba U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 0.3 ppm

Range Used:	Range	Method	Concentration ppm
☒	0 to 1 ppm	K-7510	0.3
☐	1 to 12 ppm	K-7512	

Analysis Time: 1205

- No reading possible, very turbid
- 2nd attempt GW still turbid, but a little clearer

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ____

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
____	x 0.01	=	mg/L
____	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 160 ppm

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	out of range
☒	100 to 1000 ppm	K-1920	160
☐	250 to 2500 ppm	K-1925	

Analysis Time: 1213

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
____	x 0.1	=	mg/L
____	x 0.2	=	mg/L
____	x 1.0	=	mg/L
____	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity:____ Digits Required: 1st.:____ 2nd.:____ 3rd.:____

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ____ (time)

End stripper at ____ (time)

Total stripper time ____

Pump rate ____ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW6-1
Project No.:	112GN1612	Sample Location:	WOD-TW6
Sampled By:	~~EW~~ JR	Duplicate:	☐
Field Analyst:	EW	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 200 ppm

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☑	50 to 500 ppm	K-9815	200
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1215

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 1.9 ppm

Analysis Time: 1221

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: _____

Concentration: 0.0 ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: 1226

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: _____ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: _____

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW6-1
Project No.:	112GN1612	Sample Location:	NASA WFF
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 12/10/2008 / Time: 1015 / Method: Low Flow	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model: ____________

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: ________ ppm

Analysis Time: ________

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-7510	
☐	1 to 12 ppm	K-7512	

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
________	x 0.01	= mg/L
________	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: ________ ppm

Analysis Time: ________

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-1910	
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
________	x 0.1	= mg/L
________	x 0.2	= mg/L
________	x 1.0	= mg/L
________	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ____________ (time)

End stripper at ____________ (time)

Total stripper time ____________

Pump rate ____________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW6-1
Project No.:	112GN1612	Sample Location:	NASA WFF
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: ______ ppm

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☐	50 to 500 ppm	K-9815	
☐	100 to 1000 ppm	K-9820	

Analysis Time: ______

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: ______ ppm

Analysis Time: ______

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Equipment: HS-C

Range: 0 - 5 mg/L

lt. brown water bubble up to filter so either 0 or 0.4 (I think) as read

Other: ______

Concentration: ______ ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: 1020

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ______ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ______

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-TW1-2
DATE: 12/12/08

	Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0730	0725	25.12	150	5.90	0.217	~~7~~ 60	7.68	15.54	51	0.0	Gw cloudy
0735		27.57	150	5.83	0.214	51	7.77	15.70	54	0.0	
	0740	27.96	150	5.83	0.228	127	6.62	15.75	45	0.0	1/2 gal vol.
	0745	28.41	150	5.85	0.247	550	5.68	15.67	39	0.0	

SIGNATURE(S): [signature]

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Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW1-2
Project No.:	112GN1612	Sample Location:	WOD-TW1-
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 12/12/08 Time: 0745 Method: low Flow	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
	cloudy	5.85	0.247	15.67	550	5.68	0.0	39

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) 39

Electrode Make & Model: horiba U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 4.0 ppm

Analysis Time: 0750

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-7510	
☒	1 to 12 ppm	K-7512	4.0

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 70 ppm

Analysis Time: 0753

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	70
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ________ (time)

End stripper at ________ (time)

Total stripper time ________

Pump rate ________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW1-2
Project No.:	112GN1612	Sample Location:	WOD-TW1
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 110 ppm

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-9810	out of range
☑	50 to 500 ppm	K-9815	110
☐	100 to 1000 ppm	K-9820	

Analysis Time: 0757

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 __ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 1.8 ppm

Analysis Time: 0803

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S): Range: 0 - 5 mg/L

Equipment: HS-C Other: ________

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0 ppm

Analysis Time: 0806

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8 __ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-TW3-2
DATE: 12/12/08

Time (Hrs.)	Water Level* (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0935	23.51	150	6.01	0.472	+100	2.81	15.59	-24	0.0	
	24.74		6.10	0.553	400	3.36	16.29	-25	0.0	1/2 gal
	25.59		6.05	0.375	Er 3	4.55	16.35	-8	0.0	
0945	27.92		6.02	.393	Er 3	4.60	16.35	-1	0.0	3/4 gal
					750					

SIGNATURE(S): [signature]

* Riser removed

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW3-2
Project No.:	112GN1612	Sample Location:	WOD-TW3
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 12/12/08	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time:	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: low flow	Turbid	6.02	.393	16.35	750	4.60	0.0	-1

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) -1

Electrode Make & Model: Horiba U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 3.0 ppm

Analysis Time: 0953

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-7510	
☒	1 to 12 ppm	K-7512	

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ______

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 200 ppm

Analysis Time: 1000

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-1910	
☒	100 to 1000 ppm	K-1920	200
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ______ (time)

End stripper at ______ (time)

Total stripper time ______

Pump rate ______ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW3
Project No.:	112GN1612	Sample Location:	
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 250 ppm

Analysis Time: 1007

Filtered: ☐

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☒	50 to 500 ppm	K-9815	250
☒	100 to 1000 ppm	K-9820	250

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier		Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	______ & ______	x 0.1	=	mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	______ & ______	x 0.4	=	mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	______ & ______	x 1.0	=	mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	______ & ______	x 2.0	=	mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	______ & ______	x 5.0	=	mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	______ & ______	x 10.0	=	mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 3.1 ppm

Analysis Time: 1011

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: __________

Concentration: 0.0 ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: 1015

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Analysis Time: ________

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-TW3-2
DATE: 12/12/2008

Time (Hrs.)	w/o riser Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0730	23.67	100	5.77	0.588	340	5.67	17.18	-85	0.0	turbid brown
0735	26.17		5.69	0.558	370	6.87	17.35	6	0.0	
0740			5.72	0.560	750	7.70	17.48	14	0.0	
0743	26.97		5.76	0.588	672	6.68	17.16	-17	0.0	a little more than ½ gal purged
	Shut off pump to allow recharge to sample									

SIGNATURE(S): [signature]

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF WOD-TW3-2
Project No.:	112GN1612	Sample Location:	NASA-WFF-WOD
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date:	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time:	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method:								

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model: ____________

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 3.5 ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-7510	
☒	1 to 12 ppm	K-7512	~~0756~~ 3.5 JBB

Analysis Time: 0756 ...6.5

redone 0820 3.5

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ____________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 250 ppm

Analysis Time: 0815

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	>100
☒	100 to 1000 ppm	K-1920	250
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity: ________ Digits Required: 1st.: ________ 2nd.: ________ 3rd.: ________

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ____________ (time)

End stripper at ____________ (time)

Total stripper time ____________

Pump rate ____________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612
Sampled By: JBB
Field Analyst: JBB

Sample ID No.: WFF-WOD-TW3-2
Sample Location: NASA-WFF-WOD
Duplicate: ☐
Blank: ☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 250 ppm

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☒	50 to 500 ppm	K-9815	250
☐	100 to 1000 ppm	K-9820	

Analysis Time: 0810

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	______ & ______	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	______ & ______	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	______ & ______	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	______ & ______	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	______ & ______	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	______ & ______	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 1.8 ppm

water turbid + interfers w/ reading

Analysis Time: 0805

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ______

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0 ppm

Analysis Time: 0800

little brown but most likely due to turbid brown water

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ______ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ______

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF WOO-TW4-2
DATE: 12/12/08

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
	25.21		6.06	5.80	100	5.85				
	27.95		5.98	0.492	750	7.16		13	0.0	cloudy
	28.84		6.01	.513	790	5.65		8	0.0	3/4 gal purge

SIGNATURE(S): [signature]

Slight sheen & odor Petro in purge water

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612
Sampled By: GW
Field Analyst: GW
Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.: WFF-WOD-TW4-2
Sample Location: WOD-TW4
Duplicate: ☐
Blank: ☐

SAMPLING DATA:

Date: 12/12/06	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
Time:								
Method: low flow	cloudy							

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model:

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 3.5 ppm

Analysis Time: 0838

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-7510	
☒	1 to 12 ppm	K-7512	3.5

Equipment: HACH Digital Titrator OX-DT

Analysis Time:

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 180 ppm

Analysis Time: 0843

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-1910	—
☒	100 to 1000 ppm	K-1920	180
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at __________ (time)

End stripper at __________ (time)

Total stripper time __________

Pump rate __________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF-WOD
Sample ID No.: WFF-WOD-TW4-2
Project No.: 112GN1612
Sample Location: WOD-TW4
Sampled By: EW
Duplicate: ☐
Field Analyst: EW
Blank: ☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: ~~225~~ 225 ppm

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☒	50 to 500 ppm	K-9815	225
☐	100 to 1000 ppm	K-9820	

Analysis Time: 0846

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier		Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	_____ & _____	x 0.1	=	mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	_____ & _____	x 0.4	=	mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	_____ & _____	x 1.0	=	mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	_____ & _____	x 2.0	=	mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	_____ & _____	x 5.0	=	mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	_____ & _____	x 10.0	=	mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:_______ Digits Required: 1st.:_______ 2nd.:_______ 3rd.:_______

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L
Concentration: 2.1 ppm

Program/Module: 500nm 33

Analysis Time: 0850

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: _______
Concentration: 0 ppm

Exceeded 5.0 mg/L range on color chart: ☐
Analysis Time: 0854

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L
Concentration: _______ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: _______

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF WOD-TW5-2
DATE: 12/12/2008

Time (Hrs.)	Water Level W/riser (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0957	25.57									initial brown slug
0959	27.59	160	6.24	1.18	550	7.51	15.97	174	0.1	clearing up lt. brown
1001	~~28.58~~		6.94	1.35	340	19.49	16.79	186	0.0	*DO blinking
1003	28.58		7.08	1.36	260	19.99	16.90	194	0.1	DO blink
1006	30.34		6.97	1.33	270	19.99	17.03	189	0.1	
1009	went dry		6.82	1.31		19.99	16.93	162	0.1	flow stopped let recharge to do geochem

1/2 gal purged

SIGNATURE(S): [signature]

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD TW5-2
Project No.:	112GN1612	Sample Location:	NASA WFF
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: Time: Method:	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (^{0}C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model: __________

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 9 ppm

Analysis Time: 1041

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-7510	
☒	1 to 12 ppm	K-7512	9

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 30 ppm

Analysis Time: 1044

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	30
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ________ (time)

End stripper at ________ (time)

Total stripper time ________

Pump rate ________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612
Sampled By: JBB
Field Analyst: JBB

Sample ID No.: WFF-WOD-TW5-2
Sample Location: NASA WFF
Duplicate: ☐
Blank: ☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 400 ppm

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☒	50 to 500 ppm	K-9815	400
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1032

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier		Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	_______ & _______	x 0.1	=	mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	_______ & _______	x 0.4	=	mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	_______ & _______	x 1.0	=	mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	_______ & _______	x 2.0	=	mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	_______ & _______	x 5.0	=	mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	_______ & _______	x 10.0	=	mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:_________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 0.8 ppm

Analysis Time: 1030

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: __________

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0 ppm

Analysis Time: 1037

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: _________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: _________

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

LOW FLOW PURGE DATA SHEET

WFF-WOD-TW6-2

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: ~~WFF-WOD-TW6-~~ JBB 12/12
DATE: 12/12/2008

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0847	26.49									clear
0850	27.48	180	5.82	0.683	170	7.88	16.20	-160	0.0	lt brown
0852			6.02	0.754	550	0.97	16.80	-303	0.0	darker lt brown
0853	27.95		6.24	0.753	E-2	0.76	16.98	-358	0.0	sand in tubing
0857			6.20	0.661	Er 2	0.55	16.77	-297	0.0	
0900	27.80		6.16	0.658	300	0.50	16.58	-281	0.0	
	shut off pump to let well recharge									1/2 gal purged

SIGNATURE(S):

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF WOD TW6-2
Project No.:	112GN1612	Sample Location:	NASA-WFF-WOD
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date:	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
Time:								
Method:								

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model: ____________

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 0.05 ppm

Analysis Time: 0930

Range Used:	Range	Method	Concentration ppm
☒	0 to 1 ppm	K-7510	0.05
☐	1 to 12 ppm	K-7512	

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ____________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
______	x 0.01	=	mg/L
______	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 125 ppm

Analysis Time: 0932

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-1910	
☒	100 to 1000 ppm	K-1920	125
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
______	x 0.1	=	mg/L
______	x 0.2	=	mg/L
______	x 1.0	=	mg/L
______	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ____________ (time)

End stripper at ____________ (time)

Total stripper time ____________

Pump rate ____________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW6-2
Project No.:	112GN1612	Sample Location:	NASA-WFF-WOD
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 260 ppm

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☒	50 to 500 ppm	K-9815	260
☐	100 to 1000 ppm	K-9820	

Analysis Time: 0911

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	______ & ______	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	______ & ______	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	______ & ______	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	______ & ______	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	______ & ______	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	______ & ______	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 2.2 ppm

Analysis Time: 0935

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ____________

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0 ppm

Analysis Time: 0920

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-~~EFTA~~ WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF WOD-TW1-3
DATE: 12/18/08

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
~~0940~~ 0945	~~24.82~~ 22.77*	175	5.43	0.403	85	2.00	14.24	-34	0.0	clear
0950	24.93	" "	5.69	0.395	200	0.90	15.30	-57	0.0	~~clear~~ (1/2 gal) cloudy
0955	26.26	" "	5.77	0.377	1000	0.58	15.86	-71	0.0	cloudy (3/4 gal)

SIGNATURE(S): [signature]

*Upper casing removed for sampling

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612
Sampled By: EW
Field Analyst: EW
Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.: WFF-WOD-TW1-3
Sample Location: WOD-TW1
Duplicate: ☐
Blank: ☐

SAMPLING DATA:

Date: 12/18/08	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time:	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: low flow	Cloudy	5.77	0.377	15.86	1000	0.58	0.0	-71

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) -71

Electrode Make & Model: Horiba U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 0.3 ppm

Range Used:	Range	Method	Concentration ppm
☑	0 to 1 ppm	K-7510	0.3
☐	1 to 12 ppm	K-7512	

Analysis Time: 0958

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ______

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
______	x 0.01	=	mg/L
______	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 100 ppm

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-1910	100
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Analysis Time: 1000

- color change just b/f reaching 100ppm
- reading just below 100ppm

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
______	x 0.1	=	mg/L
______	x 0.2	=	mg/L
______	x 1.0	=	mg/L
______	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ______ (time)

End stripper at ______ (time)

Total stripper time ______

Pump rate ______ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	
Project No.:	112GN1612	Sample Location:	WOD-TW1
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 200 ppm

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☒	50 to 500 ppm	K-9815	200
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1003

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier		Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	______ & ______	x 0.1	=	mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	______ & ______	x 0.4	=	mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	______ & ______	x 1.0	=	mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	______ & ______	x 2.0	=	mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	______ & ______	x 5.0	=	mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	______ & ______	x 10.0	=	mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 2.4 ppm

Analysis Time: 1008

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ________

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0 ppm

Analysis Time: 1009

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF ~~FFTA~~ WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-TW 2-3
DATE: 12/18/2008

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
1136	25.60									
1138	26.51	240	7.10	0.422	110	8.30	15.95	-85	0.0	few bubbles
1141	26.98		6.34	0.502	60	3.05	16.19	-36	0.0	
1145			5.93	0.678	45	2.85	16.37	20	0.0	
1148	28.02		5.73	0.982	55	2.81	16.37	38	0.0	over 1/2 gal purged
	start geochem kits									

SIGNATURE(S): [signature]

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Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW2-3
Project No.:	112GN1612	Sample Location:	NASA WFF
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 12/18/2008	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time:	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: low flow	clear	5.73	0.982	16.37	55	2.81	0.0	38

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model: ________

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 1 ppm

Analysis Time: 1201

Range Used:	Range	Method	Concentration ppm
☒	0 to 1 ppm	K-7510	1
☒	1 to 12 ppm	K-7512	1

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
______	x 0.01	=	mg/L
______	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 70 ppm

Analysis Time: 1203

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	70
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
______	x 0.1	=	mg/L
______	x 0.2	=	mg/L
______	x 1.0	=	mg/L
______	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity: ______ Digits Required: 1st.: ______ 2nd.: ______ 3rd.: ______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ________ (time)

End stripper at ________ (time)

Total stripper time ________

Pump rate ________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612
Sampled By: JBB
Field Analyst: JBB

Sample ID No.: WFF-WOD-TW2-3
Sample Location: NASA WFF
Duplicate: ☐
Blank: ☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 110 ppm

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☒	50 to 500 ppm	K-9815	110
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1206

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	______ & ______	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	______ & ______	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	______ & ______	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	______ & ______	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	______ & ______	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	______ & ______	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:_________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 __ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 2.6 ppm

Analysis Time: 1156

Equipment: R-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ____________

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0 ppm

Analysis Time: 1158

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8 __ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA ~~WFF-FFTA~~ WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF WOO-TW3-3
DATE: 12/18/08

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
1030	23.12	150-175	5.57	0.507	Er3	4.30	16.07	-21	0.0	cloudy/brown
1035	25.62	" "	5.40	0.516	550	1.03	16.36	8	0.0	cloudy 1/2 gal
1040	27.98	" "	5.56	0.490	520	1.28	16.25	-27	0.0	

SIGNATURE(S): [signature]

*slight sheen on purge water

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612
Sampled By: EW
Field Analyst: EW
Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.: WFF-WOD-TW3-3
Sample Location: WOD-TW3
Duplicate: ☐
Blank: ☐

SAMPLING DATA:

Date: 12/18/08	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time:	(Visual)	(S.U.)	(mS/cm)	(^{0}C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: low flow	cloudy	5.56	0.490	16.25	520	1.28	0.0	-27

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) -27

Electrode Make & Model: Horiba U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 2.0 ppm

Analysis Time: 1048

Range Used:	Range	Method	Concentration ppm
☒	0 to 1 ppm	K-7510	2.0
☐	1 to 12 ppm	K-7512	

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ______

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 160 ppm

Analysis Time: 1055

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-1910	
☒	100 to 1000 ppm	K-1920	160
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ____________ (time)

End stripper at ____________ (time)

Total stripper time __________

Pump rate __________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW3-3
Project No.:	112GN1612	Sample Location:	WOD-TW3
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 250 ppm

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☒	50 to 500 ppm	K-9815	250
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1052

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:_________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 2.5 ppm

Analysis Time: 1102

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: __________

Concentration: 0.0 ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: 1103

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-~~FTA~~ WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF WOD-TW4-3
DATE: 12/18/08

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
~~0900~~ 0905	27.70	150-175	5.25	0.470	37	5.11	13.54	24	0.0	clear
0910	29.15	" "	5.06	0.329	32	2.51	15.33	38	0.0	" "
0915	29.83	" "	4.92	0.301	19	2.37	15.65	77	0.0	approx 3/4 gal.

SIGNATURE(S): [signature]

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW3-3
Project No.:	112GN1612	Sample Location:	WOD-TW3
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 12/18/08 / Time: / Method: low flow	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (^oC)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
	Clear	4.92	0.301	15.65	19	2.37	0.0	77

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) 77

Electrode Make & Model: HORIBA U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 1.0 ppm

Range Used:	Range	Method	Concentration ppm
☑	0 to 1 ppm	K-7510	1.0
☑	1 to 12 ppm	K-7512	1.0

Analysis Time: 0920

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ______

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 200 ppm

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-1910	
☑	100 to 1000 ppm	K-1920	200
☐	250 to 2500 ppm	K-1925	

Analysis Time: 0923

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ______ (time)

End stripper at ______ (time)

Total stripper time ______

Pump rate ______ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW3-3
Project No.:	112GN1612	Sample Location:	WOD-TW3
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 110 ppm

Analysis Time: 0926

Filtered: ☐

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☑	50 to 500 ppm	K-9815	110
☐	100 to 1000 ppm	K-9820	

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 1.0 ppm

Analysis Time: 0931

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S): Range: 0 - 5 mg/L

Equipment: HS-C Other: ________

Concentration: 0.0 ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: 0933

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Analysis Time: ________

Filtered: ☐

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-~~FETA~~ WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-TWS-3
DATE: 12/18/2008

Time (Hrs.)	*w/ rise Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0950	25.07									
0956	27.36	220	7.01	0.722	650	7.19	16.18	35	0.0	
1000	28.27		6.98	0.677	390	15.24	16.82	50	0.0	
1002			6.80	0.682	250	14.58	17.15	61	0.0	
1005	29.89		6.70	0.689	270	12.00	17.37	53	0.0	product seen
1008			6.67	0.690	320	10.65	17.54	40	0.0	3/4 gal purge
	went dry shut off pump allow recharge then do geochem									
	replace tubing to do kits due to product pumped through tubing									

SIGNATURE(S): [signature]

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW5-3
Project No.:	112GN1612	Sample Location:	NASA WFF
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 12/18/2008	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time:	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: Low Flow	clear	6.67	0.690	17.54	320	10.65	0.0	40

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model:__________

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 5.5 ppm

Analysis Time: 1125

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-7510	
☒	1 to 12 ppm	K-7512	5.5

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
______	x 0.01	=	mg/L
______	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 120 ppm

Analysis Time: 1123

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	>100
☒	100 to 1000 ppm	K-1920	120
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
______	x 0.1	=	mg/L
______	x 0.2	=	mg/L
______	x 1.0	=	mg/L
______	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ________ (time)

End stripper at ________ (time)

Total stripper time ________

Pump rate ________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF-WOD
Sample ID No.: WFF-WOD-TW5-3
Project No.: 112GN1612
Sample Location:
Sampled By: JBB
Duplicate: ☐
Field Analyst: JBB
Blank: ☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 260 ppm

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☒	50 to 500 ppm	K-9815	260
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1112

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	______ & ______	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	______ & ______	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	______ & ______	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	______ & ______	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	______ & ______	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	______ & ______	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Concentration: 2.8 ppm

Program/Module: 500nm 33

Analysis Time: 1035

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S): Range: 0 - 5 mg/L

Equipment: HS-C Other: ________

Concentration: 0 ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: 1038

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-TW6-3
DATE: 12/18/2008

Time (Hrs.)	Water Level * (Ft. below TOC) w/ riser	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0900	25.06									
0902	26.42	240	6.19	0.348	150	5.25	15.20	-31	0.0	
0908	27.11		6.55	0.379	180	4.40	15.46	-64	0.0	
0912			6.54	0.420	450	4.10	15.56	-67	0.0	
0916	27.24		6.50	0.460	286	3.34	15.54	-70	0.0	
0919			6.50	0.668	230	3.32	15.62	-75	0.0	Sand in water
	Start	collect	geo chem		over	½ gal	purged			

SIGNATURE(S): [signature]

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Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFFWOD-TW6-3
Project No.:	112GN1612	Sample Location:	NASA WFF
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 12/18/2008	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time:	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: Low Flow	lt. brown	6.50	0.668	15.62	230	3.32	0.0	-75

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model: ______

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 0.3 ppm

Analysis Time: 939

Range Used:	Range	Method	Concentration ppm
☒	0 to 1 ppm	K-7510	0.3
☒	1 to 12 ppm	K-7512	ı

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ______

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 55 ppm

Analysis Time: 935

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	55
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity: ______ Digits Required: 1st.: ______ 2nd.: ______ 3rd.: ______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ______ (time)

End stripper at ______ (time)

Total stripper time ______

Pump rate ______ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW63
Project No.:	112GN1612	Sample Location:	NASA WFF
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 140 ppm

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☑	50 to 500 ppm	K-9815	140
☐	100 to 1000 ppm	K-9820	

Analysis Time: 933

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	_______ & _______	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	_______ & _______	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	_______ & _______	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	_______ & _______	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	_______ & _______	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	_______ & _______	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:_________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 2.5 ppm

Analysis Time: 922

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ____________

Concentration: 0 ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: 926

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: __________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: __________

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

TD - 32.90'
1.2 gal | vol

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-~~FFTA~~ WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-~~13~~ WOD-GW7-33
DATE: 12/8/08

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
1115	25.57	300	5.69	0.321	+30	1.45	16.26	-50	0.0	clear
1120	~~27.32~~ 27.32	" "	5.61	0.255	12	0.87	16.36	-41	0.0	
1125	26.82	" "	5.50	0.267	12	0.96	16.37	-39	0.0	1 gal
1130	27.21	" "	5.48	0.317	11	0.85	16.44	-40	0.0	1.75 gal

SIGNATURE(S): ________

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-15GW7-3
Project No.:	112GN1612	Sample Location:	15GW7
Sampled By:	SW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 12/18/08	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
Time:								
Method: low flow	Clear	5.48	0.317	16.44	11	0.85	0.0	-40

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) -40

Electrode Make & Model: HORIBA U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 0.7 ppm

Analysis Time: 1135

Range Used:	Range	Method	Concentration ppm
☒	0 to 1 ppm	K-7510	0.7
☐	1 to 12 ppm	K-7512	

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ______

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
______	x 0.01	=	mg/L
______	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 170 ppm

Analysis Time: 1144

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-1910	
☒	100 to 1000 ppm	K-1920	170
☒	250 to 2500 ppm	K-1925	—

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
______	x 0.1	=	mg/L
______	x 0.2	=	mg/L
______	x 1.0	=	mg/L
______	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ____________ (time)

End stripper at ____________ (time)

Total stripper time ____________

Pump rate ____________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-15GW7-3
Project No.:	112GN1612	Sample Location:	WOD 15GW7
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 225 ppm

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-9810	
☒	50 to 500 ppm	K-9815	225
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1138

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier		Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	_____ & _____	x 0.1	=	mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	_____ & _____	x 0.4	=	mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	_____ & _____	x 1.0	=	mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	_____ & _____	x 2.0	=	mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	_____ & _____	x 5.0	=	mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	_____ & _____	x 10.0	=	mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:_________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 1.6 ppm

Analysis Time: 1150

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: __________

Concentration: 0.0 ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: 1148

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: __________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: __________

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

TD 32.34

0.91 gal

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF-~~FFTA~~ WOD

PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-16-MW3R-3 ~~WL FFTA~~ ~~WOD~~ ~~WFF~~-16-MW3R

DATE: 12/18/08

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
1218	26.76	300	5.55	0.093	32	12.89	16.36	126	0.0	clear
1223	27.02	" "	4.86	0.092	16	13.60	16.25	175	0.0	1/2 gal
1228	27.11	" "	4.86	0.093	17	13.79	16.29	194	0.0	

SIGNATURE(S):

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-16MW3R-3
Project No.:	112GN1612	Sample Location:	16MW3R
Sampled By:	EW / JB	Duplicate:	☐
Field Analyst:	EW / JB	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 12/18/08	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time:	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: low flow	Clear	4.86	0.093	16.29	17	13.79	0.0	194

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) 194

Electrode Make & Model: Horiba U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 7 ppm

Analysis Time: 1230

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-7510	
☒	1 to 12 ppm	K-7512	7

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 18 ppm

Analysis Time: 1232

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	18
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ________ (time)

End stripper at ________ (time)

Total stripper time ________

Pump rate ________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-16MW3R-3
Project No.:	112GN1612	Sample Location:	16MW3R
Sampled By:	EW/JB	Duplicate:	☐
Field Analyst:	EW/JD	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 32 ppm

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-9810	32
☒	50 to 500 ppm	K-9815	—
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1234

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 0.2 ppm

Analysis Time: 1237

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ________

Concentration: 6.0 ppm

Exceeded 5.0 mg/L range on color chart: ☐

Analysis Time: 1240

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: WFF-WOD-TW1-4
Sample Location: WOD-TW1
Sampled By: EW
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 1/14/09	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1320	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	ORP
Method: Low flow	cloudy	4.93	0.25	13.9	764	0.89	0.0	13

PURGE DATA:

Date: 1/14/09	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: low flow	see	low	flow	purge	log			
Monitor Reading (ppm):								
Well Casing Diameter & Material								
Type: 1.5" PVC								
Total Well Depth (TD): 30								
Static Water Level (WL): 22								
One Casing Volume(gal/L): 0.736 gal								
Start Purge (hrs): 1225								
End Purge (hrs): 1320								
Total Purge Time (min): 55								
Total Vol. Purged (gal/L): 2 1/4 gal								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOC	HCL	(3) 40mL VOA vials	✓
TCL SVOC	—	(2) 1L Amber	✓
TAL Metals	HNO3	125mL poly	✓
Filtered Metals	HNO3		✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF WOD
PROJECT NUMBER: 112GN1612
WELL ID.: WFF WOD - TW1-4
DATE: 1/14/09

Time (Hrs.)	Water Level* (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
1225	22.50	200	4.78	0.17	162	1.22	14.3	90	0.0	
1230	23.92	150	4.71	0.17	495	1.16	14.7	82	0.0	
1235	25.75	150	4.72	0.18	292	1.13	14.6	82	0.0	
1240	26.18	150	4.75	0.18	510	1.14	14.8	69	0.0	
1245		150	4.92	0.18	238	1.19	14.7	40	0.0	
1253	26.29	slow rate	4.95	0.23	229	6.96	13.7	24	0.0	
1302	26.00		4.93	0.25	764	0.81	13.9	13	0.0	
1320	Start Sampling 2 1/4 gal purged									
	*w/o riser									

SIGNATURE(S):

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF WOD
Project No.: 112GN1612
Sampled By: EW
Field Analyst: ~~Jacob Birkett~~ EW
Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.: WFF-WOD-TW1-4
Sample Location:
Duplicate: ☐
Blank: ☐

SAMPLING DATA:

Date: 1/14/09	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time: 1320	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: low flow	cloudy	4.93	0.25	13.9	764	0.89	0.0	13

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) 13

Electrode Make & Model: Horiba U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 1.0 ppm

Analysis Time: 1330

Range Used:	Range	Method	Concentration ppm
~~☒~~	0 to 1 ppm	K-7510	
☒	1 to 12 ppm	K-7512	1.0

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ____

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
____	x 0.01	=	mg/L
____	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 70 ppm

Analysis Time: 1345

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	70
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
____	x 0.1	=	mg/L
____	x 0.2	=	mg/L
____	x 1.0	=	mg/L
____	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity:____ Digits Required: 1st.:____ 2nd.:____ 3rd.:____

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ________ (time)

End stripper at ________ (time)

Total stripper time ________

Pump rate ________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF WOD	Sample ID No.: WFF-WOD-TW2-4
Project No.: 112GN1612	Sample Location: WOD-TW 2
Sampled By: EW	Duplicate: ☐
Field Analyst: ~~Jacob Birkett~~ EW	Blank: ☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 70 ppm

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-9810	70
☐	50 to 500 ppm	K-9815	
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1348

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier		Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	=	mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	=	mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	=	mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	=	mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	=	mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	=	mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 1.6 ppm

Analysis Time: 1337

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ____________

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0.0 ppm

Analysis Time: 1335

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NASA WFF WOD
Project No.: 112GN1612

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: WFF-WOD-TW2-4
Sample Location: WOD-TW2
Sampled By: CW
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 1/14/09	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1030	(Visual)	(S.U.)	(mS/cm)	(^{0}C)	(NTU)	(mg/l)	(%)	ORP
Method: low flow	Clear	4.36	0.185	15.8	3.61	0.0	0.0	108

PURGE DATA:

Date: 1/14/09	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: low flow	see	low	flow	data	sheet			
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 1 1/2"								
Total Well Depth (TD): 28								
Static Water Level (WL): 22.60								
One Casing Volume(gal/L): ~~X~~ 0.5 gal								
Start Purge (hrs): 0950								
End Purge (hrs): 1030								
Total Purge Time (min): ~~1030~~ 40 min								
Total Vol. Purged (gal/L): 1 3/4 gal								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOC	HCL	(3) 40 ml glass	✓
TCL SVOC	—	(2) 1 L Amber glass	✓
TAL Metals	HNO_3	(1) 125 ml poly	✓

OBSERVATIONS / NOTES:

Circle If Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF- WOD

PROJECT NUMBER: 112GN1612

WELL ID.: WFF WOD- ~~[illegible]~~ TW2-4

DATE: 1/14/09

Time (Hrs.)	Water Level* (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0955 ~~0940~~	~~22.50~~ 22.60	175	4.10	0.91	27.8	2.74	11.9	116	0.1	
1000	24.03	" "	4.30	14.1	24.50	~~2.0~~	15.0	109	0.8	DO 0.03
1005	24.25	" "	4.37	0.90	13.8	0.00	15.4	105	0.0	
1010	24.40	" "	4.36	0.329	7.41	0.0	15.6	107	0.0	
1015	24.51	" "	4.32	0.362	6.13	0.0	15.7	107	0.0	
1020	24.54	" "	4.34	0.376	5.23	0.0	15.9	109	0.0	
1025	24.56	" "	4.32	~~0.192~~	4.76	0.0	15.9	110	0.0	0.367
1030	24.59	" "	4.36	0.385	3.61	0.0	15.8	108	0.0	
	start sampling		~~[illegible]~~ 1 3/4 gal purged							

SIGNATURE(S): [signature]

* [illegible] removed

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW2-4
Project No.:	112GN1612	Sample Location:	WOD-TW2
Sampled By:	SWV	Duplicate:	☐
Field Analyst:	SWV	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 1/14/09	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time: 1030	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: low flow	clear	4.36	0.385	15.8	56.1	0.0	0.0	108

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) 108

Electrode Make & Model: horiba U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 0.8 ppm

Analysis Time: 1045

Range Used:	Range	Method	Concentration ppm
☑	0 to 1 ppm	K-7510	0.8
☑	1 to 12 ppm	K-7512	—

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ____________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
________	x 0.01	=	mg/L
________	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 130 ppm

Analysis Time: 1100

Range Used:	Range	Method	Concentration ppm
☐	10 to 100 ppm	K-1910	
☑	100 to 1000 ppm	K-1920	130
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
________	x 0.1	=	mg/L
________	x 0.2	=	mg/L
________	x 1.0	=	mg/L
________	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ____________ (time)

End stripper at ____________ (time)

Total stripper time ____________

Pump rate ____________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612
Sampled By: EVU
Field Analyst: EVU

Sample ID No.: WFF-WOD-TW2-4
Sample Location: WOD-TW2
Duplicate: ☐
Blank: ☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: <10 ppm

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-9810	<10
☐	50 to 500 ppm	K-9815	
☑	100 to 1000 ppm	K-9820	—

Analysis Time: 1101

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	______ & ______	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	______ & ______	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	______ & ______	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	______ & ______	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	______ & ______	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	______ & ______	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 1.8 ppm

Analysis Time: 1053

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ________

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0.0 ppm

Analysis Time: ~~1046~~ 1050

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type: Temp
[] QA Sample Type:

Sample ID No.: WFF-WOD-TW3-4
Sample Location:
Sampled By: JBB
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other ORP
Date: 1/14/09								
Time: 1335								
Method: Low Flow	clear	5.18	99.4 erratic	15.3	13.5	0.77	4.0 erratic	-10

PURGE DATA:

	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 1/14/09								
Method: Low Flow								
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 1 1/2"								
Total Well Depth (TD): 30				see low flow purge sheet				
Static Water Level (WL): 22.75								
One Casing Volume(gal/L): 0.67 gal								
Start Purge (hrs): 1226								
End Purge (hrs): 1335								
Total Purge Time (min): 69								
Total Vol. Purged (gal/L): 2 1/2 gal								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOCs	HCl	(3) 40 mL VOA vials	yes
TCL SVOCs	—	(2) 1 L Amber	yes
TAL Metals	HNO3	Filtered 125 mL poly	yes
		unfiltered " "	

OBSERVATIONS / NOTES:

See field analytical log sheet for geochemical parameters

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-TW3-4
DATE: 1/14/09

Time (Hrs.)	Water Level * (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
1223	22.75									
1226	23.68	170	4.25	0.468	15.0	3.61	12.6	81	0.0	
1231	24.47	170	4.91	99.9 blink	8.80	0.00	14.6	41	4.0	air bubbles in tube
1236	25.19		5.02	4.19	9.65	0.00	14.9	16	0.2	
1241	25.69		5.08	1.29	13.3	0.00	14.9	10	0.1	
1246	26.06		5.12	1.16	16.2	0.15	15.0	1	0.1	
1251	26.16		5.14	3.33	17.7	0.18	15.1	1	0.1	
1256	26.25		5.15	31.9	16.8	0.23	15.2	-6	3.6	
1300			5.16	17.2	20.1	0.33	15.0	-7	1.2	ORP, Sal. erratic
1305	26.39		5.18	99.9 blink	18.4	0.34	15.5	-10	4.0	
1310			5.18	99.4	13.5	0.77	15.3	-10	4.0	
1312	Start	geochem		1 3/4 gal purged						
1335	Start	sampling		2 1/2 gal purged						

* w/o riser

SIGNATURE(S): [signature]

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFFWOD

Project No.: 112GN1612

Sampled By: JB

Field Analyst: JB

Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.: WFF-WOD-TW3-4

Sample Location:

Duplicate: ☐

Blank: ☐

SAMPLING DATA:

Date: 1/14/09 Time: 1335 Method: Low Flow	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
	clear	5.18	99.4, erratic	15.3	13.5	0.77	4.0 erratic	-10

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model:

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 1.5 ppm

Analysis Time: 1316

Range Used:	Range	Method	Concentration ppm
☒	0 to 1 ppm	K-7510	> 1
☒	1 to 12 ppm	K-7512	1.5

Equipment: HACH Digital Titrator OX-DT

Analysis Time:

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
	x 0.01	=	mg/L
	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: ~~0.70~~ ppm 70

Analysis Time: 1230

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
	x 0.1	=	mg/L
	x 0.2	=	mg/L
	x 1.0	=	mg/L
	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity:____ Digits Required: 1st.:____ 2nd.:____ 3rd.:____

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ______ (time)

End stripper at ______ (time)

Total stripper time ______

Pump rate ______ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF WOD
Project No.: 112GN1612
Sampled By: JB
Field Analyst: JB

Sample ID No.: WFF-WOD-TW3-4
Sample Location:
Duplicate: ☐
Blank: ☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 150 ppm

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-9810	>100
☒	50 to 500 ppm	K-9815	150
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1325

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	______ & ______	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	______ & ______	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	______ & ______	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	______ & ______	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	______ & ______	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	______ & ______	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 1.20 ppm

Analysis Time: 1314

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ____________

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0 ppm

Analysis Time: 1312

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ________

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NASA WFF WOD
Project No.: 112GN1612

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: WFF-WOD-TW4-4
Sample Location: WOD-TW4
Sampled By: E. Wu
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 1/14/09	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 0810	(Visual)	(S.U.)	(mS/cm)	(^{0}C)	(NTU)	(mg/l)	(%)	ORP
Method: low Flow	clear	4.97	0.406	14.2	2.78	0.0	0.0	-5

PURGE DATA:

Date: 1/14/09	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: low flow	see	low	flow	purge	log			
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 1 1/2"								
Total Well Depth (TD): 30								
Static Water Level (WL): 24.33								
One Casing Volume(gal/L): 0.52 gal								
Start Purge (hrs): 0730								
End Purge (hrs): 0810								
Total Purge Time (min): 40 min								
Total Vol. Purged (gal/L): 1 1/2 gal								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOC	HCL	(3) 40 ml glass	✓
TCL SVOC	—	(2) 1 L Amber glass	✓
TAL Metals	HNO_3	(1) 125 ml poly	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):
—	—	

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF WOD - TW4-4
DATE: 1/14/09

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0730	24.33	150-175	5.01	1.03	13.1	0.05	13.7	~~43~~ 43	0.0	
0735	25.44	150	4.94	0.98	8.88	0.00	13.9	29	0.0	
0740	25.52	" "	4.96	0.93	6.30	0.00	14.5	18	0.0	
0745	25.71	" "	4.97	0.93	5.51	0.00	14.4	7	0.0	
0750	25.82	" "	4.99	0.91	4.53	0.00	14.3	-3	0.0	
0755	25.84	" "	4.99	0.91	3.77	0.00	14.3	-5	0.0	
0800	25.91	" "	4.97	0.409	3.26	0.0	14.2	-5	0.0	
0805	25.95		4.97	0.406	2.78	0.0	14.2	-5	0.0	
0810	Sample	1½ gal purged								

SIGNATURE(S): ____________

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW04-4
Project No.:	112GN1612	Sample Location:	WOD-TW4
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 1/14/09	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time: 0810	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: low flow	clear	4.97	0.426	14.2	2.78	0.0	0.0	-5

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) -5

Electrode Make & Model: Horiba U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 0.6 ppm

Range Used:	Range	Method	Concentration ppm
☑	0 to 1 ppm	K-7510	0.6
☐	1 to 12 ppm	K-7512	

Analysis Time: 0815

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ______

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
______	x 0.01	=	mg/L
______	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 200 ppm

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-1910	out of range
☑	100 to 1000 ppm	K-1920	200
☐	250 to 2500 ppm	K-1925	

Analysis Time: 0843

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
______	x 0.1	=	mg/L
______	x 0.2	=	mg/L
______	x 1.0	=	mg/L
______	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at __________ (time)

End stripper at __________ (time)

Total stripper time __________

Pump rate __________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612
Sampled By: ELU
Field Analyst: ELU

Sample ID No.: WFF-WOD-TW4-4
Sample Location: WOD-TW4
Duplicate: ☐
Blank: ☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 100 ppm

Range Used:	Range	Method	Concentration ppm
☑	10 to 100 ppm	K-9810	100
☑	50 to 500 ppm	K-9815	100
☐	100 to 1000 ppm	K-9820	

Analysis Time: 0834

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:____ Digits Required: 1st.:____ 2nd.:____ 3rd.:____

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 1.2 ppm

Analysis Time: ~~0820~~ 0823

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ____

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0.0 ppm

Analysis Time: 0820

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ____ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ____

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NASA WFF WOD
Project No.: 112G1N1612

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: WFF-WOD-TWS-4
Sample Location:
Sampled By: JBB
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 1/13/09	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 0845	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	ORP
Method: Low Flow	clear	5.14	0.52	13.8	25.5	4.82	0.0	-6

PURGE DATA:

Date: 1/13/09	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low flow								
Monitor Reading (ppm):								
Well Casing Diameter & Material								
Type: 1 1/2"								
Total Well Depth (TD): 30 ft								
Static Water Level (WL)*: 24.60								
One Casing Volume(gal/L): 0.47 gal								
Start Purge (hrs): 0730								
End Purge (hrs): 0845								
Total Purge Time (min): 75								
Total Vol. Purged (gal/L): 1 3/4 gal								

See low flow purge sheet

* w/riser

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOCs	HCl	(3) 40 ml VOA vials	yes
TCL SVOCs	—	(2) 1L liter Amber	yes
TAL Metals	HNO_3	filtered/unfiltered 125 mL poly	yes

OBSERVATIONS / NOTES:

See field analytical log sheet for geochemical parameters

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-TW5-4
DATE: 1/14/09

Time (Hrs.)	Water Level* (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
730	24.60									
0733	26.93	230	5.04	0.37	30.1	8.85	13.8	84	0.0	0.04 ft product
0738	27.63	180	4.82	0.35		10.71	14.8	78	0.0	Few bubbles in tubing
0743	28.51		4.85	0.38	42.6	5.32	14.7	54	0.0	
0747	29.37		4.97	0.45	38.5	4.79	14.4	22	0.0	Sheen
0751	29.90		5.02	0.48	34.8	4.52	14.3	11	0.0	
0756	30.62		5.03	0.52	29.7	3.84	13.8	-3	0.0	
		shut	off b/c	about	to go	dry	allow to	recharge		
				1/8 gal	purged					
0810	29.29		5.19	0.56	39.2	4.90	10.4	-6	0.0	
0814	30.22		5.14	0.52	35.5	4.82	13.8	-6	0.0	
0820		Start	geochem			1/2 gal	purged			
0845		Start	sampling		1 3/4 gal	purged				
	*w/ riser									

SIGNATURE(S): [signature]

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TWS4
Project No.:	112GN1612	Sample Location:	
Sampled By:	JB	Duplicate:	☐
Field Analyst:	JB	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
Date: 1/14/09								
Time: 0845								
Method: Low Flow	clear	5.14	0.52	13.8	25.5	4.82	0.0	-6

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model: ____________

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

questioning alot of bubbles

Concentration: 8 ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-7510	
☒	1 to 12 ppm	K-7512	8

Analysis Time: 0826

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ____________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
____	x 0.01	=	mg/L
____	x 0.02	=	mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 70 ppm

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	70
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Analysis Time: 0831

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
____	x 0.1	=	mg/L
____	x 0.2	=	mg/L
____	x 1.0	=	mg/L
____	x 2.0	=	mg/L

Standard Additions: ☐ Titrant Molarity:________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ____________ (time)

End stripper at ____________ (time)

Total stripper time ____________

Pump rate ____________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612
Sampled By: JBB
Field Analyst: JBB

Sample ID No.: WFF-WOD-TWS-4
Sample Location:
Duplicate: ☐
Blank: ☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 150 ppm

Analysis Time: 0838

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-9810	>100
☒	50 to 500 ppm	K-9815	150
☐	100 to 1000 ppm	K-9820	

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	_______ & _______	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	_______ & _______	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	_______ & _______	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	_______ & _______	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	_______ & _______	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	_______ & _______	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:_________ Digits Required: 1st.:________ 2nd.:________ 3rd.:________

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8 _ _ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 2.0 ppm

Analysis Time: 0823

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S): Range: 0 - 5 mg/L

Equipment: HS-C Other: __________

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0 ppm

Analysis Time: 0825

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: __________ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: __________

Filtered: ☐

Equipment: DR-850 DR-8 _ _ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NASA WFF WOD
Project No.: 112GN1612

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type: Temp
[] QA Sample Type:

Sample ID No.: WFF-WOD-TW6-4
Sample Location:
Sampled By: JBB
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 1/14/09 Time: 1030 Method: Low Flow	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other ORP
	Clear	5.32	0.69	15.2	42.2	0.94	0.0	-64

PURGE DATA:

Date: 1/14/09	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow								
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 1/2"								
Total Well Depth (TD): 30 ft								
Static Water Level (WL): 24.85			See low flow purge sheet					
One Casing Volume(gal/L): 0.47 gal								
Start Purge (hrs): 0935								
End Purge (hrs): 1030								
Total Purge Time (min): 55								
Total Vol. Purged (gal/L): 2 gal								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOCs	HCl	(3) 40mL VOA vials	yes
TCL SVOCs	—	(2) 1L Amber	yes
TAL Metals	HNO_3	filtered/unfiltered 125 mL poly	yes

OBSERVATIONS / NOTES:

see field analytical log sheet for geochemical parameters

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-TW6-4
DATE: 1/14/09

Time (Hrs.)	Water Level* (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
0915	24.83									
0935	26.56	200	5.43	0.66	24.2	7.49	11.8	-31	0.0	oil smell
0941	27.26	170	5.29	0.77	162	0.65	14.8	-45	0.0	lots bubbles in tube
0946	27.42		5.32	0.75	150	0.63	14.6	-51	0.0	0.01 ft Film (product)
0951	27.51		5.34	0.72	137	0.68	14.6	-54	0.0	
0955	27.61		5.35	0.70	84.1	0.79	14.5	-57	0.0	
1000	27.64		5.35	0.70	60.2	0.88	14.8	-59	0.0	
1004			5.36	0.69	51.1	0.89	15.0	-62 ~~60~~	0.0	
1008			5.38	0.69	42.2	0.94	15.2	-64	0.0	
1010	Start geochem kits 1 1/2 gal purged									
1030	Start sampling 2 gal purged									

SIGNATURE(S): [illegible]

* w/riser

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-WOD	Sample ID No.:	WFF-WOD-TW6-4
Project No.:	112GN1612	Sample Location:	
Sampled By:	JBB	Duplicate:	☐
Field Analyst:	JBB	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 1/14/09	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	ORP (Eh)
Time: 1030	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	(+/- mv)
Method: Low Flow	clear	5.38	0.69	15.2	42.2	0.94	0.0	-64

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model: __________

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: ~~1022~~ 0.1 ppm

Analysis Time: 1022

Range Used:	Range	Method	Concentration ppm
☒	0 to 1 ppm	K-7510	0.1
☐	1 to 12 ppm	K-7512	

Equipment: HACH Digital Titrator OX-DT

Analysis Time: __________

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
________	x 0.01	= mg/L
________	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 80 ppm

Analysis Time: 1025

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	80
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
________	x 0.1	= mg/L
________	x 0.2	= mg/L
________	x 1.0	= mg/L
________	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity: ______ Digits Required: 1st.: ______ 2nd.: ______ 3rd.: ______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at __________ (time)

End stripper at __________ (time)

Total stripper time __________

Pump rate __________ milliliters/minute

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NASA WFF WOD
Project No.: 112GN1612

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: WFF-WOD15GW7-4
Sample Location: 15GW7
Sampled By: ECW
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other ORP
Date: 1/14/09								
Time: ~~13~~ 1435								
Method: low flow	clear	4.18	0.10	15.7	4.46	4.12	0.0	58

PURGE DATA:

Date: 1/14/09	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: low flow	see	low	flow	purge	log			
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 30								
Static Water Level (WL): 25.14								
One Casing Volume(gal/L): 0.79 gal								
Start Purge (hrs): 1400								
End Purge (hrs): 1435								
Total Purge Time (min): 35								
Total Vol. Purged (gal/L): 3 gal								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOC	HCL	(3) 40 mL VOA vials	✓
TCL SVOC	—	(2) 1L Amber	✓
TAL Metal	HNO3	125 mL poly	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.: —

Signature(s): [signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF WOD

PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD15GW 7-4

DATE: 1/14/09

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
1400	25.14	300	4.00	0.09	3.19	4.72	15.5	89	0.0	
1405	26.03	300	4.03	0.09	2.43	4.54	16.1	91	0.0	
1410	26.72	300	4.15	0.10	5.17	3.95	16.2	73	0.0	
1415	26.91	300	4.22	0.10	4.19	4.10	16.1	65	0.0	
1420	27.11	~~300~~ 200	4.19	0.10	3.89	4.27	16.1	66	0.0	
1425	27.23	200	~~4.26~~	0.10	5.34	4.26	15.9	59	0.0	pH 4.17
1430		200	4.18	0.10	4.46	4.12	15.7	58	0.0	
1435		Start Sampling								
			3 gal purged							

SIGNATURE(S):

PAGE__OF__

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-~~FFTA~~ WOD	Sample ID No.:	WFF-WOD-15GW7-4
Project No.:	112GN1612	Sample Location:	15GW7
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐
Field Form Checked as per QA/QC Checklist (initials):			

SAMPLING DATA:

Date: 1/14/09 / Time: 1435 / Method: low flow	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
	clear	4.18	0.10	15.7	4.46	4.12	0.0	58

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv) 58

Electrode Make & Model: Horiba U-22

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 3.5 ppm

Analysis Time: 1438

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-7510	
☒	1 to 12 ppm	K-7512	

Equipment: HACH Digital Titrator OX-DT

Analysis Time: ____

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
____	x 0.01	= mg/L
____	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 70 ppm

Analysis Time: 1448

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	70
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
____	x 0.1	= mg/L
____	x 0.2	= mg/L
____	x 1.0	= mg/L
____	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:____ Digits Required: 1st.:____ 2nd.:____ 3rd.:____

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at ________ (time)

End stripper at ________ (time)

Total stripper time ________

Pump rate ________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name:	NASA WFF-~~FFTA~~ WOD	Sample ID No.:	WFF-WOD-15GW7-4
Project No.:	112GN1612	Sample Location:	WOD-15GW7-4
Sampled By:	EW	Duplicate:	☐
Field Analyst:	EW	Blank:	☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 40 ppm

Analysis Time: 1444

Filtered: ☐

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-9810	40
☐	50 to 500 ppm	K-9815	
☐	100 to 1000 ppm	K-9820	

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	____ & ____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	____ & ____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	____ & ____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	____ & ____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	____ & ____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	____ & ____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:____ Digits Required: 1st.:____ 2nd.:____ 3rd.:____

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 2.4 ppm

Analysis Time: 1439

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ____

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 1.5 ppm

Analysis Time: 1442

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ____ ppm

Analysis Time: ____

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NASA WFF-WOD
Project No.: 112GN1612

[] Domestic Well Data
[x] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: WFF-WOD-MW3R-4
Sample Location:
Sampled By: JBB
C.O.C. No.:
Type of Sample:
[x] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (^{0}C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other ORP
Date: 1/14/09								
Time: 1510								
Method: Low Flow	clear	5.65	0.170	15.3	1.18	8.56	0.0	75

PURGE DATA:

Date: 1/14/09	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow								
Monitor Reading (ppm):								
Well Casing Diameter & Material Type: 2"								
Total Well Depth (TD): 32.33 ~~30~~								
Static Water Level (WL): 26.62								
One Casing Volume(gal/L): 0.93 gal								
Start Purge (hrs): 1417								
End Purge (hrs): 1510								
Total Purge Time (min): 53								
Total Vol. Purged (gal/L): 2 3/4 gal.								

See low flow purge sheet

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOCs	HCl	(3) 40ml VOA vials	yes
TCL SVOCs	—	(2) 1L Amber	yes
TAL Metals	HNO_3	125mL poly	yes

OBSERVATIONS / NOTES:

see field analytical log sheet for geochemical parameters

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NASA WFF - WOD
PROJECT NUMBER: 112GN1612

WELL ID.: WFF-WOD-MW3R-4
DATE: 1/14/09

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
1417	26.62									
1420	26.70	180	6.00	0.154	26.5	10.91	12.0	-7	0.0	
1424	26.76		5.69	0.180	5.34	8.58	14.8	26	0.0	
1429			5.65	0.172	1.49	8.52	15.1	37	0.0	
1433	26.76	180	5.66	0.161	1.25	8.66	15.1	45	0.0	
1438			5.65	0.156	1.58	8.77	14.9	55	0.0	
1443			5.61	0.149	2.56	9.05	14.8	65	0.0	
1447			5.62	0.148	1.80	8.78	14.9	70	0.0	
1451			5.64	0.163	1.18	8.67	15.2	71	0.0	
1455			5.65	0.170		8.56	15.3	75	0.0	
1500		Start geochem 2 1/4 gal purged								
1510		Start sampling 2 3/4 gal purged								

SIGNATURE(S): [signature]

PAGE 1 OF 1

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page 1 of 1

Project Site Name: NASA WFF WOD
Sample ID No.: WFF-WOD-MW3R-4
Project No.: 112GN1612
Sample Location:
Sampled By: JBB
Duplicate: ☐
Field Analyst: Jacob Birkett
Blank: ☐
Field Form Checked as per QA/QC Checklist (initials):

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	ORP (Eh) (+/- mv)
Date: 1/14/09								
Time: 1510								
Method: Low Flow	clear	5.65	0.170	15.3	1.18	8.56	0.0	75

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv)

Electrode Make & Model:

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: Chemetrics Test Kit

Concentration: 5.5 ppm

Analysis Time: 1503

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-7510	
☒	1 to 12 ppm	K-7512	5.5

Equipment: HACH Digital Titrator OX-DT

Analysis Time:

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
______	x 0.01	= mg/L
______	x 0.02	= mg/L

Notes:

Carbon Dioxide:

Equipment: Chemetrics Test Kit

Concentration: 10.5 ppm

Analysis Time: 1506

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-1910	10.5
☐	100 to 1000 ppm	K-1920	
☐	250 to 2500 ppm	K-1925	

Equipment: HACH Digital Titrator CA-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
______	x 0.1	= mg/L
______	x 0.2	= mg/L
______	x 1.0	= mg/L
______	x 2.0	= mg/L

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Hydrogen, dissolved

Equipment: Bubble strip sampling field method

Start stripper at __________ (time)

End stripper at __________ (time)

Total stripper time __________

Pump rate __________ milliliters/minute

Note: Analyte, method, and/or equipment may be deleted from form if not being performed.

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: NASA WFF WOD
Project No.: 112GN1612
Sampled By: JBB
Field Analyst: Jacob Birkett

Sample ID No.: WFF-WOD-MW3R-4
Sample Location:
Duplicate: ☐
Blank: ☐

Alkalinity:

Equipment: Chemetrics Test Kit

Concentration: 22 ppm

Range Used:	Range	Method	Concentration ppm
☒	10 to 100 ppm	K-9810	22
☐	50 to 500 ppm	K-9815	
☐	100 to 1000 ppm	K-9820	

Analysis Time: 1510

Filtered: ☐

Equipment: HACH Digital Titrator AL-DT

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	______ & ______	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	______ & ______	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	______ & ______	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	______ & ______	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	______ & ______	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	______ & ______	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Standard Additions: ☐ Titrant Molarity:______ Digits Required: 1st.:______ 2nd.:______ 3rd.:______

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-850 DR-8__ Range: 0 - 3.00 mg/L

Program/Module: 500nm 33

Concentration: 0 ppm

Analysis Time: 1502

Equipment: IR-18C Color Wheel Range: 0 - 10 mg/L

Notes:

Filtered: ☐

Hydrogen Sulfide (H_2S):

Range: 0 - 5 mg/L

Equipment: HS-C Other: ______

Exceeded 5.0 mg/L range on color chart: ☐

Concentration: 0 ppm

Analysis Time: 1500

Notes:

Sulfide (S^{2-}):

Equipment: Chemetrics Test Kit Range: 0 - 10 mg/L

Concentration: ______ ppm

Range Used:	Range	Method	Concentration ppm
☐	0 to 1 ppm	K-9510	
☐	1 to 10 ppm	K-9510	

Analysis Time: ______

Filtered: ☐

Equipment: DR-850 DR-8__ Range: 0 - 0.70 mg/L

Program/Module: 610nm 93

Notes:

ATTACHMENT 4

Lab Analytical Results

Baseline Analytical Results

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/05/08
Received Date: 12/06/08
Extraction Date:
Analysis Date: 11-DEC-2008 17:06
Report Date: 12/29/2008
Matrix: WATER
% Solids: NA

Lab ID: S37036-2RA
Client ID: WI-WOD-15GW1-1
SDG: CTO12-2
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59016
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene	U	1	1.0	1	1	0.3
127-18-4	Tetrachloroethene	U	1	1.0	1	1	0.3
1330-20-7	Xylenes (total)	U	3	1.0	3	3	0.3
	m+p-Xylenes	U	2	1.0	2	2	0.7
95-47-6	o-Xylene	U	1	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene	U	1	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		84%				
17060-07-0	1,2-Dichloroethane-D4		75%				
2037-26-5	Toluene-D8		98%				
460-00-4	P-Bromofluorobenzene		89%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/05/08
Received Date: 12/06/08
Extraction Date: 12/09/08
Analysis Date: 17-DEC-2008 16:22
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7036-2
Client ID: WI-WOD-15GW1-1
SDG: CTO12-2
Extracted by: KF
Extraction Method: SW846 3510
Analyst: JLP
Analysis Method: SW846 8270C
Lab Prep Batch: WG58922
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	10	1.0	10	10	3
91-20-3	Naphthalene	U	10	1.0	10	10	2
367-12-4	2-Fluorophenol		31%				
13127-88-3	Phenol-D6		19%				
4165-60-0	Nitrobenzene-D5		77%				
321-60-8	2-Fluorobiphenyl		80%				
118-79-6	2,4,6-Tribromophenol		74%				
1718-51-0	Terphenyl-D14		95%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WI-WOD-15GW1-1

Matrix: WATER

SDG Name: CTO12-2

Percent Solids: 0.00

Lab Sample ID: SB7036-002

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	3.3	B		MS	5	5.0	1.45

Bottle ID: D

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/05/08
Received Date: 12/06/08
Extraction Date:
Analysis Date: 11-DEC-2008 17:37
Report Date: 12/29/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7036-7RA
Client ID: WI-WOD-15GW2
SDG: CT012-2
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59016
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene	U	1	1.0	1	1	0.3
127-18-4	Tetrachloroethene	U	1	1.0	1	1	0.3
1330-20-7	Xylenes (total)	U	3	1.0	3	3	0.3
	m+p-Xylenes	U	2	1.0	2	2	0.7
95-47-6	o-Xylene	U	1	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene	U	1	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		90%				
17060-07-0	1,2-Dichloroethane-D4		76%				
2037-26-5	Toluene-D8		98%				
460-00-4	P-Bromofluorobenzene		89%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/05/08
Received Date: 12/06/08
Extraction Date: 12/09/08
Analysis Date: 17-DEC-2008 21:56
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7036-7
Client ID: WI-WOD-15GW2
SDG: CTO12-2
Extracted by: KF
Extraction Method: SW846 3510
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG58922
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	11	1.0	10	11	3
91-20-3	Naphthalene	U	11	1.0	10	11	2
367-12-4	2-Fluorophenol		33%				
13127-88-3	Phenol-D6		17%				
4165-60-0	Nitrobenzene-D5		62%				
321-60-8	2-Fluorobiphenyl		69%				
118-79-6	2,4,6-Tribromophenol		74%				
1718-51-0	Terphenyl-D14		95%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: WI-WOD-15GW2

SDG Name: CTO12-2

Lab Sample ID: SB7036-007

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	4.8	B		MS	5	5.0	1.45

Bottle ID: D

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WI-WOD-15GW2

Matrix: WATER

SDG Name: CTO12-2

Percent Solids: 0.00

Lab Sample ID: SB7036-008

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, DISSOLVED	4.1	B		MS	5	5.0	1.45

Bottle ID: A

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/08/08
Received Date: 12/11/08
Extraction Date:
Analysis Date: 17-DEC-2008 00:30
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7125-2
Client ID: WFF-WOD-15MW3R-1
SDG: CTO12-3
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59135
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene	U	1	1.0	1	1	0.3
127-18-4	Tetrachloroethene	U	1	1.0	1	1	0.4
1330-20-7	Xylenes (total)	U	3	1.0	3	3	0.3
	m+p-Xylenes	U	2	1.0	2	2	0.7
95-47-6	o-Xylene	U	1	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene	U	1	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		94%				
17060-07-0	1,2-Dichloroethane-D4		87%				
2037-26-5	Toluene-D8		95%				
460-00-4	P-Bromofluorobenzene		90%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/08/08
Received Date: 12/11/08
Extraction Date: 12/14/08
Analysis Date: 17-DEC-2008 03:36
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7125-2
Client ID: WFF-WOD-15MW3R-1
SDG: CT012-3
Extracted by: GN
Extraction Method: SW846 3510
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG59045
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	11	1.0	10	11	3
91-20-3	Naphthalene	U	11	1.0	10	11	2
367-12-4	2-Fluorophenol		33%				
13127-88-3	Phenol-D6		22%				
4165-60-0	Nitrobenzene-D5		57%				
321-60-8	2-Fluorobiphenyl		62%				
118-79-6	2,4,6-Tribromophenol		66%				
1718-51-0	Terphenyl-D14		88%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WFF-WOD-15MW3R-1

Matrix: WATER

SDG Name: CTO12-3

Percent Solids: 0.00

Lab Sample ID: SB7125-002

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted CRDL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	1.45	U		MS	5	5.0	1.45

Bottle ID: F

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/08/08
Received Date: 12/11/08
Extraction Date:
Analysis Date: 16-DEC-2008 23:58
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7125-1
Client ID: WFF-WOD-15GW7-1
SDG: CTO12-3
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59135
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		32	1.0	1	1	0.3
127-18-4	Tetrachloroethene		3	1.0	1	1	0.4
1330-20-7	Xylenes (total)		330	1.0	3	3	0.3
	m+p-Xylenes		240	1.0	2	2	0.7
95-47-6	o-Xylene		96	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene		73	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		89%				
17060-07-0	1,2-Dichloroethane-D4		88%				
2037-26-5	Toluene-D8		93%				
460-00-4	P-Bromofluorobenzene		89%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/08/08
Received Date: 12/11/08
Extraction Date: 12/14/08
Analysis Date: 17-DEC-2008 04:19
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7125-1
Client ID: WFF-WOD-15GW7-1
SDG: CTO12-3
Extracted by: GN
Extraction Method: SW846 3510
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG59045
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	11	1.0	10	11	3
91-20-3	Naphthalene		96	1.0	10	11	2
367-12-4	2-Fluorophenol		38%				
13127-88-3	Phenol-D6		33%				
4165-60-0	Nitrobenzene-D5		76%				
321-60-8	2-Fluorobiphenyl		80%				
118-79-6	2,4,6-Tribromophenol		97%				
1718-51-0	Terphenyl-D14		98%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WFF-WOD-15GW7-J

Matrix: WATER

SDG Name: CTO12-3

Percent Solids: 0.00

Lab Sample ID: SB7125-001

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted CRDL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	26.9			MS	5	5.0	1.45

Bottle ID: F

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/05/08
Received Date: 12/06/08
Extraction Date:
Analysis Date: 11-DEC-2008 16:35
Report Date: 12/29/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7036-1RA
Client ID: WI-WOD-16GW2D
SDG: CTO12-2
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59016
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		3	1.0	1	1	0.3
127-18-4	Tetrachloroethene	U	1	1.0	1	1	0.3
1330-20-7	Xylenes (total)	U	3	1.0	3	3	0.3
	m+p-Xylenes	U	2	1.0	2	2	0.7
95-47-6	o-Xylene	U	1	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene	U	1	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		98%				
17060-07-0	1,2-Dichloroethane-D4		75%				
2037-26-5	Toluene-D8		100%				
460-00-4	P-Bromofluorobenzene		91%				

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KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/05/08
Received Date: 12/06/08
Extraction Date: 12/09/08
Analysis Date: 17-DEC-2008 19:49
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7036-1
Client ID: WI-WOD-16GW2D
SDG: CT012-2
Extracted by: KF
Extraction Method: SW846 3510
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG58922
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	11	1.0	10	11	3
91-20-3	Naphthalene	U	11	1.0	10	11	2
367-12-4	2-Fluorophenol		40%				
13127-88-3	Phenol-D6		23%				
4165-60-0	Nitrobenzene-D5		72%				
321-60-8	2-Fluorobiphenyl		83%				
118-79-6	2,4,6-Tribromophenol		87%				
1718-51-0	Terphenyl-D14		105%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** WI-WOD-16GW2D

Matrix: WATER | **SDG Name:** CTO12-2

Percent Solids: 0.00 | **Lab Sample ID:** SB7036-001

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	12.3			MS	5	5.0	1.45

Bottle ID: D

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/05/08
Received Date: 12/06/08
Extraction Date:
Analysis Date: 10-DEC-2008 21:06
Report Date: 12/29/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7036-5
Client ID: WI-WOD-16GW2S-1
SDG: CTO12-2
Extracted by:
Extraction Method: SW846 5030
Analyst: HCG
Analysis Method: SW846 8260B
Lab Prep Batch: WG58976
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		5	1.0	1	1	0.3
127-18-4	Tetrachloroethene	U	1	1.0	1	1	0.3
1330-20-7	Xylenes (total)	U	3	1.0	3	3	0.3
	m+p-Xylenes	U	2	1.0	2	2	0.7
95-47-6	o-Xylene	U	1	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene	U	1	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		113%				
17060-07-0	1,2-Dichloroethane-D4		124%				
2037-26-5	Toluene-D8		103%				
460-00-4	P-Bromofluorobenzene		104%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/05/08
Received Date: 12/06/08
Extraction Date: 12/09/08
Analysis Date: 17-DEC-2008 21:13
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7036-5
Client ID: WI-WOD-16GW2S-1
SDG: CTO12-2
Extracted by: KP
Extraction Method: SW846 3510
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG58922
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	13	1.0	10	13	4
91-20-3	Naphthalene	U	13	1.0	10	13	2
367-12-4	2-Fluorophenol		44%				
13127-88-3	Phenol-D6		26%				
4165-60-0	Nitrobenzene-D5		65%				
321-60-8	2-Fluorobiphenyl		69%				
118-79-6	2,4,6-Tribromophenol		87%				
1718-51-0	Terphenyl-D14		90%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WI-WOD-16GW2S-1

Matrix: WATER

SDG Name: CTO12-2

Percent Solids: 0.00

Lab Sample ID: SB7036-005

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	18.4			MS	5	5.0	1.45

Bottle ID: D

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WI-WOD-16GW2S-1

Matrix: WATER

SDG Name: CTO12-2

Percent Solids: 0.00

Lab Sample ID: SB7036-006

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, DISSOLVED	16.0			MS	5	5.0	1.45

Bottle ID: A

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc	Lab ID: SB7036-3
Project: CTO 12 NASA Wallops	Client ID: WI-WOD-16GWS-1
PO No:	SDG: CTO12-2
Sample Date: 12/05/08	Extracted by:
Received Date: 12/06/08	Extraction Method: SW846 5030
Extraction Date:	Analyst: HCG
Analysis Date: 10-DEC-2008 20:32	Analysis Method: SW846 8260B
Report Date: 12/29/2008	Lab Prep Batch: WG58976
Matrix: WATER	Units: ug/l
% Solids: NA	

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene	U	1	1.0	1	1	0.3
127-18-4	Tetrachloroethene	U	1	1.0	1	1	0.3
1330-20-7	Xylenes (total)	U	3	1.0	3	3	0.3
	m+p-Xylenes	U	2	1.0	2	2	0.7
95-47-6	o-Xylene	U	1	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene	U	1	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		109%				
17060-07-0	1,2-Dichloroethane-D4		121%				
2037-26-5	Toluene-D8		101%				
460-00-4	P-Bromofluorobenzene		99%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/05/08
Received Date: 12/06/08
Extraction Date: 12/09/08
Analysis Date: 17-DEC-2008 20:31
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7036-3
Client ID: WI-WOD-16GW5-1
SDG: CTO12-2
Extracted by: KF
Extraction Method: SW846 3510
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG58922
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	11	1.0	10	11	3
91-20-3	Naphthalene	U	11	1.0	10	11	2
367-12-4	2-Fluorophenol		33%				
13127-88-3	Phenol-D6		20%				
4165-60-0	Nitrobenzene-D5		72%				
321-60-8	2-Fluorobiphenyl		79%				
118-79-6	2,4,6-Tribromophenol		75%				
1718-51-0	Terphenyl-D14		94%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WI-WOD-16GW5-1

Matrix: WATER

SDG Name: CTO12-2

Percent Solids: 0.00

Lab Sample ID: SB7036-003

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	2.2	B		MS	5	5.0	1.45

Bottle ID: D

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: W1-WOD-16GW5-1

Matrix: WATER

SDG Name: CTO12-2

Percent Solids: 0.00

Lab Sample ID: SB7036-004

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, DISSOLVED	1.45	U		MS	5	5.0	1.45

Bottle ID: A

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date:
Analysis Date: 18-DEC-2008 04:13
Report Date: 12/29/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7177-1
Client ID: WFF-WOD-16GW8-1
SDG: CTO12-2
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59203
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene	U	1	1.0	1	1	0.3
127-18-4	Tetrachloroethene	U	1	1.0	1	1	0.3
1330-20-7	Xylenes (total)	U	3	1.0	3	3	0.3
	m+p-Xylenes	U	2	1.0	2	2	0.7
95-47-6	o-Xylene	U	1	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene	U	1	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		92%				
17060-07-0	1,2-Dichloroethane-D4		88%				
2037-26-5	Toluene-D8		98%				
460-00-4	P-Bromofluorobenzene		98%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date: 12/16/08
Analysis Date: 17-DEC-2008 19:06
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7177-1
Client ID: WFF-WOD-16GWB-1
SDG: CTO12-2
Extracted by: KF
Extraction Method: SW846 3520
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG59113
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	9	1.0	10	9	2
91-20-3	Naphthalene	U	9	1.0	10	9	2
367-12-4	2-Fluorophenol		28%				
13127-88-3	Phenol-D6		16%				
4165-60-0	Nitrobenzene-D5		67%				
321-60-8	2-Fluorobiphenyl		71%				
118-79-6	2,4,6-Tribromophenol		73%				
1718-51-0	Terphenyl-D14		85%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services
Client Field ID: WFF-WOD-16GW8-1
Matrix: WATER
SDG Name: CTO12-2
Percent Solids: 0.00
Lab Sample ID: SB7177-001

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	6.3			MS	5	5.0	1.45

Bottle ID: A

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/09/08
Received Date: 12/11/08
Extraction Date:
Analysis Date: 17-DEC-2008 01:02
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7125-3
Client ID: WFF-WOD-TW2-1
SDG: CTO12-3
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59135
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		90	1.0	1	1	0.3
127-18-4	Tetrachloroethene		2	1.0	1	1	0.4
1330-20-7	Xylenes (total)	E	620	1.0	3	3	0.3
	m+p-Xylenes	E	480	1.0	2	2	0.7
95-47-6	o-Xylene		140	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene		140	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		92%				
17060-07-0	1,2-Dichloroethane-D4		89%				
2037-26-5	Toluene-D8		92%				
460-00-4	P-Bromofluorobenzene		86%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/09/08
Received Date: 12/11/08
Extraction Date:
Analysis Date: 17-DEC-2008 10:06
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SS7123-3DL
Client ID: WFF-WOD-TW1-1
SDG: CTO12-3
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59149
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		85	5.0	1	5	1
127-18-4	Tetrachloroethene	U	5	5.0	1	5	2
1330-20-7	Xylenes (total)		700	5.0	3	15	1
	m+p-Xylenes		560	5.0	2	10	3
95-47-6	o-Xylene		150	5.0	1	5	1
95-63-6	1,2,4-Trimethylbenzene		160	5.0	1	5	1
1868-53-7	Dibromofluoromethane		89%				
17060-07-0	1,2-Dichloroethane-D4		85%				
2037-26-5	Toluene-D8		95%				
460-00-4	P-Bromofluorobenzene		86%				

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KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/09/08
Received Date: 12/11/08
Extraction Date: 12/14/08
Analysis Date: 17-DEC-2008 05:43
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7125-3
Client ID: WFF-WOD-TW1-1
SDG: CTO12-3
Extracted by: GN
Extraction Method: SW846 3510
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG59045
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	J	4	1.0	10	11	3
91-20-3	Naphthalene		190	1.0	10	11	2
367-12-4	2-Fluorophenol		47%				
13127-88-3	Phenol-D5		42%				
4165-60-0	Nitrobenzene-D5		87%				
321-60-8	2-Fluorobiphenyl		89%				
118-79-6	2,4,6-Tribromophenol		96%				
1718-51-0	Terphenyl-D14		101%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WFF-WOD-TW1-1

Matrix: WATER

SDG Name: CTO12-3

Percent Solids: 0.00

Lab Sample ID: SB7125-003

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted CRDL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	51.8			MS	5	5.0	1.45

Bottle ID: E

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: WFF-WOD-TW1-1

SDG Name: CTO12-3

Lab Sample ID: SB7125-004

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted CRDL	Adjusted MDL
7440-38-2	ARSENIC, DISSOLVED	42.0			MS	5	5.0	1.45

Bottle ID: A

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date:
Analysis Date: 17-DEC-2008 04:12
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7173-3
Client ID: WPF-WOD-TW2-1
SDG: CTO12-3
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59135
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		120	1.0	1	1	0.3
127-18-4	Tetrachloroethene	J	0.5	1.0	1	1	0.4
1330-20-7	Xylenes (total)	E	930	1.0	3	3	0.3
	m+p-Xylenes	E	660	1.0	2	2	0.7
95-47-6	o-Xylene	E	270	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene		190	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		97%				
17060-07-0	1,2-Dichloroethane-D4		88%				
2037-26-5	Toluene-D8		96%				
460-00-4	P-Bromofluorobenzene		85%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date:
Analysis Date: 17-DEC-2008 12:11
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7173-3DL
Client ID: WFF-WOD-TW2-1
SDG: CTO12-3
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59149
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		100	10	1	10	3
127-18-4	Tetrachloroethene	U	10	10	1	10	4
1330-20-7	Xylenes (total)		1200	10	3	30	3
	m+p-Xylenes		930	10	2	20	7
95-47-6	o-Xylene		270	10	1	10	3
95-63-6	1,2,4-Trimethylbenzene		270	10	1	10	2
1868-53-7	Dibromofluoromethane		90%				
17060-07-0	1,2-Dichloroethane-D4		84%				
2037-26-5	Toluene-D8		90%				
460-00-4	P-Bromofluorobenzene		79%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date: 12/16/08
Analysis Date: 18-DEC-2008 04:14
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SD7173-3
Client ID: WFF-NOD-TW2-I
SDG: CTO12-3
Extracted by: KF
Extraction Method: SW846 3510
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG59113
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	11	1.0	10	11	3
91-20-3	Naphthalene		210	1.0	10	11	2
367-12-4	2-Fluorophenol		42%				
13127-88-3	Phenol-D6		33%				
4165-60-0	Nitrobenzene-D5		72%				
321-60-8	2-Fluorobiphenyl		75%				
118-79-6	2,4,6-Tribromophenol		89%				
1718-51-0	Terphenyl-D14		75%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WFF-WOD-TW2-1

Matrix: WATER

SDG Name: CTO12-3

Percent Solids: 0.00

Lab Sample ID: SB7173-003

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted CRDL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	103			MS	5	5.0	1.45

Bottle ID: A

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: WFF-WOD-TW2-1

SDG Name: CTO12-3

Lab Sample ID: SB7173-004

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted CRDL	Adjusted MDL
7440-38-2	ARSENIC, DISSOLVED	72.6			MS	5	5.0	1.45

Bottle ID: A

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date:
Analysis Date: 17-DEC-2008 04:43
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7173-5
Client ID: WFF-WOD-TW3-1
SDG: CT012-3
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59135
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		87	1.0	1	1	0.3
127-18-4	Tetrachloroethene	J	0.7	1.0	1	1	0.4
1330-20-7	Xylenes (total)	E	750	1.0	3	3	0.3
	m+p-Xylenes	E	570	1.0	2	2	0.7
95-47-6	o-Xylene		180	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene		170	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		90%				
17060-07-0	1,2-Dichloroethane-D4		86%				
2037-26-5	Toluene-D8		92%				
460-00-4	P-Bromofluorobenzene		85%				

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KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date:
Analysis Date: 18-DEC-2008 00:09
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7173-5DLRA
Client ID: WFF-WOD-TW3-1
SDG: CTO12-3
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59204
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		87	10	1	10	3
127-18-4	Tetrachloroethene	U	10	10	1	10	4
1330-20-7	Xylenes (total)		1300	10	3	30	3
	m+p-Xylenes		1000	10	2	20	7
95-47-6	o-Xylene		260	10	1	10	3
95-63-6	1,2,4-Trimethylbenzene		320	10	1	10	2
1868-53-7	Dibromofluoromethane		86%				
17060-07-0	1,2-Dichloroethane-D4		85%				
2037-26-5	Toluene-D8		94%				
460-00-4	P-Bromofluorobenzene		86%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date: 12/16/08
Analysis Date: 18-DEC-2008 04:56
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7173-5
Client ID: WFF-WOD-TW3-1
SDG: CTO12-3
Extracted by: KF
Extraction Method: SW846 3510
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG59113
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	J	6	1.0	10	11	3
91-20-3	Naphthalene		200	1.0	10	11	2
367-12-4	2-Fluorophenol		42%				
13127-88-3	Phenol-D6		33%				
4165-60-0	Nitrobenzene-D5		72%				
321-60-8	2-Fluorobiphenyl		78%				
118-79-6	2,4,6-Tribromophenol		86%				
1718-51-0	Terphenyl-D14		84%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: WFF-WOD-TW3-1

SDG Name: CTO12-3

Lab Sample ID: SB7173-005

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted CRDL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	65.7			MS	5	5.0	1.45

Bottle ID: A

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WFF-WOD-TW3-1

Matrix: WATER

SDG Name: CTO12-3

Percent Solids: 0.00

Lab Sample ID: SB7173-006

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted CRDL	Adjusted MDL
7440-38-2	ARSENIC, DISSOLVED	63.9			MS	5	5.0	1.45

Bottle ID: A

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/09/08
Received Date: 12/11/08
Extraction Date:
Analysis Date: 17-DEC-2008 01:33
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7125-5
Client ID: WFF-WOD-TW4-1
SDG: CTO12-3
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59135
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene	E	260	1.0	1	1	0.3
127-18-4	Tetrachloroethene	U	1	1.0	1	1	0.4
1330-20-7	Xylenes (total)	E	930	1.0	3	3	0.3
	m+p-Xylenes	E	650	1.0	2	2	0.7
95-47-6	o-Xylene	E	290	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene		170	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		88%				
17060-07-0	1,2-Dichloroethane-D4		86%				
2037-26-5	Toluene-D8		76%				
460-00-4	P-Bromofluorobenzene		83%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/09/08
Received Date: 12/11/08
Extraction Date:
Analysis Date: 17-DEC-2008 10:37
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7125-5DL
Client ID: WFF-WOD-TW4-1
SDG: CTO12-3
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59149
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		250	10	1	10	3
127-18-4	Tetrachloroethene	U	10	10	1	10	4
1330-20-7	Xylenes (total)		1400	10	3	30	3
	m+p-Xylenes		1000	10	2	20	7
95-47-6	o-Xylene		390	10	1	10	3
95-63-6	1,2,4-Trimethylbenzene		260	10	1	10	2
1868-53-7	Dibromofluoromethane		92%				
17060-07-0	1,2-Dichloroethane-D4		84%				
2037-26-5	Toluene-D8		85%				
460-00-4	P-Bromofluorobenzene		81%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/09/08
Received Date: 12/11/08
Extraction Date: 12/14/08
Analysis Date: 17-DEC-2008 05:01
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7125-5
Client ID: WFF-WOD-TW4-1
SDG: CTO12-3
Extracted by: GN
Extraction Method: SW846 3510
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG59045
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol		31	1.0	10	12	3
91-20-3	Naphthalene	E	340	1.0	10	12	2
367-12-4	2-Fluorophenol		48%				
13127-88-3	Phenol-D6		* 53%				
4165-60-0	Nitrobenzene-D5		* 89%				
321-60-8	2-Fluorobiphenyl		*128%				
118-79-6	2,4,6-Tribromophenol		*123%				
1718-51-0	Terphenyl-D14		* 56%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/09/08
Received Date: 12/11/08
Extraction Date: 12/14/08
Analysis Date: 17-DEC-2008 27:05
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7125-5DL
Client ID: WFF-WOD-TW4-1
SDG: CTC12-3
Extracted by: GN
Extraction Method: SW846 3510
Analyst: JLP
Analysis Method: SW846 8270C
Lab Prep Batch: WG59045
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol		28	2.0	10	24	6
91-20-3	Naphthalene		320	2.0	10	24	4
367-12-4	2-Fluorophenol		44%				
13127-88-3	Phenol-D6		* 46%				
4165-60-0	Nitrobenzene-D5		73%				
321-60-8	2-Fluorobiphenyl		68%				
118-79-6	2,4,6-Tribromophenol		60%				
1718-51-0	Terphenyl-D14		* 52%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WFF-WOD-TW4-1

Matrix: WATER

SDG Name: CTO12-3

Percent Solids: 0.00

Lab Sample ID: SB7125-005

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted CRDL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	135			MS	5	5.0	1.45

Bottle ID: E

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: WFF-WOD-TW4-1

SDG Name: CTO12-3

Lab Sample ID: SB7125-006

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted CRDL	Adjusted MDL
7440-38-2	ARSENIC, DISSOLVED	138			MS	5	5.0	1.45

Bottle ID: A

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date:
Analysis Date: 17-DEC-2008 13:13
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7173-7
Client ID: WFF-WOD-TW5-1
SDG: CT012-3
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59149
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		92	1.0	1	1	0.3
127-18-4	Tetrachloroethene	U	1	1.0	1	1	0.4
1330-20-7	Xylenes (total)	E	1000	1.0	3	3	0.3
	m+p-Xylenes	E	760	1.0	2	2	0.7
95-47-6	o-Xylene	E	250	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene	E	220	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		91%				
17060-07-0	1,2-Dichloroethane-D4		86%				
2037-26-5	Toluene-D8		92%				
460-00-4	P-Bromofluorobenzene		84%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date:
Analysis Date: 18-DEC-2008 00:41
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7173-7DL
Client ID: WFF-WOD-TW5-1
SDG: CTO12-3
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59204
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		84	10	1	10	3
127-18-4	Tetrachloroethene	U	10	10	1	10	4
1330-20-7	Xylenes (total)		1700	10	3	30	8
	m+p-Xylenes		1400	10	2	20	7
95-47-6	o-Xylene		320	10	1	10	3
95-63-6	1,2,4-Trimethylbenzene		300	10	1	10	2
1868-53-7	Dibromofluoromethane		94%				
17060-07-0	1,2-Dichloroethane-D4		84%				
2037-26-5	Toluene-D8		92%				
460-00-4	P-Bromofluorobenzene		85%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date: 12/16/08
Analysis Date: 17-DEC-2008 22:38
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7173-7DL2
Client ID: WFF-WOD-TW5-1
SDG: CTO12-3
Extracted by: KF
Extraction Method: SW846 3510
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG59113
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	2100	10	10	2100	550
91-20-3	Naphthalene		20000	10	10	2100	360
367-12-4	2-Fluorophenol		D				
13127-88-3	Phenol-D6		D				
4165-60-0	Nitrobenzene-D5		D				
321-60-8	2-Fluorobiphenyl		D				
118-79-6	2,4,6-Tribromophenol		D				
1718-51-0	Terphenyl-D14		D				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WFF-WOD-TW5-I

Matrix: WATER

SDG Name: CTO12-3

Percent Solids: 0.00

Lab Sample ID: SB7173-007

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted CRDL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	102			MS	5	5.0	1.45

Bottle ID: A

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WFF-WOD-TW5-I

Matrix: WATER

SDG Name: CTO12-3

Percent Solids: 0.00

Lab Sample ID: SB7173-008

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted CRDL	Adjusted MDL
7440-38-2	ARSENIC, DISSOLVED	95.5			MS	5	5.0	1.45

Bottle ID: A

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date:
Analysis Date: 17-DEC-2008 03:48
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7373-1
Client ID: WFF-WOD-TW6-1
SDG: CT012-3
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59135
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		44	1.0	1	1	0.3
127-18-4	Tetrachloroethene	U	1	1.0	1	1	0.4
1330-20-7	Xylenes (total)	E	880	1.0	3	3	0.3
	m+p-Xylenes	E	620	1.0	2	2	0.7
95-47-6	o-Xylene	E	260	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene		170	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		89%				
17060-07-0	1,2-Dichloroethane-D4		86%				
2037-26-5	Toluene-D8		90%				
460-00-4	P-Bromofluorobenzene		84%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date:
Analysis Date: 17-DEC-2008 23:38
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7173-1DLRA
Client ID: WFF-WOD-TW6-1
SDG: CTO12-3
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59204
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		47	10	1	10	3
127-18-4	Tetrachloroethene	U	10	10	1	10	4
1330-20-7	Xylenes (total)		1600	10	3	30	3
	m+p-Xylenes		1200	10	2	20	7
95-47-6	o-Xylene		430	10	1	10	3
95-63-6	1,2,4-Trimethylbenzene		410	10	1	10	2
1868-53-7	Dibromofluoromethane		89%				
17060-07-0	1,2-Dichloroethane-D4		85%				
2037-26-5	Toluene-D8		95%				
460-00-4	P-Bromofluorobenzene		87%				

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KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date: 12/16/08
Analysis Date: 18-DEC-2008 05:38
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7173-1
Client ID: WFF-WOD-TW6-1
SDG: CTO12-3
Extracted by: KF
Extraction Method: SW846 3510
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG59113
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	10	1.0	10	10	3
91-20-3	Naphthalene	E	370	1.0	10	10	2
367-12-4	2-Fluorophenol		36%				
13127-88-3	Phenol-D5		26%				
4165-60-0	Nitrobenzene-D5		65%				
321-60-8	2-Fluorobiphenyl		101%				
118-79-6	2,4,6-Tribromophenol		106%				
1718-51-0	Terphenyl-D14		63%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 12/10/08
Received Date: 12/12/08
Extraction Date: 12/16/08
Analysis Date: 18-DEC-2008 10:38
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7173-1DL
Client ID: WFF-WOD-TW6-1
SDG: CTO12-3
Extracted by: KF
Extraction Method: SW846 3510
Analyst: JLP
Analysis Method: SW846 8270C
Lab Prep Batch: WG59113
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	49	5.0	10	49	13
91-20-3	Naphthalene		400	5.0	10	49	8
367-12-4	2-Fluorophenol		35%				
13127-88-3	Phenol-D6		24%				
4165-60-0	Nitrobenzene-D5		65%				
321-60-8	2-Fluorobiphenyl		75%				
118-79-6	2,4,6-Tribromophenol		70%				
1718-51-0	Terphenyl-D14		66%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: WFF-WOD-TW6-1

SDG Name: CTO12-3

Lab Sample ID: SB7173-001

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted CRDL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	27.7			MS	5	5.0	1.45

Bottle ID: A

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WFF-WOD-TW6-1

Matrix: WATER

SDG Name: CTO12-3

Percent Solids: 0.00

Lab Sample ID: SB7173-002

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted CRDL	Adjusted MDL
7440-38-2	ARSENIC, DISSOLVED	16.2			MS	5	5.0	1.45

Bottle ID: A

Comments:

1 Month Analytical Results

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date:
Analysis Date: 20-JAN-2009 19:55
Report Date: 01/27/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-2
Client ID: WFF-WOD-15-MW3R-4
SDG: CTO12-6
Extracted by:
Extraction Method: SW846 5030
Analyst: JSS
Analysis Method: SW846 8260B
Lab Prep Batch: WG60010
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene	U	1	1.0	1	1	0.3
127-18-4	Tetrachloroethene	U	1	1.0	1	1	0.3
1330-20-7	Xylenes (total)	U	3	1.0	3	3	0.3
	m+p-Xylenes	U	2	1.0	2	2	0.7
95-47-6	o-Xylene	U	1	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene	U	1	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		103%				
17060-07-0	1,2-Dichloroethane-D4		100%				
2037-26-5	Toluene-D8		93%				
460-00-4	P-Bromofluorobenzene		90%				

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KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date: 01/16/09
Analysis Date: 19-JAN-2009 21:55
Report Date: 01/23/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-2
Client ID: WFF-WOD-15-MW3R-4
SDG: CTO12-6
Extracted by: CB
Extraction Method: SW846 3510
Analyst: JLP
Analysis Method: SW846 8270C
Lab Prep Batch: WG59859
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	9	1.0	10	9	2
91-20-3	Naphthalene	U	9	1.0	10	9	2
367-12-4	2-Fluorophenol		31%				
13127-88-3	Phenol-D6		17%				
4165-60-0	Nitrobenzene-D5		* 48%				
321-60-8	2-Fluorobiphenyl		62%				
118-79-6	2,4,6-Tribromophenol		68%				
1718-51-0	Terphenyl-D14		97%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: WFF-WOD-15-MW3R-4

SDG Name: CTO12-6

Lab Sample ID: SC0219-002

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	1.45	U		MS	5	5.0	1.45

Bottle ID: D

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date:
Analysis Date: 20-JAN-2009 19:22
Report Date: 01/27/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-1
Client ID: WFF-WOD-15-GW7-4
SDG: CTO12-6
Extracted by:
Extraction Method: SW846 5030
Analyst: JSS
Analysis Method: SW846 8260B
Lab Prep Batch: WG60010
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		2	1.0	1	1	0.3
127-18-4	Tetrachloroethene		2	1.0	1	1	0.3
1330-20-7	Xylenes (total)		120	1.0	3	3	0.3
	m+p-Xylenes		74	1.0	2	2	0.7
95-47-6	o-Xylene		50	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene		54	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		108%				
17060-07-0	1,2-Dichloroethane-D4		109%				
2037-26-5	Toluene-D8		96%				
460-00-4	P-Bromofluorobenzene		94%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date: 01/16/09
Analysis Date: 19-JAN-2009 21:13
Report Date: 01/23/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-1
Client ID: WFF-WOD-15-GW7-4
SDG: CTO12-6
Extracted by: CB
Extraction Method: SW846 3510
Analyst: JLP
Analysis Method: SW846 8270C
Lab Prep Batch: WG59859
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	11	1.0	10	11	3
91-20-3	Naphthalene		55	1.0	10	11	2
367-12-4	2-Fluorophenol		40%				
13127-88-3	Phenol-D6		28%				
4165-60-0	Nitrobenzene-D5		69%				
321-60-8	2-Fluorobiphenyl		76%				
118-79-6	2,4,6-Tribromophenol		92%				
1718-51-0	Terphenyl-D14		106%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: WFF-WOD-15-GW7-4

SDG Name: CTO12-6

Lab Sample ID: SC0219-001

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	9.7			MS	5	5.0	1.45

Bottle ID: D

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date:
Analysis Date: 20-JAN-2009 20:27
Report Date: 01/27/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-3
Client ID: WFF-WOD-TW1-4
SDG: CTO12-6
Extracted by:
Extraction Method: SW846 5030
Analyst: JSS
Analysis Method: SW846 8260B
Lab Prep Batch: WG60010
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		39	1.0	1	1	0.3
127-18-4	Tetrachloroethene		1	1.0	1	1	0.3
1330-20-7	Xylenes (total)		370	1.0	3	3	0.3
	m+p-Xylenes		270	1.0	2	2	0.7
95-47-6	o-Xylene		94	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene		86	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		103%				
17060-07-0	1,2-Dichloroethane-D4		98%				
2037-26-5	Toluene-D8		94%				
460-00-4	P-Bromofluorobenzene		90%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date:
Analysis Date: 22-JAN-2009 15:47
Report Date: 01/27/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-3DL
Client ID: WFF-WOD-TW1-4
SDG: CT012-6
Extracted by:
Extraction Method: SW846 5030
Analyst: JSS
Analysis Method: SW846 8260B
Lab Prep Batch: WG60080
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		36	2.0	1	2	0.5
127-18-4	Tetrachloroethene	J	1	2.0	1	2	0.5
1330-20-7	Xylenes (total)		360	2.0	3	6	0.5
	m+p-Xylenes		270	2.0	2	4	1
95-47-6	o-Xylene		89	2.0	1	2	0.5
95-63-6	1,2,4-Trimethylbenzene		81	2.0	1	2	0.5
1868-53-7	Dibromofluoromethane		96%				
17060-07-0	1,2-Dichloroethane-D4		94%				
2037-26-5	Toluene-D8		94%				
460-00-4	P-Bromofluorobenzene		91%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date: 01/16/09
Analysis Date: 19-JAN-2009 22:38
Report Date: 01/23/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-3
Client ID: WFF-WOD-TW1-4
SDG: CTO12-6
Extracted by: CB
Extraction Method: SW846 3510
Analyst: JLP
Analysis Method: SW846 8270C
Lab Prep Batch: WG59859
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	11	1.0	10	11	3
91-20-3	Naphthalene		51	1.0	10	11	2
367-12-4	2-Fluorophenol		24%				
13127-88-3	Phenol-D6		23%				
4165-60-0	Nitrobenzene-D5		52%				
321-60-8	2-Fluorobiphenyl		67%				
118-79-6	2,4,6-Tribromophenol		81%				
1718-51-0	Terphenyl-D14		102%				

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INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** WFF-WOD-TW1-4

Matrix: WATER | **SDG Name:** CTO12-6

Percent Solids: 0.00 | **Lab Sample ID:** SC0219-003

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	22.3			MS	5	5.0	1.45

Bottle ID: D

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** WFF-WOD-TW1-4

Matrix: WATER **SDG Name:** CTO12-6

Percent Solids: 0.00 **Lab Sample ID:** SC0219-004

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, DISSOLVED	19.3			MS	5	5.0	1.45

Bottle ID: A

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date:
Analysis Date: 20-JAN-2009 20:59
Report Date: 01/27/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-5
Client ID: WFF-NOD-TW2-4
SDG: CTO12-6
Extracted by:
Extraction Method: SW846 5030
Analyst: JSS
Analysis Method: SW846 8260B
Lab Prep Batch: WG60010
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		12	1.0	1	1	0.3
127-18-4	Tetrachloroethene		1	1.0	1	1	0.3
1330-20-7	Xylenes (total)	E	600	1.0	3	3	0.3
	m+p-Xylenes	E	430	1.0	2	2	0.7
95-47-6	o-Xylene		170	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene		150	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		97%				
17060-07-0	1,2-Dichloroethane-D4		95%				
2037-26-5	Toluene-D8		94%				
460-00-4	P-Bromofluorobenzene		92%				

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KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date:
Analysis Date: 22-JAN-2009 16:19
Report Date: 01/27/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-6DL
Client ID: WFF-WOD-TW2-4
SDG: CTO12-6
Extracted by:
Extraction Method: SW846 5030
Analyst: JSS
Analysis Method: SW846 8260B
Lab Prep Batch: WG60080
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		12	2.0	1	2	0.5
127-18-4	Tetrachloroethene	J	1.0	2.0	1	2	0.5
1330-20-7	Xylenes (total)		590	2.0	3	6	0.5
	m+p-Xylenes		420	2.0	2	4	1
95-47-6	o-Xylene		160	2.0	1	2	0.5
95-63-6	1,2,4-Trimethylbenzene		140	2.0	1	2	0.5
1868-53-7	Dibromofluoromethane		93%				
17060-07-0	1,2-Dichloroethane-D4		91%				
2037-26-5	Toluene-D8		96%				
460-00-4	P-Bromofluorobenzene		91%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date: 01/16/09
Analysis Date: 19-JAN-2009 23:20
Report Date: 01/23/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-5
Client ID: WFF-WOD-TW2-4
SDG: CTO12-5
Extracted by: CB
Extraction Method: SW846 3510
Analyst: JLP
Analysis Method: SW846 8270C
Lab Prep Batch: WG59859
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	12	1.0	10	12	3
91-20-3	Naphthalene		130	1.0	10	12	2
367-12-4	2-Fluorophenol		27%				
13127-88-3	Phenol-D6		22%				
4165-60-0	Nitrobenzene-D5		70%				
321-60-8	2-Fluorobiphenyl		81%				
118-79-6	2,4,6-Tribromophenol		77%				
1718-51-0	Terphenyl-D14		111%				

I

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: WFF-WOD-TW2-4

SDG Name: CTO12-6

Lab Sample ID: SC0219-005

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	10.3			MS	5	5.0	1.45

Bottle ID: D

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date:
Analysis Date: 20-JAN-2009 21:31
Report Date: 01/27/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-6
Client ID: WFF-WOD-TW3-4
SDG: CTO12-6
Extracted by:
Extraction Method: SW846 5030
Analyst: JSS
Analysis Method: SW846 8260B
Lab Prep Batch: WG60010
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		93	1.0	1	1	0.3
127-18-4	Tetrachloroethene	J	0.6	1.0	1	1	0.3
1330-20-7	Xylenes (total)	E	640	1.0	3	3	0.3
	m+p-Xylenes	E	480	1.0	2	2	0.7
95-47-6	o-Xylene		170	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene		120	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		100%				
17060-07-0	1,2-Dichloroethane-D4		96%				
2037-26-5	Toluene-D8		95%				
460-00-4	P-Bromofluorobenzene		88%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date:
Analysis Date: 22-JAN-2009 16:51
Report Date: 01/27/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-6DL
Client ID: WFF-WOD-TW3-4
SDG: CTO12-6
Extracted by:
Extraction Method: SW846 5030
Analyst: JSS
Analysis Method: SW846 8260B
Lab Prep Batch: WG60080
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		110	10	1	10	3
127-18-4	Tetrachloroethene	U	10	10	1	10	3
1330-20-7	Xylenes (total)		870	10	3	30	3
	m+p-Xylenes		670	10	2	20	7
95-47-6	o-Xylene		200	10	1	10	3
95-63-6	1,2,4-Trimethylbenzene		150	10	1	10	2
1868-53-7	Dibromofluoromethane		92%				
17060-07-0	1,2-Dichloroethane-D4		88%				
2037-26-5	Toluene-D8		94%				
460-00-4	P-Bromofluorobenzene		91%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date: 01/16/09
Analysis Date: 20-JAN-2009 00:02
Report Date: 01/23/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-6
Client ID: WFF-WOD-TW3-4
SDG: CTO12-6
Extracted by: CB
Extraction Method: SW846 3510
Analyst: JLP
Analysis Method: SW846 8270C
Lab Prep Batch: WG59859
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	10	1.0	10	10	3
91-20-3	Naphthalene		110	1.0	10	10	2
367-12-4	2-Fluorophenol		45%				
13127-88-3	Phenol-D6		38%				
4165-60-0	Nitrobenzene-D5		76%				
321-60-8	2-Fluorobiphenyl		52%				
118-79-6	2,4,6-Tribromophenol		61%				
1718-51-0	Terphenyl-D14		99%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services
Client Field ID: WFF-WOD-TW3-4
Matrix: WATER
SDG Name: CTO12-6
Percent Solids: 0.00
Lab Sample ID: SC0219-006

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	56.4			MS	5	5.0	1.45

Bottle ID: D

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** WFF-WOD-TW3-4

Matrix: WATER | **SDG Name:** CTO12-6

Percent Solids: 0.00 | **Lab Sample ID:** SC0219-007

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, DISSOLVED	59.0			MS	5	5.0	1.45

Bottle ID: A

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date:
Analysis Date: 20-JAN-2009 22:03
Report Date: 01/27/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-9
Client ID: WFF-WOD-TW4-4
SDG: CTO12-6
Extracted by:
Extraction Method: SW846 5030
Analyst: JSS
Analysis Method: SW846 8260B
Lab Prep Batch: WG60010
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		120	1.0	1	1	0.3
127-18-4	Tetrachloroethene	J	0.4	1.0	1	1	0.3
1330-20-7	Xylenes (total)	E	760	1.0	3	3	0.3
	m+p-Xylenes	E	530	1.0	2	2	0.7
95-47-6	o-Xylene	E	240	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene		110	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		99%				
17060-07-0	1,2-Dichloroethane-D4		98%				
2037-26-5	Toluene-D8		93%				
460-00-4	P-Bromofluorobenzene		89%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date:
Analysis Date: 22-JAN-2009 17:23
Report Date: 01/27/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-8DL
Client ID: WFF-WOD-TW4-4
SDG: CTO12-6
Extracted by:
Extraction Method: SW846 5030
Analyst: JSS
Analysis Method: SW846 8260B
Lab Prep Batch: WG60080
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		100	20	1	20	5
127-18-4	Tetrachloroethene	U	20	20	1	20	5
1330-20-7	Xylenes (total)		900	20	3	60	5
	m+p-Xylenes		660	20	2	40	14
95-47-6	o-Xylene		250	20	1	20	5
95-63-6	1,2,4-Trimethylbenzene		120	20	1	20	5
1868-53-7	Dibromofluoromethane		95%				
17060-07-0	1,2-Dichloroethane-D4		91%				
2037-26-5	Toluene-D8		96%				
460-00-4	P-Bromofluorobenzene		90%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date: 01/16/09
Analysis Date: 20-JAN-2009 00:44
Report Date: 01/23/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0239-8
Client ID: WFF-WOD-TW4-4
SDG: CTO12-6
Extracted by: CB
Extraction Method: SW846 3510
Analyst: JLP
Analysis Method: SW846 8270C
Lab Prep Batch: WG69859
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	11	1.0	10	11	3
91-20-3	Naphthalene		83	1.0	10	11	2
367-12-4	2-Fluorophenol		54%				
13127-88-3	Phenol-D6		* 48%				
4165-60-0	Nitrobenzene-D5		66%				
321-60-8	2-Fluorobiphenyl		98%				
118-79-6	2,4,6-Tribromophenol		*131%				
1718-51-0	Terphenyl-D14		80%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: WFF-WOD-TW4-4

SDG Name: CTO12-6

Lab Sample ID: SC0219-008

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	203			MS	5	5.0	1.45

Bottle ID: D

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date:
Analysis Date: 22-JAN-2009 19:00
Report Date: 01/27/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-9
Client ID: WFF-WOD-TW5-4
SDG: CTO12-6
Extracted by:
Extraction Method: SW846 5030
Analyst: JSS
Analysis Method: SW846 8260B
Lab Prep Batch: WG60080
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		20	1.0	1	1	0.3
127-18-4	Tetrachloroethene	J	0.4	1.0	1	1	0.3
1330-20-7	Xylenes (total)		440	1.0	3	3	0.3
	m+p-Xylenes		310	1.0	2	2	0.7
95-47-6	o-Xylene		130	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene		85	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		89%				
17060-07-0	1,2-Dichloroethane-D4		87%				
2037-26-5	Toluene-D8		90%				
460-00-4	P-Bromofluorobenzene		88%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date: 01/16/09
Analysis Date: 20-JAN-2009 01:26
Report Date: 01/23/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-9
Client ID: WPF-WOD-TW5-4
SDG: CTO12-6
Extracted by: CB
Extraction Method: SW846 3510
Analyst: JLP
Analysis Method: SW846 8270C
Lab Prep Batch: WG59059
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	10	1.0	10	10	3
91-20-3	Naphthalene		73	1.0	10	10	2
367-12-4	2-Fluorophenol		44%				
13127-88-3	Phenol-D6		35%				
4165-60-0	Nitrobenzene-D5		62%				
321-60-8	2-Fluorobiphenyl		69%				
118-79-6	2,4,6-Tribromophenol		95%				
1718-51-0	Terphenyl-D14		104%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WFF-WOD-TW5-4

Matrix: WATER

SDG Name: CTO12-6

Percent Solids: 0.00

Lab Sample ID: SC0219-009

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	72.8			MS	5	5.0	1.45

Bottle ID: D

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: WFF-WOD-TW5-4

SDG Name: CTO12-6

Lab Sample ID: SC0219-010

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, DISSOLVED	62.0			MS	5	5.0	1.45

Bottle ID: A

Comments:

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date:
Analysis Date: 22-JAN-2009 19:32
Report Date: 01/27/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-11
Client ID: WFF-WOD-TW6-4
SDG: CTO12-6
Extracted by:
Extraction Method: SW846 5030
Analyst: JSS
Analysis Method: SW846 8260B
Lab Prep Batch: WG60080
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		46	1.0	1	1	0.3
127-18-4	Tetrachloroethene	J	0.3	1.0	1	1	0.3
1330-20-7	Xylenes (total)	E	910	1.0	3	3	0.3
	m+p-Xylenes	E	630	1.0	2	2	0.7
95-47-6	o-Xylene	E	280	1.0	1	1	0.3
95-63-6	1,2,4-Trimethylbenzene		160	1.0	1	1	0.2
1868-53-7	Dibromofluoromethane		95%				
17060-07-0	1,2-Dichloroethane-D4		91%				
2037-26-5	Toluene-D8		93%				
460-00-4	P-Bromofluorobenzene		90%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date:
Analysis Date: 23-JAN-2009 15:47
Report Date: 01/27/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-11DL
Client ID: WFF-WOD-TW6-4
SDG: CTO12-6
Extracted by:
Extraction Method: SW846 5030
Analyst: JSS
Analysis Method: SW846 8260B
Lab Prep Batch: WG60135
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene		39	10	1	10	3
127-18-4	Tetrachloroethene	U	10	10	1	10	3
1330-20-7	Xylenes (total)		1200	10	3	30	3
	m+p-Xylenes		840	10	2	20	7
95-47-6	o-Xylene		340	10	1	10	3
95-63-6	1,2,4-Trimethylbenzene		190	10	1	10	2
1868-53-7	Dibromofluoromethane		93%				
17060-07-0	1,2-Dichloroethane-D4		91%				
2037-26-5	Toluene-D8		96%				
460-00-4	P-Bromofluorobenzene		97%				

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KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Tetra Tech NUS, Inc
Project: CTO 12 NASA Wallops
PO No:
Sample Date: 01/14/09
Received Date: 01/15/09
Extraction Date: 01/16/09
Analysis Date: 20-JAN-2009 02:09
Report Date: 01/23/2009
Matrix: WATER
% Solids: NA

Lab ID: SC0219-11
Client ID: WFF-WOD-TW6-4
SDG: CTO12-6
Extracted by: CB
Extraction Method: SW846 3510
Analyst: JLP
Analysis Method: SW846 8270C
Lab Prep Batch: WG59859
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
65794-96-9	3&4-Methylphenol	U	11	1.0	10	11	3
91-20-3	Naphthalene	E	230	1.0	10	11	2
367-12-4	2-Fluorophenol		48%				
13127-88-3	Phenol-D6		* 43%				
4165-60-0	Nitrobenzene-D5		71%				
321-60-8	2-Fluorobiphenyl		88%				
118-79-6	2,4,6-Tribromophenol		101%				
1718-51-0	Terphenyl-D14		96%				

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: WFF-WOD-TW6-4

Matrix: WATER

SDG Name: CTO12-6

Percent Solids: 0.00

Lab Sample ID: SC0219-011

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted MDL
7440-38-2	ARSENIC, TOTAL	116			MS	5	5.0	1.45

Bottle ID: D

Comments:

APPENDIX B

ORC ADVANCED® CALCULATIONS

ORC *Advanced* Design Software for Grid Applications Using Slurry Injection

August 2004

Regenesis Technical Support: USA (949) 366-8000 www.regenesis.com

Site Name: Wallops Island
Location: WOD
Consultant: W. Wright

Estimated Plume Requiring Treatment

Width of plume (intersecting gw flow direction)	52	ft			
Length of plume (parallel to gw flow direction)	162	ft		8,424	ft^2
Depth to contaminated zone	20	ft			
Thickness of contaminated saturated zone	10	ft			
Nominal aquifer soil (gravel, sand, silty sand, silt, clay)	sand				
Total porosity	0.33		Effective porosity:	0.25	
Hydraulic conductivity	25	ft/day		8.8E-03	cm/sec
Hydraulic gradient	0.005	ft/ft			
Seepage velocity	182.5	ft/yr		0.500	ft/day
Treatment Zone Pore Volume	27,799	ft^3		207,966	gallons

Dissolved Phase Oxygen Demand:	Contaminant Conc.	Contaminant Mass	Stoichiometry (wt/wt)	ORC-Adv Dose
Individual species that represent oxygen demand:	(mg/L)	(lb)	O_2/contaminant	(lb)
Benzene	0.25	0.4	3.1	8
Toluene	0.00	0.0	3.1	0
Ethylbenzene	0.00	0.0	3.2	0
Xylenes	1.70	2.9	3.2	56
MTBE	0.00	0.0	2.7	0
cis-1,2-DCE	0.00	0.0	0.7	0
Vinyl Chloride	0.00	0.0	1.3	0
Naphthalene	0.40	0.7	3.2	13
1,2,4-Trimethylbenzene	0.30	0.5	3.2	10
Reduced metals: Fe^{+2} and Mn^{+2}	20.00	34.7	0.1	20
1,2,3-trimethylbenzene	<- pull-down menu			
Measures of total oxygen demand				
Total Petroleum Hydrocarbons (see pull-down for Koc)	0.00	0.0	3.1	0
Biological Oxygen Demand (BOD)	0.00	0.0	1.0	0
Chemical Oxygen Demand (COD)	0.00	0.0	1.0	0

Parameters for Sorbed Phase Oxygen Demand:

Soil bulk density	1.76	g/cm^3 =	110	lb/cf
Fraction of organic carbon (foc)	0.002	range: 0.0001 to 0.01		

(Estimated using sorbed phase = foc*Koc*Cgw)	Koc	Contaminant Conc.	Contaminant Mass	Stoichiometry (wt/wt)	ORC-Adv Dose
(Adjust Koc as necessary to provide realistic estimates)	(L/kg)	(mg/kg)	(lb)	O_2/contaminant	(lb)
Benzene	123	0.06	0.6	3.1	10
Toluene	267	0.00	0.0	3.1	0
Ethylbenzene	327	0.00	0.0	3.2	0
Xylenes	298	1.01	9.4	3.2	177
MTBE	12	0.00	0.0	2.7	0
cis-1,2-DCE	80	0.00	0.0	0.7	0
Vinyl Chloride	2.5	0.00	0.0	1.3	0
Naphthalene	1000.0	0.80	7.4	3.2	140
1,2,4-Trimethylbenzene	884.0	0.53	4.9	3.2	93
Measures of total oxygen demand					
Total Petroleum Hydrocarbons	373	0.00	0.0	3.1	0

Summary of Estimated ORC-Adv Requirements	Dissolved Phase ORC-Adv Demand (lbs)	Sorbed Phase ORC-Adv Demand (lbs)	Additional Demand Factor (1 to 10x)	Total ORC-Adv Demand (lbs)	ORC-Adv Cost	
Total BTEX, MTBE, etc.	107	420	5.0	2,635	$22,525	<-
Total Petroleum Hydrocarbons	0	0	2.0	0	$0	
Biological Oxygen Demand (BOD)	0	0	2.0	0	$0	
Chemical Oxygen Demand (COD)	0	0	1.5	0	$0	

Required ORC-Adv quantity (in 25 lb increments) -------------------------------> **2,650** **pounds ORC-Adv**

Delivery Design for ORC-Adv Slurry

Spacing within rows (ft)	15.0	feet
# points per row	4	points/row
Spacing between rows (ft)	15.0	ft
# of rows	11	rows
Advective travel time bet. rows (days)	30	days
Number of points in grid	44	points
ORC-Adv application rate	6.0	lbs/foot
Total ORC-Adv required	**2,650**	lbs of ORC-Adv

Slurry Mixing Volume for Injections

Pounds per location	60	pounds
Buckets per location	2.4	buckets
Design solids content (20-40% by wt. for injections)	30%	
Volume of water required per hole (gal)	17	gallons
Total water for mixing all holes (gal)	741	gallons
Simple ORC-Adv Backfilling: min hole dia. for 67% slurry	4.1	inches
Feasibility for slurry injection in sand: ok up to 15 lb/ft	(ok)	
Feasibility for slurry injection in silt: ok up to 10 lb/ft	(ok)	
Feasibility for slurry injection in clay: ok up to 10 lb/ft	(ok)	

Project Summary			
Number of ORC-Adv delivery points (adjust as necessary for site)			44
ORC-Adv application rate in lbs/ft (adjust as necessary for site)			6.0
ORC-Adv bulk material for slurry injection (lbs)			2,650
Number of 25 lb ORC-Adv buckets			106.0
ORC-Adv bulk material cost		$	8.50
Cost for bulk ORC-Adv material		$	22,525
Shipping and Tax Estimates in US Dollars			
Sales Tax	rate: 0.00%	$	-
Total Material Cost		$	22,525
Shipping (call for amount)		$	-
Total Regenesis Material Cost		**$**	**22,525**

ORC-Adv Slurry Injection Cost Estimate (responsibility of customer to contract work)		
Footage for each point = uncontaminated interval + ORC-Adv injection interval (ft)		30
Total length for direct push for project (ft)		1,320
Estimated daily installation rate (ft per day: 300 for push, 150 for drilling)		300
Estimated points per day (10 to 30 is typical for direct push)		10.0
Required number of days		5
Mob/demob cost for injection subcontractor	$	400
Daily rate for injection subcontractor ($1-2K for push, $3-4K for drill rig)	$	1,500
Total injection subcontractor cost for application	$	7,900
Total Install Cost (not including consultant, lab, etc.)	**$**	**30,425**

Other Project Cost Estimates		
Design	$	-
Permitting and reporting	$	-
Construction management	$	-
Groundwater monitoring and rpts	$	-
Other	$	-
Other	$	-
Other	$	-
Other	$	-
Total Project Cost	**$**	**30,425**

APPENDIX C

ORC ADVANCED® MIXING & INJECTING INSTRUCTIONS

(As retrieved from Regenesis' Website.)

REGENESIS

DIRECTIONS FOR ORC *Advanced*™ SLURRY MIXING

1. Open the 5-gallon bucket and remove the pre-measured bag of ORC *Advanced* (each bag contains 25 lbs of ORC *Advanced*).

2. Measure and pour water into the 5-gallon bucket according to the desired slurry consistency (a slurry calculation table is available on the Regenesis software in the Appendix tab):

% Solids	Quantity of ORC *Advanced* (lbs)	Quantity of Water (gal)
65	25	1.6
60	25	2.0
55	25	2.5
50	25	3.0
45	25	3.7
40	25	4.5
35	25	5.6
30	25	7.0
25	25	9.0
20	25	12.0

3. Add the corresponding quantity of water to the pre-measured quantity of ORC *Advanced*.

4. Use an appropriate mixing device to thoroughly mix the ORC *Advanced* and water together. A hand-held drill with a "jiffy mixer" or a stucco mixer on it may be used in conjunction with a small paddle to scrape the bottom and sides of the container. Standard environmental slurry mixers may also be used, following the equipment instructions for operation. For small quantities, the slurry can be mixed by hand if care is taken to blend all lumps into the mixture thoroughly.

CAUTION: **ORC *Advanced* may settle out of slurry if left standing.** ORC *Advanced* eventually hardens into a cement-like compound and cannot be re-mixed after that has occurred. Therefore, mix immediately before using to ensure that the mixture has not settled out. **Do not let stand more than 30 minutes.** If a mechanical slurry mixer attached to a pump is being used, the material may be cycled back through the mixer to maintain slurry suspension and consistency.

Oxygen Release Compound (ORC®)
&
Advanced Formula Oxygen Release Compound (ORC Advanced™)

INSTALLATION INSTRUCTIONS

SAFETY

Pure ORC and ORC Advanced are shipped as fine white and pale yellow powders, respectively. ORC is considered to be a mild oxidizer while ORC Advanced is considered an oxidizer therefore both products should be handled with care while in the field. Field personnel should take precautions while installing either the ORC or ORC Advanced product. Typically, the operator should work upwind of the products as well as use the appropriate personal protection equipment (PPE) which includes eye, respiratory protection, and gloves as deemed appropriate by exposure duration and field conditions. In addition, personnel operating the field equipment utilized during installation activities should have appropriate training, supervision and experience.

GENERAL GUIDELINES

ORC/ORC Advanced can be installed in the contaminated saturated zone in the ground utilizing hand-augured holes, direct-push, hollow stem augers or air/mud-rotary drilling techniques. For optimum results, the ORC/ORC Advanced slurry should be installed across the entire vertical contaminated saturated thickness, including the capillary fringe and "smear zone."

Two general approaches are available for installation of these products. The first is to inject the ORC/ORC Advanced slurry through direct-push drive rods across the contaminated saturated zone and the second is to backfill the application points with the ORC/ORC Advanced slurry. Using the injection method should increase oxygen dispersion in the zone of interest over the life of the project because the ORC/ORC Advanced slurry affects a larger zone right from the start. If the backfill method is used more time may be required for the completion of the remediation process because oxygen distribution will be most likely be less.

It is important that the installation method and specific ORC/ORC Advanced slurry point location be established prior to field installation. It is also important that the ORC/ORC Advanced slurry volume and solids content for each drive point be pre-determined. The Regenesis Technical Services Group is available to discuss these issues. The Helpful Hints at the end of these instructions offers relevant information. Further information regarding ORC/ORC Advanced is available on the Regenesis website at www.regenesis.com.

SPECIFIC INSTALLATION PROCEDURES

1. Identify the location of all underground structures, including utilities, tanks, and distribution piping, sewers, drains, and landscape irrigation systems.

2. Identify surface and aerial impediments.

3. Adjust planned installation locations for all impediments and obstacles.

4. Pre-mark the installation grid/barrier point locations, noting any that have special depth requirements.

5. Set up the unit over each specific point, following manufacturer recommended standard operating procedures (SOP).

The section below contains instructions for augured-hole (hollow stem or air/mud rotary) applications. For direct-push applications, go to the following section.

Instructions for Augured Whole Applications

6. Hand augering and solid stem auger applications will generally require the soil matrix to stay open during auger removal. If this is the method being used, the ORC/ORC Advanced slurry should be installed immediately upon tool removal from the borehole.

7. Mix the appropriate quantity of ORC/ORC Advanced slurry for the current application point. Do not mix more slurry than will be used within a 30-minute period because the slurry could solidify and become useless.

8. Where soil conditions are unstable in the saturated zone, we recommend using a thicker ORC/ORC Advanced slurry. A solids content of 65-67% (consistency of toothpaste) is appropriate in these situations, since it comes relatively close to mimicking the density of soil.

9. **Tremie pipe option #1**: The slurry may be pumped through standard geotechnical slurry pumps and a tremie hose/pipe. We strongly recommend following the equipment manufacturer's standard operating instructions. Regenesis recommends that the tremie application be performed from the bottom of the hole up to the top of the capillary fringe. This is especially important if there is groundwater in the bottom of the installation hole, since it serves to maintain the densest portion of the ORC/ORC Advanced slurry mix.

10. **Tremie pipe option #2**: In relatively shallow situations, a tremie pipe may be used. Depending on the open hole diameter, a PVC tremie pipe with a one- to two-inch diameter may be used. The hole should be filled from the bottom of the hole to the top of the capillary fringe. It is normally a good idea, and may sometimes be a necessity, to use a "plunger" inside the tremie pipe to push the slurry through as the pipe is withdrawn. A funnel to pour slurry into the tremie pipe is advised.

11. **Hollow-stem auger option #1**: If the borehole being drilled would collapse during tool removal, augering applications require a hollow stem. By drilling with a plug in place, an open temporary source hole is created. The slurry may be installed with a tremie pipe or a tremie pump, following the pump manufacturer's operating instructions. Depending on the saturated zone soil conditions, it may be necessary to carefully coordinate the rate of auger withdrawal with the rate of slurry addition to preserve the hole void space for acceptance of the slurry.

12. **Hollow stem auger option #2 (auger as "tremie pipe")**: When soil conditions in the saturated zone are unstable and borehole collapse is likely, the hollow stem auger may be used as a tremie pipe. Prior to dropping the auger plug at the bottom of the hole, the ORC/ORC Advanced slurry is poured directly into the hollow stem, in a volume equal to the expected requirement for the hole. A plunger inside the auger is used to push the slurry down in the hole to keep it there as the auger is removed.

Skip the next section and proceed to Step 13.

For Direct-Push Applications

6. Push the drive rods (A 1.5-inch pre-probe can be used but is not recommended) with the detachable tip to the maximum desired depth. Standard drive rods (typically 1.25-inch O.D.) should be used. Pre-counted drive rods should be positioned prior to the installation driving procedure to assure the desired depth is reached.

7. Disconnect the drive rods from the implantable tip, following standard equipment procedures.

8. Mix the appropriate quantity of ORC/ORC Advanced slurry for the current injection point. Do not mix more slurry than will be used within a 30-minute period.

9. Set up and operate an appropriate slurry pump according to manufacturer's directions. Connect the pump to the probe puller/injector connector via a standard delivery hose. The hose is then attached to the drive rod with its quick disconnect fitting. Upon confirmation of all connections, add the ORC/ORC Advanced slurry to the pump hopper/tank.

10a. **Injection Application (if this is a backfill application, go to step 10b)**: While slowly withdrawing the drive rods, pump the pre-determined amount of ORC/ORC Advanced slurry into the aquifer. Typically, ORC/ORC Advanced injection rates are based on pounds of material installed per foot of vertical treatment. Observe pump pressure levels for indications of slurry dispersion and/or slurry refusal into aquifer (increasing pressure indicates reduced acceptance of material by the aquifer). As an optional pre-treatment step, pump one to two gallons of tap water into the aquifer to enhance dispersion pathways from the probe hole.

10b. **Backfill Application**: Pump the pre-determined quantity of ORC/ORC Advanced slurry into the borehole being treated. Observe pump pressure levels for indications of slurry dispersion and/or slurry refusal into aquifer (increasing pressure indicates reduced acceptance of material by the aquifer).

11. Remove one four-foot section of the drive rod. If the drive rod contains slurry, return it to the ORC/ORC Advanced bucket/pump hopper for reuse.

12. Repeat steps 10 and 11 until treatment of the entire targeted thickness has been achieved. It is generally recommended that the procedure extend to the top of the capillary fringe/smear zone.

13. Place an appropriate seal, such as bentonite, above the ORC/ORC Advanced slurry through the entire vadose zone. This helps ensure that the slurry stays in place and prevents contaminants from migrating go the surface. Depending on soil conditions and local regulations, a bentonite seal can be pumped through the grout pump or added via chips or pellets after the drive rods have been removed.

14. Remove and decontaminate the drive rods and pre-probe (optional).

15. Finish the probe hole at surface as appropriate (concrete or asphalt cap, if necessary).

16. Move to the next injection point, repeating steps 5 through 15.

HELPFUL HINTS

1) Physical characteristics

The ORC/ORC Advanced slurry is made using the dry ORC/ORC Advanced powder makes a smooth slurry, the consistency of which depends on the amount of water used.

A 65-67% solids content ORC/ORC Advanced slurry (consistency of toothpaste) is thick but can still be pumped easily. This solids content slurry is normally used for back filling a borehole or probe hole. It is especially useful in situations where maximum density is desired, such as when ground water is present in the hole or when there are heaving sands.

As a rule, it is best to mix the first batch of slurry at the maximum solids content one would expect to use. The slurry can then be thinned by adding water in small increments. By monitoring this process, the appropriate quantities of water for subsequent batches can be determined.

The slurry should be mixed at about the time it is expected to be used. It is best not to hold it for longer than 30 minutes. Thinner slurries can experience separation if they stand too long. All solids content ORC/ORC Advanced slurries have a tendency to form a weak cement when left standing for extended periods or time. If a slurry begins to thicken too much, it should be mixed again and additional water should be added.

The ORC/ORC Advanced slurry should not be left sitting inside a grout pump or hose for extended periods because it will begin to set-up and harden. This problem can generally be avoided by re-circulating the slurry through the pump and hose back into the pump's hopper or mixing tank.

2) ***Pump Equipment Cleaning and Maintenance***

Pumping equipment and drive rods can be lightly cleaned by circulating clear water through them. If necessary, further cleaning and decontamination should be performed according to the equipment supplier's standard procedures and local regulatory requirements.

3) ***General Operating Procedures for Backfill Applications***

When performing a backfill installation, it is important to fill the appropriate portion of the hole with a thick (65-67% solids content) slurry that will solidify in place. Moderate amounts of pressure should be used to avoid fracturing the soil matrix or pumping slurry into the soil.

The operator should use care and monitor pumping pressures and quantities to ensure that the hole is being filled without pushing excess material into the soil matrix. Ideally, the rate of slurry pumping will be coordinated with the rate of drive rod withdrawal. It is usually important to install the slurry material to the top of the capillary fringe.

In addition, it is important that the entire contaminated saturated zone is treated (including the capillary fringe), as this is often the location of highest contaminant concentrations. Failure to properly treat this area can undermine an otherwise successful remediation effort.

1011 Calle Sombra • San Clemente, CA 92673 • tel: 949.366.8000 • fax: 949.366.8090

tech@regenesis.com • www.regenesis.com

APPENDIX D

ORC ADVANCED® MSDS Sheets

(As retrieved from Regenesis' Website.)

Oxygen Release Compound – Advanced (ORC *Advanced*™)
MATERIAL SAFETY DATA SHEET (MSDS)

Last Revised: March 13, 2007

Section 1 - Material Identification

Supplier:

REGENESIS

1011 Calle Sombra
San Clemente, CA 92673

Phone:	**949.366.8000**
Fax:	**949.366.8090**
E-mail:	**info@regenesis.com**

Chemical Description:	A mixture of Calcium OxyHydroxide [$CaO(OH)_2$] and Calcium Hydroxide [$Ca(OH)_2$].
Chemical Family:	Inorganic Chemical
Trade Name:	Advanced Formula Oxygen Release Compound (ORC *Advanced*™)
Chemical Synonyms	Calcium Hydroxide Oxide; Calcium Oxide Peroxide
Product Use:	Used to remediate contaminated soil and groundwater (environmental applications)

Section 2 – Composition

CAS No.	Chemical
682334-66-3	**Calcium Hydroxide Oxide [$CaO(OH)_2$]**
1305-62-0	**Calcium Hydroxide [$Ca(OH)_2$]**
7758-11-4	**Dipotassium Phosphate (HK_2O_4P)**
7778-77-0	**Monopotassium Phosphate (H_2KO_4P)**

Section 3 – Physical Data

Form:	Powder
Color:	White to Pale Yellow
Odor:	Odorless
Melting Point:	527 °F (275 °C) – Decomposes
Boiling Point:	Not Applicable (NA)
Flammability/Flash Point:	NA
Auto- Flammability:	NA
Vapor Pressure:	NA
Self-Ignition Temperature:	NA
Thermal Decomposition:	527 °F (275 °C) – Decomposes
Bulk Density:	0.5 – 0.65 g/ml (Loose Method)
Solubility:	1.65 g/L @ 68° F (20° C) for calcium hydroxide.
Viscosity:	NA
pH:	11-13 (saturated solution)
Explosion Limits % by Volume:	Non-explosive
Hazardous Decomposition Products:	Oxygen, Hydrogen Peroxide, Steam, and Heat
Hazardous Reactions:	None

Section 4 – Reactivity Data

Stability:	Stable under certain conditions (see below).
Conditions to Avoid:	Heat and moisture.
Incompatibility:	Acids, bases, salts of heavy metals, reducing agents, and flammable substances.
Hazardous Polymerization:	Does not occur.

Section 5 – Regulations

TSCA Inventory List:	Listed

CERCLA Hazardous Substance (40 CFR Part 302)

Listed Substance:	No
Unlisted Substance:	Yes
Reportable Quantity (RQ):	100 pounds
Characteristic(s):	Ignitibility
RCRA Waste Number:	D001

SARA, Title III, Sections 302/303 (40 CFR Part 355 – Emergency Planning and Notification)

Extremely Hazardous Substance:	No

SARA, Title III, Sections 311/312 (40 CFR Part 370 – Hazardous Chemical Reporting: Community Right-To-Know

Hazard Category:	Immediate Health Hazard Fire Hazard
Threshold Planning Quantity:	10,000 pounds

Section 5 – Regulations (cont)

SARA, Title III, Section 313 (40 CFR Part 372 – Toxic Chemical Release Reporting: Community Right-To-Know

Extremely Hazardous Substance:	No	
WHMIS Classification:	C	Oxidizing Material Poisonous and Infectious Material
	D	Material Causing Other Toxic Effects – Eye and Skin Irritant
Canadian Domestic Substance List:	Not Listed	

Section 6 – Protective Measures, Storage and Handling

Technical Protective Measures

Storage:	Keep in tightly closed container. Store in dry area, protected from heat sources and direct sunlight.
Handling:	Clean and dry processing pipes and equipment before operation. Never return unused product to the storage container. Keep away from incompatible products. Containers and equipment used to handle this product should be used exclusively for this material. Avoid contact with water or humidity.

Section 6 – Protective Measures, Storage and Handling (cont)

Personal Protective Equipment (PPE)

Engineering Controls:	Calcium Hydroxide ACGIH® TLV® (2000) 5 mg/m^3 TWA OSHA PEL Total dust–15 mg/m^3 TWA Respirable fraction– 5 mg/m^3 TWA NIOSH REL (1994) 5 mg/m^3
Respiratory Protection:	For many conditions, no respiratory protection may be needed; however, in dusty or unknown atmospheres use a NIOSH approved dust respirator.
Hand Protection:	Impervious protective gloves made of nitrile, natural rubbber or neoprene.
Eye Protection:	Use chemical safety goggles (dust proof).
Skin Protection:	For brief contact, few precautions other than clean clothing are needed. Full body clothing impervious to this material should be used during prolonged exposure.
Other:	Safety shower and eyewash stations should be present. Consultation with an industrial hygienist or safety manager for the selection of PPE suitable for working conditions is suggested.
Industrial Hygiene:	Avoid contact with skin and eyes.
Protection Against Fire & Explosion:	NA

Section 7 – Hazards Identification

Emergency Overview:	Oxidizer – Contact with combustibles may cause a fire. This material decomposes and releases oxygen in a fire. The additional oxygen may intensify the fire.
Potential Health Effects:	Irritating to the mucous membrane and eyes. If the product splashes in ones face and eyes, treat the eyes first. Do not dry soiled clothing close to an open flame or heat source. Any

	clothing that has been contaminated with this product should be submerged in water prior to drying.
Inhalation:	High concentrations may cause slight nose and throat irritation with a cough. There is risk of sore throat and nose bleeds if one is exposed to this material for an extended period of time.
Eye Contact:	Severe eye irritation with watering and redness. There is also the risk of serious and/or permanent eye lesions.
Skin Contact:	Irritation may occur if one is exposed to this material for extended periods.
Ingestion:	Irritation of the mouth and throat with nausea and vomiting.

Section 8 – Measures in Case of Accidents and Fire

After Spillage/Leakage/Gas Leakage:	Collect in suitable containers. Wash remainder with copious quantities of water.
Extinguishing Media:	See next.
Suitable:	Large quantities of water or water spray. In case of fire in close proximity, all means of extinguishing are acceptable.
Further Information:	Self contained breathing apparatus or approved gas mask should be worn due to small particle size. Use extinguishing media appropriate for surrounding fire. Apply cooling water to sides of transport or storage vessels that are exposed to flames until the fire is extinguished. Do not approach hot vessels that contain this product.
First Aid:	After contact with skin, wash immediately with plenty of water and soap. In case of contact with eyes, rinse immediately with plenty of water and seek medical attention. Consult an opthalmologist in all cases.

Section 8 – Measures in Case of Accidents and Fire

Eye Contact:	Flush eyes with running water for 15 minutes, while keeping the eyelids wide open. Consult with an ophthalmologist in all cases.
Inhalation:	Remove subject from dusty environment. Consult with a physician in case of respiratory symptoms.

Ingestion:	If the victim is conscious, rinse mouth and admnister fresh water. DO NOT induce vomiting. Consult a physician in all cases.
Skin Contact:	Wash affected skin with running water. Remove and clean clothing. Consult with a physician in case of persistent pain or redness.
Special Precautions:	Evacuate all non-essential personnel. Intervention should only be done by capable personnel that are trained and aware of the hazards associated with this product. When it is safe, unaffected product should be moved to safe area.
Specific Hazards:	<u>Oxidizing substance</u>. Oxygen released on exothermic decomposition may support combustion. Confined spaces and/or containers may be subject to increased pressure. If product comes into contact with flammables, fire or explosion may occur.

Section 9 – Accidental Release Measures

Precautions:	Observe the protection methods cited in Section 3. Avoid materials and products that are incompatible with product. Immediately notify the appropriate authorities in case of reportable discharge (> 100 lbs).
Cleanup Methods:	Collect the product with a suitable means of avoiding dust formation. All receiving equipment should be clean, vented, dry, labeled and made of material that this product is compatible with. Because of the contamination risk, the collected material should be kept in a safe isolated place. Use large quantities of water to clean the impacted area. See Section 12 for disposal methods.

Section 10 – Information on Toxicology

Toxicity Data

Acute Toxicity:	Oral Route, LD_{50}, rat, > 2,000 mg/kg (powder 50%) Dermal Route, LD_{50}, rat, > 2,000 mg/kg (powder 50%) Inhalation, LD_{50}, rat, > 5,000 mg/m^3 (powder 35%)
Irritation:	Rabbit (eyes), severe irritant

Sensitization:	No data
Chronic Toxicity:	In vitro, no mutagenic effect (Powder 50%)
Target Organ Effects:	Eyes and respiratory passages.

Section 11 – Information on Ecology

Ecology Data	
	10 mg $Ca(OH)_2$/L: pH = 9.0
	100 mg $Ca(OH)_2$/L: pH = 10.6
Acute Exotoxicity:	Fishes, Cyprinus carpio, LC_{50}, 48 hrs, 160 mg/L
	Crustaceans, Daphnia sp., EC_{50}, 24 hours, 25.6 mg/L
	(Powder 16%)
Mobility:	Low Solubility and Mobility
Abiotic Degradation:	Water – Slow Hydrolysis. Degradation Products: Calcium Hydroxide Water/soil – complexation/precipitation. Carbonates/sulfates present at environmental concentrations. Degradation products: carbonates/sulfates sparingly soluble
Biotic Degradation:	NA (inorganic compound)
Potential for Bioaccumulation:	NA (ionizable inorganic compound)

Section 11 – Information on Ecology (cont)

Comments:	Observed effects are related to alkaline properties of the product. Hazard for the environment is limited due to the product properties of: • No bioaccumulation • Weak solubility and precipatation as carbonate or sulfate in an aquatic environment. Diluted product is rapidly neutralized at environmental pH.
Further Information:	NA

Section 12 – Disposal Considerations

Waste Disposal Method:	Consult current federal, state and local regulations regarding the proper disposal of this material and its emptied containers.

Section 13 – Shipping/Transport Information

D.O.T Shipping Name:	Oxidizing Solid, N.O.S [A mixture of Calcium OxyHydroxide [$CaO(OH)_2$] and Calcium Hydroxide [$Ca(OH)_2$].
UN Number:	1479
Hazard Class:	5.1
Label(s):	5.1 (Oxidizer)
Packaging Group:	II
STCC Number:	4918717

Section 14 – Other Information

HMIS® Rating	Health – 2 Flammability – 0	Reactivity – 1 PPE - Required

HMIS® is a registered trademark of the National Painting and Coating Association.

NFPA® Rating	Health – 2 Flammability – 0	Reactivity – 1 OX

NFPA® is a registered trademark of the National Fire Protection Association.

Reason for Issue: Update toxicological and ecological data

Section 15 – Further Information

The information contained in this document is the best available to the supplier at the time of writing, but is provided without warranty of any kind. Some possible hazards have been determined by analogy to similar classes of material. The items in this document are subject to change and clarification as more information become available.

APPENDIX E

HEALTH AND SAFETY PLAN

Health and Safety Plan

For

Former Fire Training Area
and
Waste Oil Dump Site 16
NASA Wallops Flight Facility
Wallops Island, Virginia

National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility

May 2008

HEALTH AND SAFETY PLAN

FOR

FORMER FIRE TRAINING AREA
AND
WASTE OIL DUMP SITE 16
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY CONTRACT

Submitted to:
National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility
Building F-160, Code 250.W
Wallops Island, Virginia 23337

Submitted by:
Tetra Tech NUS, Inc.
234 Mall Boulevard, Suite 260
King of Prussia, Pennsylvania 19406

CONTRACT NO. N62472-03-D-0057
CONTRACT TASK ORDER 0012

MAY 2008

PREPARED UNDER THE SUPERVISION OF:	APPROVED FOR SUBMITTAL BY:
	Matthew M. Soltis
GARTH GLENN PROJECT MANAGER TETRA TECH NUS, INC. NORFOLK, VIRGINIA	MATTHEW SOLTIS, CIH, CSP. CLEAN HEALTH & SAFETY MANAGER TETRA TECH NUS, INC. PITTSBURGH, PENNSYLVANIA

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1.0 INTRODUCTION

The objective of this Health and Safety Plan (HASP) is to provide the safety and health requirements, restrictions, practices and procedures for Tetra Tech NUS, Inc. (TtNUS) personnel participating in soil boring via Direct Push Technology (DPT), groundwater sampling and (ORC) Oxygen Release Compound injection at the Former Fire Training Area at NASA Wallops Flight Facility (WWF) Wallops Island, Virginia.

This HASP is to be used in conjunction with the Tetra Tech NUS Health and Safety Guidance Manual. The Guidance Manual provides detailed information pertaining to hazard recognition and control, and TtNUS standard operating procedures. This HASP and the contents of the Guidance Manual were developed to comply with the requirements stipulated in 29 CFR 1910.120 (OSHA's Hazardous Waste Operations and Emergency Response Standard). Both documents must be present at the site to satisfy these requirements.

This HASP has been written to support proposed tasks and techniques associated with the scope of work as presented in Section 4.0. It has been developed using the latest available information regarding known or suspected chemical contaminants and potential physical hazards associated with the proposed work at the site. Should the proposed work site conditions and/or suspected hazards change, or if new information becomes available, this document will be modified. Changes to the HASP will be made with the approval of the TtNUS Site Safety Officer (SSO) and the TtNUS Health and Safety Manager (HSM). Requests for modifications to the HASP will be directed to the SSO who will determine whether to make the changes. The SSO will notify the Project Manager (PM), who will notify the affected personnel of changes.

1.1 AUTHORITY

This work is authorized under the Comprehensive Long - Term Environmental Action Navy (CLEAN) contract, administered through the U.S. Navy Southeast, Naval Facilities Engineering Command, as defined under Contract No. N62467-04-D-0055; Contract Task Order Number 012.

1.2 KEY PROJECT PERSONNEL AND ORGANIZATION

This section defines responsibilities for site safety and health for TtNUS employees conducting the DPT soil boring, groundwater sampling and ORC Injection and other supporting field activities under this field effort. All personnel assigned to participate in the field work have the primary responsibility for performing all of their work tasks in a manner that is consistent with the TtNUS Health and Safety Policy, the health and safety training that they have received, the contents of this HASP, and in an overall manner that protects their personal safety and health and that of their co-workers. The following persons are the primary point of contact and have the primary responsibility for observing and implementing this HASP and for overall on-site health and safety.

- The TtNUS PM is responsible for the overall direction and implementation of health and safety for this work.

- The TtNUS Field Operations Leader (FOL) is responsible for implementation of this HASP. The FOL manages field activities, executes the Work Plan, and enforces safety procedures as applicable to the Work Plan. Specifically, the FOL will:

  - Verify training and medical status of on-site personnel in relation to site activities.
  - Assist and represent TtNUS with emergency services (if needed)
  - Provide elements site-specific training for on site personnel.

- The TtNUS Site Safety Officer (SSO) or his/her representative supports the FOL concerning the aspects of health and safety including, but not limited to:

  - Coordinating health and safety activities
  - Selecting, applying, inspecting, and maintaining personal protective equipment
  - Establishing work zones and control points
  - Implementing air monitoring procedures
  - Implementing hazard communication, respiratory protection, and other associated safety and health programs
  - Coordinating emergency services
  - Providing elements of site-specific training

- Compliance with these requirements is monitored by the Project Health and Safety Officer (PHSO) and is coordinated through the HSM.

1.3 SITE INFORMATION AND PERSONNEL ASSIGNMENTS

Site Name: NASA Wallops Flight Facility **Address:** Wallops Island, Virginia

Remedial Project Manager: Carolyn Turner **Phone Number:** 747-824-1720

Site Contact: T.J. Meyer **Phone Number:** 747-824-1987

Site Address: Wallops Island, Virginia 23337

Purpose of Site Visit: Pilot study to determine if the application of Oxygen Releasing compounds can reduce SVOC's and VOC's

Proposed Start-up Date: .May 2008 till completion

Project Team:

TtNUS Personnel:	Discipline/Tasks Assigned:
Garth Glenn,	Project Manager (PM)
TBD	Field Operations Leader
Matthew M. Soltis, CIH, CSP	Health and Safety Manager (HSM)
Clyde J. Snyder	Project Health and Safety Officer (PHSO)
TBD	Site Safety Officer

Prepared by: Clyde J. Snyder

2.0 EMERGENCY ACTION PLAN

2.1 INTRODUCTION

This section has been developed as part of a planning effort to direct and guide field personnel in the event of an emergency. In the event of an emergency, the field team will primarily evacuate and assemble to an area unaffected by the emergency and notify the appropriate local emergency response personnel/agencies. TtNUS personnel are not authorized to participate in any emergency response activities. Workers who are ill or who have suffered a non-serious injury may be transported by site personnel to nearby medical facilities, provided that such transport does not aggravate or further endanger the welfare of the injured/ill person. The emergency response agencies listed in this plan are capable of providing the most effective response, and as such, will be designated as the primary responders. These agencies are located within a reasonable distance from the area of site operations, which ensures adequate emergency response time. The Navy RPM will be notified if outside response agencies are contacted.

TtNUS personnel may participate in minor event response and emergency prevention activities such as:

- Initial fire-fighting support and prevention
- Initial spill control and containment measures and prevention
- Removal of personnel from emergency situations
- Provision of initial medical support for injury/illness requiring only first-aid level support
- Provision of site control and security measures as necessary

2.2 EMERGENCY PLANNING

Through the initial hazard/risk assessment effort, emergencies resulting from chemical, physical, or fire hazards are the types of emergencies which could be encountered during site activities. To minimize or eliminate the potential for these emergency situations, pre-emergency planning activities will include the following (which are the responsibility of the SSO and/or the FOL):

- Coordinating with the Municipal Emergency Response personnel to ensure that TtNUS emergency action activities are compatible with existing emergency response procedures.

- Establishing and maintaining information at the project staging area (support zone) for easy access in the event of an emergency. This information will include the following:

  - Chemical Inventory (of chemicals used onsite), with Material Safety Data Sheets.

- Onsite personnel medical records (Medical Data Sheets).
- A log book identifying personnel onsite each day.
- Hospital route maps with directions (these should also be placed in each site vehicle).
- Emergency Notification - phone numbers.

The TtNUS FOL will be responsible for the following tasks:

- Identifying a chain of command for emergency action.
- Educating site workers to the hazards and control measures associated with planned activities at the site, and providing early recognition and prevention, where possible.
- Periodically performing practice drills to ensure site workers are familiar with incidental response measures.
- Providing the necessary equipment to safely accomplish identified tasks.

2.3 EMERGENCY RECOGNITION AND PREVENTION

2.3.1 Recognition

Emergency situations that may be encountered during site activities will generally be recognized by visual observation. Visual observation will also play a role in detecting potential exposure events to some chemical hazards. To adequately recognize chemical exposures, site personnel must have a clear knowledge of signs and symptoms of exposure associated with the principle site contaminants of concern as presented in this HASP. Tasks to be performed at the site, potential hazards associated with those tasks and the recommended control methods are discussed in detail in Sections 5.0 and 6.0. Additionally, early recognition of hazards will be supported by daily site surveys to eliminate any situation predisposed to an emergency. The FOL and/or the SSO will be responsible for performing surveys of work areas prior to initiating site operations and periodically while operations are being conducted. Survey findings are documented by the FOL and/or the SSO in the Site Health and Safety logbook; however, site personnel will be responsible for reporting hazardous situations. Where potential hazards exist, TtNUS will initiate control measures to prevent adverse effects to human health and the environment.

The above actions will provide early recognition for potential emergency situations, and allow TtNUS to instigate necessary control measures. However, if the FOL and the SSO determine that control measures are not sufficient to eliminate the hazard; TtNUS will withdraw from the site and notify the appropriate response agencies listed in Table 2-1.

2.3.2 Prevention

TtNUS and subcontractor personnel will minimize the potential for emergencies by following the Health and Safety Guidance Manual and ensuring compliance with the HASP and applicable OSHA regulations. Daily site surveys of work areas, prior to the commencement of that day's activities, by the FOL and/or the SSO will also assist in prevention of illness/injuries when hazards are recognized early and control measures initiated.

2.4 EVACUATION ROUTES, PROCEDURES, AND PLACES OF REFUGE

An evacuation will be initiated whenever recommended hazard controls are insufficient to protect the health, safety or welfare of site workers. Specific examples of conditions that may initiate an evacuation include, but are not limited to the following: severe weather conditions; fire or explosion; monitoring instrumentation readings which indicate levels of contamination are greater than instituted action levels; and evidence of personnel overexposure to potential site contaminants.

In the event of an emergency requiring evacuation, personnel will immediately stop activities and report to the designated safe place of refuge unless doing so would pose additional risks. When evacuation to the primary place of refuge is not possible, personnel will proceed to a designated alternate location and remain until further notification from the TtNUS FOL. Safe places of refuge will be identified prior to the commencement of site activities by the SSO and will be conveyed to personnel as part of the pre-activities training session. This information will be reiterated during daily safety meetings. Whenever possible, the safe place of refuge will also serve as the telephone communications point for that area. During an evacuation, personnel will remain at the refuge location until directed otherwise by the TtNUS FOL or the on-site Incident Commander of the Emergency Response Team. The FOL or the SSO will perform a head count at this location to account for and to confirm the location of site personnel. Emergency response personnel will be immediately notified of any unaccounted personnel. The SSO will document the names of personnel onsite (on a daily basis) in the site Health and Safety Logbook. This information will be utilized to perform the head count in the event of an emergency.

Evacuation procedures will be discussed during the pre-activities training session, prior to the initiation of project tasks. Evacuation routes from the site and safe places of refuge are dependent upon the location at which work is being performed and the circumstances under which an evacuation is required. Additionally, site location and meteorological conditions (i.e., wind speed and direction) may dictate evacuation routes. As a result, assembly points will be selected and communicated to the workers relative to the site location where work is being performed. Evacuation should always take place in an upwind direction from the site.

2.5 EMERGENCY CONTACTS

Prior to initiating field activities, personnel will be thoroughly briefed on the emergency procedures to be followed in the event of an accident. Table 2-1 provides a list of emergency contacts and their associated telephone numbers. This table must be posted where it is readily available to site personnel. Facility maps should also be posted showing potential evacuation routes and designated meeting areas.

As soon as possible, Navy contact will be informed of any incident or accident that requires medical attention.

Any pertinent information regarding allergies to medications or other special conditions will be provided to medical services personnel. This information is listed on Medical Data Sheets filed onsite (See Attachment I). If an exposure to hazardous materials has occurred, provide hazard information from Table 6-1 to medical service personnel.

TABLE 2-1
EMERGENCY CONTACTS

WALLOPS FLIGHT FACILITY WALLOPS ISLAND, VIRGINIA

AGENCY	TELEPHONE
EMERGENCY (WFF Land Line) - Fire, Security, Emergency Medical Services	911
Site Emergency From a Cell Phone	**(757) 824-1333**
Peninsula Regional Medical Center	(410) 546-6400
Chemtrec	(800) 424-9300
National Response Center	(800) 424-8802
Virginia Utility One Call (Miss Utility of Virginia)	(800) 552-7001
Virginia Poison Control	(800) 222-1222
NASA Point of Contact, Carolyn Turner	(757) 824-1720
Base Safety Office:	
Alyson Cornell	(757) 824-1884
Terry Potterton	(757) 824-1498
Marvin Bunting	(757) 824-2030
Project Manager, Garth Glenn	(610) 491-9688
Project Health and Safety Officer, Clyde Snyder	412-921-8904
CLEAN Health and Safety Manager, Matthew M. Soltis, CIH, CSP	(412) 921-8912

2.6 EMERGENCY ROUTE TO HOSPITAL

ROUTE TO MEDICAL CENTER

TtNUS will notify WFF Emergency Services of any serious illness or injury. However workers who are ill or who have suffered a non-serious injury may be transported to the Peninsula Regional Medical Center provided the transport can be completed in a safe manner for the injured or ill person.

Peninsula Regional Medical Center
100 East Carroll Street
Salisbury, MD 21801-5493
410-546-6400

Take Virginia Route 175 for 10.5 miles.

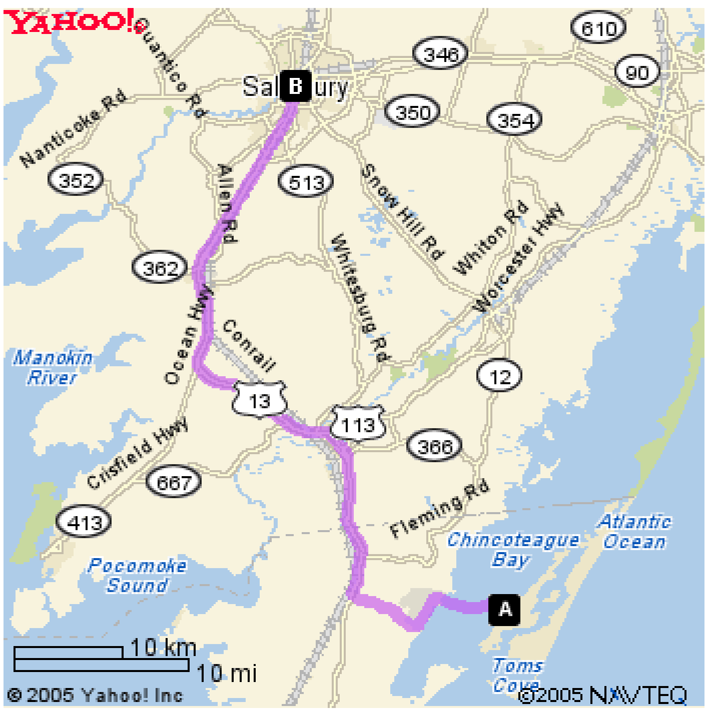
Turn right on US 13 North.

Continue straight into Maryland approximately 31 miles.

Take the ramp onto US 13 Business North toward Salisbury/Fruitland and go 5 miles.

At Carroll St turn left and the facility will be on the left.

FIGURE 2-1
ROUTE TO MEDICAL CENTER



2.7 EMERGENCY ALERTING AND ACTION/RESPONSE PROCEDURES

TtNUS personnel will be working in close proximity to each other at NASA Wallops Island and other work sites associated with the ORC Pilot Study. As a result, hand signals, voice commands, and line of site communication will be sufficient to alert site personnel of an emergency.

If an emergency warranting evacuation occurs, the following procedures are to be initiated:

- Initiate the evacuation via hand signals, voice commands, or line of site communication
- Report to the designated refuge point where the FOL will account for all personnel
- Once non-essential personnel are evacuated, appropriate response procedures will be enacted to control the situation.
- Describe to the FOL (FOL will serve as the Incident Coordinator) pertinent incident details.

In the event that site personnel cannot mitigate the hazardous situation, the FOL and SSO will enact emergency notification procedures to secure additional assistance in the following manner:

Dial 911 and call other pertinent emergency contacts listed in Table 2-1 and report the incident. Give the emergency operator the location of the emergency, the type of emergency, the number of injured, and a brief description of the incident. Stay on the phone and follow the instructions given by the operator. The operator will then notify and dispatch the proper emergency response agencies.

2.8 PPE AND EMERGENCY EQUIPMENT

A first-aid kit, eye wash units (or bottles of disposable eyewash solution) and fire extinguishers (strategically placed) will be maintained onsite and shall be immediately available for use in the event of an emergency. This equipment will be located in the field office as well as in each site vehicle. At least one first aid kit supplied with equipment to protect against bloodborne pathogens will also be available on site. Personnel identified within the field crew with bloodborne pathogen and first-aid training will be the only personnel permitted to offer first-aid assistance.

2.9 DECONTAMINATION PROCEDURES / EMERGENCY MEDICAL TREATMENT

During any site evacuation, decontamination procedures will be performed only if doing so does not further jeopardize the welfare of site workers. Decontamination will not be performed if the incident warrants immediate evacuation. However, it is unlikely that an evacuation would occur which would require workers to evacuate the site without first performing the necessary decontamination procedures.

TtNUS personnel will perform rescue operations from emergency situations and may provide initial medical support for injury/illnesses requiring only "Basic First-Aid" level support, and only within the limits of training obtained by site personnel. Basic First-Aid is considered treatment that can be rendered by a trained first aid provider at the injury location and not requiring follow-up treatment or examination by a physician (for example; minor cuts, bruises, stings, scrapes, and burns). Not included as Basic First-Aid are second or third degree burns, cuts, lacerations requiring stitches or butterfly bandaging, heat exhaustion, severe poisonous plant or insect bite reactions. Personnel providing medical assistance are required to be trained in First-Aid and in the requirements of OSHA's Bloodborne Pathogen Standard (29 CFR 1910.1030). Medical attention above First-Aid level support will require assistance from the designated emergency response agencies. Attachment II provides the procedure to follow when reporting an injury/illness, and the form to be used for this purpose. **If the emergency involves personnel exposures to chemicals, follow the steps provided in Figure 2-2.**

2.10 INJURY/ILLNESS REPORTING

If any TtNUS personnel are injured or develop an illness as a result of working on site, the TtNUS “Incident Report Form” (Attachment II) must be followed. Filling out this form is necessary for documenting of the information obtained at the time of the incident. In addition any onsite injury must also be reported to NASA via the Mishap Report Form contained in Attachment II.

Any pertinent information regarding allergies to medications or other special conditions will be provided to medical services personnel. This information is listed on Medical Data Sheets filed onsite. If an exposure to hazardous materials has occurred, provide information on the chemical, physical, and toxicological properties of the subject chemical(s) to medical service personnel.

FIGURE 2-2

POTENTIAL EXPOSURE PROTOCOL

The purpose of this protocol is to provide guidance for the medical management of injury situations.

In the event of a personnel injury or accident:

- Rescue, when necessary, employing proper equipment and methods.
- Give attention to emergency health problems -- breathing, cardiac function, bleeding, and shock.
- Transfer the victim to the medical facility designated in this HASP by suitable and appropriate conveyance (i.e. ambulance for serious events)
- Obtain as much exposure history as possible (a Potential Exposure report is attached).
- If the injured person is a Tetra Tech NUS employee, call the medical facility and advise them that the patient(s) is/are being sent and that they can anticipate a call from the WorkCare physician. WorkCare will contact the medical facility and request specific testing which may be appropriate. WorkCare physicians will monitor the care of the victim. Site officers and personnel should not attempt to get this information, as this activity leads to confusion and misunderstanding.
    - Call WorkCare at 1-800-455-6155 and enter Extension 109, being prepared to provide:
        - Any known information about the nature of the injury.
        - As much of the exposure history as was feasible to determine in the time allowed.
        - Name and phone number of the medical facility to which the victim(s) has/have been taken.
        - Name(s) of the involved Tetra Tech NUS, Inc. employee(s).
        - Name and phone number of an informed site officer who will be responsible for further investigations.
        - Fax appropriate information to WorkCare at (714) 456-2154.
- Contact Corporate Health and Safety Department (Matt Soltis) and Human Resources Department (Marilyn Duffy) at 1-800-245-2730.

As data is gathered and the scenario becomes more clearly defined, this information should be forwarded to WorkCare.

WorkCare will compile the results of data and provide a summary report of the incident. A copy of this report will be placed in each victim's medical file in addition to being distributed to appropriately designated company officials.

Each involved worker will receive a letter describing the incident but deleting any personal or individual comments. A personalized letter describing the individual findings/results will accompany this generalized summary. A copy of the personal letter will be filed in the continuing medical file maintained by WorkCare.

FIGURE 2-2 (continued)
WORKCARE

POTENTIAL EXPOSURE REPORT

Name: ______________________ Date of Exposure: ______________

Social Security No.: ______________ Age: ________ Sex: __________

Client Contact: ______________________ Phone No.: ______________

Company Name: ______________________

I. Exposing Agent

Name of Product or Chemicals (if known):______________________

____

Characteristics (if the name is not known)

Solid Liquid Gas Fume Mist Vapor

II. Dose Determinants

What was individual doing?______________________

How long did individual work in area before signs/symptoms developed? ______________

Was protective gear being used? If yes, what was the PPE? ______________

Was their skin contact? ______________________

Was the exposing agent inhaled?______________________

Were other persons exposed? If yes, did they experience symptoms? ______________

III. Signs and Symptoms (check off appropriate symptoms)

<u>Immediately With Exposure:</u>

Burning of eyes, nose, or throat
Tearing
Headache
Cough
Shortness of Breath
Chest Tightness / Pressure
Nausea / Vomiting
Dizziness
Weakness

<u>Delayed Symptoms:</u>

Weakness
Nausea / Vomiting
Shortness of Breath
Cough
Loss of Appetite
Abdominal Pain
Headache
Numbness / Tingling

IV. Present Status of Symptoms (check off appropriate symptoms)

Burning of eyes, nose, or throat
Tearing
Headache
Cough
Shortness of Breath
Chest Tightness / Pressure
Cyanosis
Nausea / Vomiting
Dizziness
Weakness
Loss of Appetite
Abdominal Pain
Numbness / Tingling

Have symptoms: (please check off appropriate response and give duration of symptoms)

Improved: ________ Worsened: _______ Remained Unchanged: _______

V. Treatment of Symptoms (check off appropriate response)

None: ___________ Self-Medicated: _______ Physician Treated: _______

3.0 SITE BACKGROUND

3.1 SITE HISTORY AND CURRENT OPERATIONS

The (WFF) is located in Accomack County, on the Eastern Shore of the Commonwealth of Virginia. The facility is comprised of three separate areas, the Main Base (MB), the Mainland (ML), and Wallops Island (WI). These three areas are in close proximity to each other and total approximately 5,000 acres of landmass and 1,000 acres of marshland. The most heavily developed area is the MB (about 1900 acres) which includes administrative and technical offices, tracking and data acquisition components, the range control center, rocket motor storage and processing facilities, research and development facilities, airfield and control tower, aircraft hangar and maintenance facilities, and Navy administration and housing areas.

3.2 INVESTIGATION AREAS

The Former Fire Training Area (FFTA) and the Waste Oil Dump (WOD) (Site 16) are both located within the MB area.

3.2.1 FFTA

Environmental investigations at the FFTA began in 1986 after a Virginia inspection noted the presence of possible petroleum products in the fire training area. NASA responded to this finding by conducting a soil excavation and disposal in that same year. From 1990 through 1992 additional investigations including soil gas surveys and soil and groundwater sampling were conducted at the FFTA. Based on the finding that a potential for groundwater contamination and exposure existed, NASA initiated Remedial Investigation (RI) activities in 1993. RI activities included the completion of soil gas surveys, soil boring and sampling programs, monitoring well installation and groundwater sampling, and surface soil sampling. Based on the findings of the RI an FS was completed in 1997. Additional groundwater sampling and further human health risk assessment evaluations were completed between 1997 and 2000.

The FFTA is located adjacent to an abandoned runway and was used for fire fighting training exercises from 1965 to 1987. Fuels, waste solvents, and other combustibles were released into an open tank or below grade pit and ignited as part of the exercises. The open tank and pit were removed by NASA and a soil excavation and disposal operation was completed in 1986. The area is an open grass field surround by areas of higher elevation. No samples were collected at the time of the removal. However, subsequent to the removal investigations conducted from 1988 through 2000 have included the performance of soil gas surveys, magnetometer surveys, surface and subsurface soil sampling, soil boring, monitoring well installation, and groundwater sampling. The analytical data from these investigations has been evaluated and presented in a series of reports including preliminary assessments, site investigations, remedial investigations, human and ecological risk assessments, and feasibility studies.

3.2.2 Waste Oil Dump Site (WOD) (Site 16)

The WOD Site 16 history is similar to that of the FFTA. NASA conducted a soils removal action at WOD Site 16 in 1986 shortly after an area of petroleum impacted soils were noted during a Virginia site inspection. In 1988 a preliminary assessment of the area was conducted. As a follow-up to the preliminary assessment, a site inspection, including soil, groundwater and sediment sampling and a soil gas survey was conducted in 1989. Based on the results of the soil gas study additional surveys and sampling were conducted in 1990. Based on these investigations it was concluded that no further action was necessary at Site 16. During the performance of a RI at an adjacent Former Used Defense Site (FUD) (Site 15) groundwater contamination was discovered and thought to be originating from the Site 16 area. Upon further investigation a previously unknown area of surface disposal was discovered at Site 16. In response to this finding a full RI was initiated at WOD Site 16 in 1998 and completed in 2000.

WOD Site 16 is located at the end of an active runway and is an unimproved open plot of land that extends out in a peninsula-like manner into marshland adjacent to Little Mosquito Creek. WOD Site 16 was the site of waste oil and solvent disposal for an unknown period of time from the mid-1940's to the mid-1950's. The exact quantity and nature of material disposed at WOD Site 16 is not documented. In 1986 an inspection of the area identified what appeared to be waste petroleum residues in the area. At that time NASA conducted an extensive excavation and off-site disposal operation that removed 180 cubic yards of petroleum impacted soils. No sampling was conducted at that time. Subsequent investigations in the area conducted from 1988 through 2000 have included the performance of soil gas surveys, magnetometer surveys, surface and subsurface soil sampling, soil boring, monitoring well installation, and groundwater sampling. The analytical data from these investigations has been evaluated and presented in a series of reports including preliminary assessments, site investigations, remedial investigations, human and ecological risk assessments, and feasibility studies.

4.0 SCOPE OF WORK

This section of the HASP addresses proposed site activities for the Pilot Study:

- Mobilization and Demobilization

- Installation of DPT soil borings in the area up gradient of monitoring wells MW-61I and 15GW-7. Three DPT locations will be used to inject ORC® and the six remaining locations will be installed between the injection points and completed as temporary 1.5-inch diameter monitoring wells to monitor the radius of influence of the injections. Influence will be determined though geochemical parameter measurements in MW-61I and 15GW-7 and the DPT monitoring locations.

- The injection and monitoring points will be surveyed by a surveyor licensed in the Commonwealth of Virginia.

- Sampling and analysis of groundwater at MW-61I and 15GW-7, the temporary monitoring points and a background monitoring wells to evaluate water quality parameters and contaminant concentrations, including one baseline sampling event prior to injection activities and three post-injection sampling events (one day, one week and one month following the injection event).

- Decontamination of DPT, ORC and sampling equipment.

- IDW Waste Management

No other activities are anticipated to be necessary. If it becomes apparent that additional or modified tasks must be performed beyond those listed above, the work is not to proceed until the FOL or SSO notifies the Project Manager and the HSM, so that any appropriate modifications to this HASP can first be developed and communicated to the intended task participants.

5.0 IDENTIFYING AND COMMUNICATING TASK-SPECIFIC HAZARDS AND GENERAL SAFE WORK PRACTICES

The purpose of this section is to identify the anticipated hazards and appropriate hazard prevention/hazard control measures that are to be observed for each planned task or operation. These topics have been summarized for each planned task through the use of task-specific Safe Work Permits (SWPs), which are to be reviewed in the field by the SSO with all task participants prior to initiating any task. Additionally, potential hazard and hazard control matters that are relevant but are not necessarily task-specific are addressed it the following portions of this section.

Section 6.0 presents additional information on hazard anticipation, recognition, and control relevant to the planned field activities.

5.1 GENERAL SAFE WORK PRACTICES

In addition to the task-specific work practices and restrictions identified in the SWPs attached to this HASP, the following general safe work practices are to be followed when conducting work on-site.

- Eating, drinking, chewing gum or tobacco, taking medication, or smoking in contaminated or potentially contaminated areas or where the possibility for the transfer of contamination exists is prohibited.

- Wash hands and face thoroughly upon leaving a contaminated or suspected contaminated area. If a source of potable water is not available at the work site that can be used for hands-washing, the use of waterless hands cleaning products will be used, followed by actual hands-washing as soon as practicable upon exiting the site.

- Avoid contact with potentially contaminated substances including puddles, pools, mud, or other such areas. Avoid, kneeling on the ground or leaning or sitting on equipment. Keep monitoring equipment away from potentially contaminated surfaces.

- Plan and mark entrance, exit, and emergency evacuation routes.

- Rehearse unfamiliar operations prior to implementation.

- Buddies should maintain visual contact with each other and with other on-site team members by remaining in close proximity to assist each other in case of emergency.

- Establish appropriate safety zones including support, contamination reduction, and exclusion zones.

- Minimize the number of personnel and equipment in contaminated areas (such as the exclusion zone). Non-essential vehicles and equipment should remain within the support zone.

- Establish appropriate decontamination procedures for leaving the site.

- Immediately report all injuries, illnesses, and unsafe conditions, practices, and equipment to the SSO.

- Observe co-workers for signs of toxic exposure and heat or cold stress.

- Inform co-workers of potential symptoms of illness, such as headaches, dizziness, nausea, or blurred vision.

5.2 DPT/DRILLING SAFE WORK PRACTICES

The following safe work practices are to be followed when working in or around drill rig/DPT operations.

- Identify underground utilities and buried structures before drilling. Use the Utility Locating and Excavation Clearance SOP provided in Section 7 of the Health and Safety Guidance Manual.

- Drill/DPT rigs will be inspected by the SSO or designee, prior to the acceptance of the equipment at the site and prior to the use of the equipment.

- Any repairs or deficiencies identified during the inspection will be corrected prior to use.

- The inspection will be documented using the Equipment Inspection Checklist provided in Attachment III.

- Equipment Inspections will be conducted once each shift (either 5 or 10 day) or following repairs.

- Equipment and staging lay down areas will be established keep the work area clear of clutter and slips, trips, and fall hazards.

- The drill operator shall verbally alert employees and visually ensure employees are clear from dangerous parts of equipment before starting or engaging equipment.

- One person shall be responsible for emergency shut-off switch operation during drilling operation, such that the machinery can be shutdown quickly if another person is in danger. The identity of this person will be made known to personnel in the drilling area.

- Secure frayed or loose clothing, hair, and jewelry when working with operating equipment.

- Minimize contact to the extent possible with contaminated tooling and environmental media.

- Support functions (sampling and screening stations) will be maintained a minimum distance from the drill/DPT rig of the height of the mast plus five feet to remove these activities from within physical hazard boundaries.

- Only qualified operators and knowledgeable ground crew personnel will participate in the operation of the drill/DPT rig.

- Only personnel absolutely essential to the work activity will be allowed in the exclusion zone. Site visitors will be escorted.

- Equipment that comes into direct contact with potentially contaminated media will undergo a complete decontamination prior to moving to the next location, exiting the site, or prior to down time for maintenance.

- Whenever possible, motorized equipment will be fueled prior to the commencement of the day's activities.

- During fueling operations on site, equipment will be shutdown and bonded to the fuel provider to prevent the potential accumulation of static charges.

- When not in use drill/DPT rigs will be shutdown, emergency brakes set, and wheels chocked where hilly terrain is present.

Areas subjected to subsurface investigative methods will be restored to equal or better condition than original to the extent practical to remove contamination brought to the surface and to remove physical hazards. In situations where these hazards cannot be removed these areas will be barricaded to minimize the impact on field crews working in the area.

6.0 HAZARD ASSESSMENT AND CONTROLS

This section provides reference information regarding the chemical and physical hazards which may be associated with activities that are to be conducted as part of the scope of work.

6.1 CHEMICAL HAZARDS

Previous analytical data determined the presence of various volatile organic compounds (VOCs). Based on an evaluation of these data, and historical information about the site, the primary contaminants of concern (COC) at this site are Benzene and Vinyl Chloride. Other VOCs have been detected, but an evaluation of the data indicate that will not likely be encountered at concentrations that would represent a reasonable exposure concern.

Properties and Exposure Signs/Symptoms

TABLE 6-1

COMPARISON OF WORST-CASE PCE AIR CONCENTRATIONS WITH CURRENT OCCUPATIONAL EXPOSURE LIMITS

Contaminant of Concern	Highest Concentration Previously Detected in Water	Worst-Case Air Concentration That Could Be Encountered	Current OSHA PEL And ACGIH TLV
Benzene	28 ug/l	1.94	OSHA: 1 PPM TWA 1 PPM STEL ACGIH: 0.5 PPM TWA_8 2.5 PPM STEL
Vinyl Chloride	6 ug/l	2.67	OSHA: 1 PPM TWA_8 5 PPM STEL ACGIH: 1 PPM TWA_8 NA STEL

Table Notes:

TWA_8: Average air concentration over an 8-hour work period that is not to be exceeded

OSHA STEL: Concentration in air that is not to be exceed for more than 5 minutes in any 3 hour period

ACGIH STEL: Concentration in air that is not be exceeded for more than 15 minutes more than 4 times per day

Benzene

Benzene is a highly flammable liquid the odor of benzene can be detected in water at 2 ppm. Brief exposure (5 to 10 minutes) to very high benzene air concentrations (10,000 to 20,000 ppm) can result in death. Lower levels (700 to 3,000 ppm) can cause drowsiness, dizziness, tachycardia, headaches, tremors, confusion and unconsciousness. Exposure to high air concentrations (3,000 ppm or higher) may cause acute poisoning, characterized by the narcotic action of benzene on the CNS. The planned work area is outdoors, with ample natural ventilation that will reduce any airborne through dilution and dispersion,

Vinyl Chloride

Vinyl chloride is a flammable gas that depresses the central nervous system, and inhaling its vapors produces symptoms similar to alcohol intoxication. The nervous system is the primary target of vinyl chloride exposure. Signs and symptoms following ingestion include weakness; ataxia; inebriation; headache; fatigue; numbness; tingling and pallor or cyanosis of the extremities; nausea; abdominal pain; GI bleeding; visual disturbances; cardiac dysrhythmias; narcosis and death. Vinyl chloride is a severe irritant of the eyes, skin, and mucous membranes.

As a result of the data previously identified at this site, it is very unlikely that workers participating in this activity will encounter any airborne concentrations of benzene or vinyl chloride that would represent an occupational exposure concern. To monitor this route, real-time direct reading monitoring instruments will be used (as described in section 7.0).

Ingestion and Skin Contact: Potential exposure concerns to benzene and Vinyl chloride may also occur through ingesting or coming into direct skin contact with contaminated soils. The likelihood of worker exposure concerns through these two routes are also considered very unlikely, provided that workers follow good personal hygiene and standard good sample collection/sample handling practices, and wear appropriate PPE as specified in this HASP. Examples onsite practices that are to be observed that will protect workers from exposure via ingestion or skin contact include the following:

- No hand-to-mouth activities on site (eating, drinking, smoking, etc.)
- Washing hands upon leaving the work area and prior to performing any hand to mouth activities
- Wearing surgeon's-style gloves whenever handling potentially-contaminated media, including soils, hand tools, and sample containers.

ORC®

ORC® will be injected into specified soil borings using a pump and tremie method. This method introduces the ORC® from the bottom of the boring in a retracting up-ward fashion. The material to be injected is a registered material and the MSDS is provided in Appendix VII.

Health effects associated with overexposure to magnesium products are as indicated below.

6.1.1.1 Chemical Hazards of ORC® include:

- Magnesium oxide fume – Metal fume fever –Flu-like symptoms

- Magnesium particles or alloys which enter through perforations in the skin have been recorded to produce a severe local reaction (evolution of gas and severe irritation locally) resulting in necrosis or killing of the cells within the impacted area (See chemical gas gangrene for more information). These injuries are very slow to heal.

- It is estimated based on the physical properties and ingredients (magnesium oxide, magnesium peroxide, and magnesium hydroxide) evaluated that this material will be irritating to the eyes and skin and upper respiratory tract as well as other exposed mucous membranes.

- The material as indicated in the MSDS has a pH of 10 in solution. If swallowed, this material is slow to be absorbed, however, will result in vomiting and diarrhea.

The health effects reported above are considered acute responses to overexposure. Based on limited use and application chronic responses are not addressed. It is imperative to control the dust when dispensing this product.

6.1.1.2 Physical Hazards of ORC® include:

- Incompatibilities with acids, certain bases and interhalogen compounds(i.e., maleic anhydride, sodium hydroxide, bromine pentafluoride, chlorine trifluoride). The result will be violent reaction and potentially ignition. This material should be maintained and used away from potential ignition sources because of the potential violent reaction (i.e., oxidizer + any fuel source/combustible material = fire and/or explosion) given suitable conditions (i.e., closed container; insufficient media to absorb the heat of reaction). This material will intensify a fire.

- This material (25-35% Magnesium peroxide) will react with water to release oxygen. The magnesium oxide component will react with water to create magnesium hydroxide, both of which will slowly release oxygen to the water. To control the release of oxygen and the reaction, it is recommended that this material, when mixing, is added slowly to the prescribed amount of water. Upon completing the mixture and the injection, flush the container and pump with copious amounts of water.

Specified control measures have been provided in the Safe Work Permit for this task (See Attachment IV).

Table 6-1 provides information on the most common and significant site contaminants that may be present at Wallops Island. Included is information on the toxicological, chemical, and physical properties of these substances.

6.2 PHYSICAL HAZARDS

The following is a list of physical hazards that may be encountered at the site or may be present during the performance of site activities.

- Injury due to overexertion from operating the hand auger
- Slip, trips, and falls
- Contact with underground (electric lines, gas lines, water lines, etc.)
- Strain/muscle pulls from heavy lifting
- Heat Stress
- Pinch/compression points
- Natural hazards (snakes, ticks, poisonous plants, etc.)
- Vehicular and equipment traffic
- Inclement weather
- Noise

These hazards are discussed further below, and are presented relative to each task in the task-specific Safe Work Permits.

6.2.1 Slips, Trips, and Falls

During various site activities there is a potential for slip, trip, and fall hazards associated with wet, steep, or unstable work surfaces. To minimize hazards of this nature, personnel required to work in and along areas prone to these types of hazards will be required to exercise caution, and use appropriate precautions (restrict access, guardrails, life lines and/or safety harnesses) and other means suitable for the task at hand. Site activities will be performed using the buddy system.

6.2.2 Contact with Underground Utilities

Underground utilities such as pressurized lines, water lines, telephone lines, buried utility lines, and high voltage power lines are known to be present throughout the facility. Clearance of underground utilities for each boring injection location will be coordinated with the NASA WFF Facility Management Branch and a dig permit will be issued by the facility before any intrusive activities. The dig permit request will be completed by the PM or FOL a copy of the dig permit must be present at the site before any intrusive activities begin. The TtNUS Utility Locating and Excavation Clearance SOP found in Section 7.0 of the Health and Safety Guidance Manual and must also be completed to verify site clearance.

6.2.3 Strain/Muscle Pulls from Heavy Lifting

During execution of planned activities there is some potential for strains, sprains, and/or muscle pulls due to the physical demands and nature of this site work. To avoid injury during lifting tasks personnel are to lift with the force of the load carried by their legs and not their backs. When lifting or handling heavy material or equipment use an appropriate number of personnel. Keep the work area free from ground clutter to avoid unnecessary twisting or sudden movements while handling loads.

6.2.4 Heat Stress

Because of the geographical location of the planned work, the likely seasonal weather conditions that will exist during the planned schedule, and the physical exertion that can be anticipated with some of the planned tasks, it will be necessary for the field team to be aware of the signs and symptoms and the measures appropriate to prevent heat stress. This is addressed in detail in section 4.0 of the TtNUS Health and Safety Guidance Manual, which the SSO is responsible for reviewing and implementing as appropriate on this project.

In general, early signs of heat-related disorders include heat rash, cramps, heavy sweating which may be followed by the complete shutdown of a person's ability to sweat, pale/clammy skin, headaches, dizziness, incoordination, and other maladies. To prevent heat stress disorders, the following preventive measures are to be implemented by the SSO:

- When possible, schedule the most physically-demanding tasks so that they are performed during cooler periods of the day such as early morning or late afternoon

- Educate the field staff in heat stress signs and symptoms so that they can monitor themselves and their co-workers

- Schedule frequent breaks during the hottest parts of the day (such as a few minutes each hour). Breaks should be in shaded areas, and in a location where workers can remove PPE, wash their hands, and drink fluids

- Drinking fluids should be cool and non-caffeinated. Sports-drinks with electrolytes are acceptable provided that they do not contain alcohol. Water is also acceptable.

For more information on heat stress recognition and prevention, consult section 4.0 of the TtNUS Health and Safety Guidance Manual.

6.2.5 Pinch/Compression Points

Handling of tools, machinery, and other equipment on site may expose personnel to pinch/compression point hazards during normal work activities. Where applicable, equipment will have intact and functional guarding to prevent personnel contact with hazards. Personnel will exercise caution when working around pinch/compression points, using additional tools or devices (e.g., pinch bars) to assist in completing activities.

6.2.6 Natural Hazards

Natural hazards such as poisonous plants, bites from poisonous or disease carrying animals or insects (e.g., snakes, ticks, mosquitoes) are often prevalent at sites that are being investigated as part of hazardous waste site operations. Given the geographic location and the environment (marshes and lakes), alligators are also assumed to be potentially present at the NASA Wallops Island facility. To minimize the potential for site personnel to encounter these hazards, nesting areas in and about work areas will be avoided to the greatest extent possible. Work areas will be inspected to look for any evidence that dangerous animals may be present. Based on the planned location for the work covered by this HASP, encountering alligators is not a likely probability.

During warm months (spring through early fall), tick-borne Lyme Disease may pose a potential health hazard. The longer a disease carrying tick remains attached to the body, the greater the potential for contracting the disease. Wearing long sleeved shirts and long pants (tucked into boots and taped) will prevent initial tick attachment, while performing frequent body checks will help prevent long term attachment. Site first aid kits should be equipped with medical forceps and rubbing alcohol to assist in tick removal. For information regarding tick removal procedures and symptoms of exposure, consult Section 4.0 of the Health and Safety Guidance Manual.

Contact with poisonous plants and bites or stings from poisonous insects are other potential natural hazards. Long sleeved shirts and long pants (tucked into boots), and avoiding potential nesting areas, will minimize the potential for exposure. Additionally, insect repellents may be used by site personnel. Personnel who are allergic to stinging insects (such as bees, wasps and hornets) must be particularly careful since severe illness and death may result from allergic reactions. As with any medical condition or allergy, information regarding the condition must be listed on the Medical Data Sheet (see Attachment I of this HASP), and the FOL or SSO notified.

6.2.7 Inclement Weather

Project tasks under this Scope of Work will be performed outdoors. As a result, inclement weather may be encountered. In the event that adverse weather (electrical storms, tornadoes, etc.) conditions arise, the FOL and/or the SSO will be responsible for temporarily suspending or terminating activities until hazardous conditions no longer exist.

7.0 AIR MONITORING

None of the contaminants are expected to be present in significant concentrations to present an inhalation hazard during planned site activities. As a precautionary measure to assure that such exposures are avoided and documented, a direct reading instrument will be used to monitor worker exposures to chemical hazards present at the site. For this project, based on the properties of the primary contaminants of concern (i.e., Benzene and vinyl chloride), a Photoionization Detector (PID) may be used to monitor the air.

7.1 INSTRUMENTS AND USE

Instruments will be used primarily to monitor source points and worker breathing zone areas, while observing instrument action levels. The SSO shall obtain and document the daily background (BG) reading at an upwind, unaffected area and observe for readings above that BG level. The SSO shall monitor source areas (e.g., auger bore hole locations and above collected soil samples) for the presence of any reading above the daily-established BG level. If elevated readings are observed, the SSO shall monitor the workers breathing zone (BZ) areas with the PID

7.1.1 Action Level

Based on the contaminant of concern, Benzene and vinyl chloride, workers must limit exposure to a maximum of 10 ppm in the BZ for no more than 15 minutes total in an 8 hour work day (e.g., 1 exposure for 15 minutes, 2 exposures for 7.5 minutes or 3 exposures for 5 minutes). If sustained readings above 10 ppm are measured, the following process will be followed:

- The SSO shall stop work and retreat upwind to a safe, unaffected area, where they will remain until further directed by the SSO.

- The SSO shall allow at least 5 minutes to pass so that the work area can ventilate, and will then re-approach the work area while continuously monitoring the BZ areas.

- Only when BG levels are regained in BZ areas will work be permitted to resume.

- If BG levels are not regained, the SSO will contact the HSM for additional direction.

<u>Instrument Action Levels</u>: The use of a PID will be acceptable, provided that the following action levels are observed:

- PID Action Level: 10 ppm above BG in BZ areas.

7.2 INSTRUMENT MAINTENANCE AND CALIBRATION

Hazard monitoring instruments will be maintained and pre-field calibrated by the equipment provider (i.e., rental agency used). Operational checks and field calibration will be performed on site instruments each day prior to their use. Field calibration will be performed on instruments according to manufacturer's recommendations. These operational checks and calibration efforts will be performed in a manner that complies with the employees health and safety training, the manufacturer's recommendations, and with the applicable manufacturer standard operating procedure (which the SSO must assure are included with the instrument upon its receipt onsite). Field calibration efforts must be documented. Figure 7-1 is provided for documenting these calibration efforts. This information may instead be recorded in a field operations logbook, provided that the information specified in Figure 7-1 is recorded. This required information includes the following:

- Date calibration was performed
- Individual calibrating the instrument
- Instrument name, model, and serial number
- Any relevant instrument settings and resultant readings (before and after) calibration
- Identification of the calibration standard (lot no., source concentration, supplier)
- Any relevant comments or remarks

7.3 DOCUMENTING INSTRUMENT READINGS

The SSO is responsible for ensuring that air monitoring instruments are used in accordance with the specifications of this HASP and with manufacturer's specifications/recommendations. In addition, the SSO is also responsible for ensuring that all instrument use is documented. This requirement can be satisfied either by recording instrument readings on pre-printed sampling log sheets or in a field log book. **This includes the requirement for documenting instrument readings that indicate no elevated readings above noted daily background levels (i.e., no-exposure readings)**. At a minimum, the SSO must document the following information for each use of an air monitoring device:

- Date, time, and duration of the reading
- Site location where the reading was obtained

- Instrument used (e.g., PID, etc.)
- Personnel present at the area where the reading was noted
- Other conditions that are considered relevant to the SSO (such as weather conditions, possible instrument interferences, etc.)

FIGURE 7-1

DOCUMENTATION OF FIELD CALIBRATION

SITE NAME: ______________________________ **PROJECT NO.:**______________

Date of Calibration	Instrument Name and Model	Instrument I.D. Number	Person Performing Calibration	Instrument Settings		Instrument Readings		Calibration Standard (Lot Number)	Remarks/ Comments
				Pre-Calibration	Post-Calibration	Pre-Calibration	Post-Calibration		

8.0 TRAINING/MEDICAL SURVEILLANCE REQUIREMENTS

8.1 INTRODUCTORY/REFRESHER/SUPERVISORY TRAINING

This section is included to specify health and safety training and medical surveillance requirements for TtNUS personnel participating in on site activities. TtNUS personnel must complete 40 hours of introductory hazardous waste site training prior to performing work at the NASA Wallops Island. TtNUS personnel who have had introductory training more than 12 months prior to site work must have completed 8 hours of refresher training within the past 12 months before being cleared for site work. In addition, 8-hour supervisory training in accordance with 29 CFR 1910.120(e)(4) will be required for site supervisory personnel.

Documentation of TtNUS introductory, supervisory, and refresher training as well as site-specific training will be maintained at the site. Copies of certificates or other official documentation will be used to fulfill this requirement.

8.2 SITE-SPECIFIC TRAINING

TtNUS SSO will provide site-specific training to TtNUS employees who will perform work on this project. Figure 8-1 will be used to document the provision and content of the project-specific and associated training. Site personnel will be required to sign this form prior to commencement of site activities. This training documentation will be employed to identify personnel who through record review and attendance of the site-specific training are cleared for participation in site activities. This document shall be maintained at the site to identify and maintain an active list of trained and cleared site personnel.

The TtNUS SSO will also conduct a pre-activities training session prior to initiating site work. This will consist of a brief meeting at the beginning of each day to discuss operations planned for that day, and a review of the appropriate Safe Work Permits with the planned task participants. A short meeting may also be held at the end of the day to discuss the operations completed and any problems encountered.

8.3 MEDICAL SURVEILLANCE

TtNUS personnel participating in project field activities will have had a physical examination meeting the requirements of TtNUS's medical surveillance program. Documentation for medical clearances will be maintained in the TtNUS Pittsburgh office and made available, as necessary, and will be documented using Figure 8-1 for every employee participating in onsite work activities at this site.

Each field team member, including visitors, entering the exclusion zone(s) shall be required to complete and submit a copy of the Medical Data Sheet (see Attachment I of this HASP). This shall be provided to the SSO, prior to participating in site activities. The purpose of this document is to provide site personnel and emergency responders with additional information that may be necessary in order to administer medical attention.

8.4 SITE VISITORS

All site visitors to the site must be 100% escorted at all times and restricted from approaching any work areas where they could be exposed to hazards from TtNUS operations. If a visitor has authorization from the client and from the TtNUS Project Manager to approach our work areas, the FOL must assure that the visitor first provides documentation indicating that he/she/they have successfully completed the necessary OSHA introductory training, receive site-specific training from the SSO, and that they have been physically cleared to work on hazardous waste sites.

FIGURE 8-1

SITE-SPECIFIC TRAINING DOCUMENTATION

My signature below indicates that I am aware of the potential hazardous nature of performing field investigation activities at NASA Wallops Island, Virginia and that I have received site-specific training which included the elements presented below:

- Names of designated personnel and alternates responsible for site safety and health
- Safety, health, and other hazards present on site
- Use of personal protective equipment
- Safe use of engineering controls and equipment
- Medical surveillance requirements
- Signs and symptoms of overexposure
- Contents of the Health and Safety Plan
- Emergency response procedures (evacuation and assembly points)
- Incipient response procedures
- Review of the contents of relevant Material Safety Data Sheets
- Review of the use of Safe Work Permits

I have been given the opportunity to ask questions and all of my questions have been answered to my satisfaction. The dates of my training and my medical surveillance requirements indicated below are accurate to the best of my knowledge.

Name (Printed and Signature)	Site-Specific Training Date	40-Hour Training (Date)	8-Hour Refresher Training (Date)	8-Hour Supervisory Training (Date)	Medical Exam

9.0 SITE CONTROL

This section outlines the means by which TtNUS will delineate work zones and use these work zones in conjunction with decontamination procedures to prevent the spread of contaminants into previously unaffected areas of the site. It is anticipated that a three-zone approach will be used during work at this site. This approach will be comprised of an exclusion zone, a contamination reduction zone, and a support zone. It is also anticipated that this approach will control access to site work areas, restricting access by the general public, minimizing the potential for the spread of contaminants, and protecting individuals who are not cleared to enter work areas.

9.1 EXCLUSION ZONE

The exclusion zone will be considered the areas of the site of known or suspected contamination. It is anticipated that the areas around the exhaust vents will have the potential for contaminants brought to the surface. These areas will be marked and personnel will maintain safe distances. Once intrusive activities have been completed and surface contamination has been removed, the potential for exposure is again diminished and the area can then be reclassified as part of the contamination reduction zone. Therefore, the exclusion zones for this project will be limited to those areas of the site where active work (hand augering and sample collection) is being performed plus a designated area of at least 15 feet surrounding the work area. Exclusion zones will be delineated as deemed appropriate by the FOL, through means such as erecting visibility fencing, barrier tape, cones, and/or postings to inform and direct personnel.

9.1.1 Exclusion Zone Clearance

A pre-startup site visit will be conducted by members of the identified field team in an effort to identify proposed subsurface investigation locations, conduct utility clearances, and provide upfront notices concerning scheduled activities within the facility.

Subsurface activities will proceed only when utility clearance has been obtained. In the event that a utility is struck during a subsurface investigative activity, the emergency numbers provided in Section 2.0, Table 2-1, will be notified.

9.2 CONTAMINATION REDUCTION ZONE

The contamination reduction zone (CRZ) will be a buffer area between the exclusion zone and any area of the site where contamination is not suspected. This area may also serve as a focal point in supporting exclusion zone activities. This area will be delineated using barrier tape, cones, and postings to inform and direct facility personnel. Decontamination will be conducted at a central location. Equipment potentially contaminated will be bagged and taken to that location for decontamination.

9.3 SUPPORT ZONE

The support zone for this project will include a staging area where site vehicles will be parked, equipment will be unloaded, and where food and drink containers will be maintained. The support zones will be established at areas of the site where away from potential exposure to site contaminants during normal working conditions or foreseeable emergencies.

9.4 SAFE WORK PERMITS

Exclusion Zone work conducted in support of this project will be performed using Safe Work Permits (SWPs) to guide and direct field crews on a task by task basis. An example of the SWP to be used is provided in Figure 9-1. Partially completed SWPs for the work to be performed are attached to this HASP. These permits were completed to the extent possible as part of the development of this HASP. It is the SSO's responsibility to finalize and complete all blank portions of the SWPs based on current, existing conditions the day the task is to be performed, and then review that completed permit with all task participants as part of a pre-task tail gate briefing session. This will ensure that site-specific considerations and changing conditions are appropriately incorporated into the SWP, provide the SSO with a structured format for conducting the tail gate sessions, as well will also give personnel an opportunity to ask questions and make suggestions. All SWPs require the signature of the FOL or SSO.

9.5 SITE VISITORS

Site visitors for the purpose of this document are identified as representing the following groups of individuals:

- Personnel invited to observe or participate in operations by TtNUS
- Regulatory personnel (i.e., NASA, EPA, VADEQ and OSHA)
- Authorized NASA Personnel
- Other authorized visitors

Non-NASA personnel working on this project are required to gain initial access to the base by coordinating with the TtNUS FOL or designee and following established base access procedures.

Once access to the base is obtained, personnel who require site access into areas of ongoing operations will be required to obtain permission from the PM. Upon gaining access to the site, site visitors wishing to observe operations in progress will be escorted by a TtNUS representative and shall be required to meet the minimum requirements discussed below:

- Site visitors will be directed to the FOL/SSO, who will sign them into the field logbook. Information to be recorded in the logbook will include the individual's name (proper identification required), the entity which they represent, and the purpose of the visit.

- Site visitors wishing to enter the exclusion zone will be required to produce the necessary information supporting clearance to the site. This shall include information attesting to applicable training and medical surveillance as stipulated in Section 8.0 of this document. In addition, to enter the site operational zones during planned activities, visitors will be required to first go through site-specific training covering the topics stipulated in Section 8.2 of this HASP.

Once the site visitors have completed the above items, they will be permitted to enter the operational zone. Visitors are required to observe the protective equipment and site restrictions in effect at the site at the time of their visit. Visitors entering the exclusion zones during ongoing operations will be accompanied by a TtNUS representative. Visitors not meeting the requirements, as stipulated in this plan, for site clearance will not be permitted to enter the site operational zones during planned activities. Any incidence of unauthorized site visitation will cause the termination of on site activities until the unauthorized visitor is removed from the premises. Removal of unauthorized visitors will be accomplished with support from local law enforcement personnel.

9.6 SITE SECURITY

Site security will be accomplished using TtNUS field personnel. TtNUS will retain complete control over active operational areas. As this activity takes place at a Navy facility open to public access, the first line of security will take place using exclusive zone barriers, site work permits, and any existing barriers at the sites to restrict the general public. The second line of security will take place at the work site referring interested parties to the Base Contact. The Base Contact will serve as a focal point for base personnel, interested parties, and serve as the final line of security and the primary enforcement contact.

9.7 BUDDY SYSTEM

Personnel engaged in on site activities will practice the "buddy system" to ensure the safety of personnel involved in this operation.

9.8 MATERIAL SAFETY DATA SHEET (MSDS) REQUIREMENTS

TtNUS and subcontractor personnel will provide MSDSs for chemicals brought on site. The contents of these documents will be reviewed by the SSO with the user(s) of the chemical substances prior to any actual use or application of the substances on site. A chemical inventory of the chemicals used on site will be developed using the Health and Safety Guidance Manual. The MSDSs will then be maintained in a central location (i.e., temporary office) and will be available for anyone to review upon request.

9.9 COMMUNICATION

As personnel will be working in proximity to one another during field activities, a supported means of communication between field crew members will not be necessary.

External communication will be accomplished by using the telephones at predetermined and approved locations. External communication will primarily be used for the purpose of resource and emergency resource communications. Prior to the commencement of activities at the NASA Wallops Island, the FOL will determine and arrange for telephone communications.

FIGURE 9-1
SAFE WORK PERMIT

Permit No. _______________ Date: ___________________ Time: From _____________ to _____________

I. Work limited to the following (description, area, equipment used): ______________________________

II. Primary Hazards: Potential hazards associated with this task: ______________________________

III. Field Crew: ______________________________

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____________TtNUS
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____________TtNUS

V. Protective equipment required
Level D ☐ Level B ☐
Level C ☐ Level A ☐
Modifications/Exceptions: ______________________________

Respiratory equipment required
Yes ☐ Specify on the reverse
No ☐

VI.

Chemicals of Concern	Hazard Monitoring	Action Level(s)	Response Measures
________	________	________	________
________	________	________	________
	________	________	________

Primary Route(s) of Exposure/Hazard: ______________________________

(Note to FOL and/or SSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

	Yes	No		Yes	No
Hard-hat	☐ Yes	☐ No	Hearing Protection (Plugs/Muffs)	☐ Yes	☐ No
Safety Glasses	☐ Yes	☐ No	Safety belt/harness	☐ Yes	☐ No
Chemical/splash goggles	☐ Yes	☐ No	Radio/Cellular Phone	☐ Yes	☐ No
Splash Shield	☐ Yes	☐ No	Barricades	☐ Yes	☐ No
Splash suits/coveralls	☐ Yes	☐ No	Gloves (Type –)	☐ Yes	☐ No
Impermeable apron	☐ Yes	☐ No	Work/rest regimen	☐ Yes	☐ No
Steel toe Work shoes or boots	☐ Yes	☐ No	Chemical Resistant Boot Covers	☐ Yes	☐ No
High Visibility vest	☐ Yes	☐ No	Tape up/use insect repellent	☐ Yes	☐ No
First Aid Kit	☐ Yes	☐ No	Fire Extinguisher	☐ Yes	☐ No
Safety Shower/Eyewash	☐ Yes	☐ No	Other	☐ Yes	☐ No

Modifications/Exceptions: ______________________________

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc.)	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.) ☐ Yes ☐ No
If yes, SSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: ______________________________

Permit Issued by: ______________________________ Permit Accepted by: ______________________________

10.0 SPILL CONTAINMENT PROGRAM

10.1 SCOPE AND APPLICATION

It is not anticipated that bulk hazardous materials (over 55-gallons) will be generated or handled at any given time as part of this scope of work. It is also not anticipated that such spillage would constitute a danger to human health or the environment. However, as the job progresses, some potential may exist for accumulating Investigative Derived Wastes (IDW) such as decontamination fluids, soil cuttings, disposable sampling equipment and PPE.

10.2 POTENTIAL SPILL AREAS

Potential spill areas will be periodically monitored in an ongoing attempt to prevent and control further potential contamination of the environment. Currently, limited areas are vulnerable to this hazard including:

- Resource deployment
- Waste transfer
- Central staging

It is anticipated that the IDW generated as a result of this scope of work will be containerized, labeled, and staged to await further analyses. The results of these analyses will determine the method of disposal.

10.3 LEAK AND SPILL DETECTION

To establish an early detection of potential spills or leaks, a periodic walk-around by the personnel staging or disposing of drums area will be conducted during working hours to visually determine that storage vessels are not leaking. If a leak is detected, the contents will be transferred, using a hand pump, into a new vessel. The leak will be collected and contained using absorbents such as Oil-Dry, vermiculite, or sand, which are stored at the vulnerable areas in a conspicuously marked drum. This used material, too, will be containerized for disposal pending analysis. Inspections will be documented in the project logbook.

10.4 PERSONNEL TRAINING AND SPILL PREVENTION

Personnel will be instructed in the procedures for incipient spill prevention, containment, and collection of hazardous materials in the site-specific training. The FOL and the SSO will serve as the Spill Response Coordinators for this operation, should the need arise.

10.5 SPILL PREVENTION AND CONTAINMENT EQUIPMENT

The following represents the types of equipment that should be maintained at the staging areas for the purpose of supporting this Spill Prevention/Containment Program.

- Sand, clean fill, vermiculite, or other non combustible absorbent (Oil-dry)
- Drums (55-gallon U.S. DOT 1A 1 or 1 A 2)
- Shovels, rakes, and brooms
- Container labels

10.6 SPILL CONTROL PLAN

This section describes the procedures the TtNUS field crew members will employ upon the detection of a spill or leak.

1. Notify the SSO or FOL immediately upon detection of a leak or spill. Activate emergency alerting procedures for that area to remove non-essential personnel.

2. Employ the personal protective equipment stored at the staging area. Take immediate actions to stop the leak or spill by plugging or patching the container or raising the leak to the highest point in the vessel. Spread the absorbent material in the area of the spill, covering it completely.

3. Transfer the material to a new vessel; collect and containerize the absorbent material. Label the new container appropriately. Await analyses for treatment and disposal options.

4. Re-containerize spills, including 2-inch of top cover impacted by the spill. Await test results for treatment or disposal options.

It is not anticipated that a spill will occur that the field crew cannot handle. Should this occur, notification of the appropriate Emergency Response agencies will be carried out by the FOL or SSO in accordance with the procedures discussed in Section 2.0 of this HASP.

11.0 CONFINED-SPACE ENTRY

It is not anticipated, under the proposed scope of work, that confined space and permit-required confined space activities will be conducted. **Therefore, personnel under the provisions of this HASP are not allowed, under any circumstances, to enter confined spaces**. A confined space is defined as an area which has one or more of the following characteristics:

- Is large enough and so configured that an employee can bodily enter and perform assigned work.
- Has limited or restricted means for entry or exit (for example, tanks, manholes, sewers, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry).
- Is not designed for continuous employee occupancy.

Additionally, a Permit-Required Confined Space must also have one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly caving walls or by a floor that slopes downward and tapers to a smaller cross-section.
- Contains any other recognized, serious, safety or health hazard.

For further information on confined space, consult the Health and Safety Guidance Manual or call the PHSO. If confined space operations are to be performed as part of the scope of work, detailed procedures and training requirements will have to be addressed.

12.0 MATERIALS AND DOCUMENTATION

The TtNUS Field Operations Leader (FOL) shall ensure the following materials/documents are taken to the project site and used when required.

- A complete copy of this HASP
- Health and Safety Guidance Manual
- Incident Reports
- Medical Data Sheets
- Material Safety Data Sheets for chemicals brought on site, including decontamination solutions, fuels, sample preservatives, calibration gases, etc.
- A full-size OSHA Job Safety and Health Poster (posted in the site trailer)
- Training/Medical Surveillance Documentation Form (Blank)
- First-Aid Supply Usage Form
- Emergency Reference Form (Section 2.0, extra copy for posting)
- Directions to the Hospital

12.1 MATERIALS TO BE POSTED AT THE SITE

The following documentation is to be posted or maintained at the site for quick reference purposes. In situations where posting these documents is not feasible (such as no office trailer), these documents should be separated and immediately accessible.

- **Chemical Inventory Listing (posted)** - This list represents all chemicals brought on-site, including decontamination solutions, sample preservations, fuel, etc. This list should be posted in a central area.

- **MSDSs (maintained)** - The MSDSs should also be in a central area accessible to all site personnel. These documents should match all the listings on the chemical inventory list for all substances employed on-site. It is acceptable to have these documents within a central folder and the chemical inventory as the table of contents.

- **The OSHA Job Safety & Health Protection Poster (posted)** - This poster should be conspicuously posted in places where notices to employees are normally posted, as directed by 29 CFR 1903.2 (a)(1). Each FOL shall ensure that this poster is not defaced, altered, or covered by other material. The law also states that reproductions or facsimiles of the poster shall be at least 8 1/2 by 14 inches with 10 point type.

- **Site Clearance (maintained)** - This list is found within the training section of the HASP (Figure 8-1). This list identifies all site personnel, dates of training (including site-specific training), and medical surveillance. The list indicates not only clearance, but also status. If personnel do not meet these requirements, they do not enter the site while site personnel are engaged in activities.

- **Emergency Phone Numbers and Directions to the Hospital(s) (posted)** - This list of numbers and directions will be maintained at all phone communications points and in each site vehicle.

- **Medical Data Sheets/Cards (maintained)** - Medical Data Sheets will be filled out by on-site personnel and filed in a central location. The Medical Data Sheet will accompany any injury or illness requiring medical attention to the medical facility. A copy of this sheet or a wallet card will be given to all personnel to be carried on their person.

- **Personnel Monitoring (maintained)** - All results generated through personnel sampling (levels of airborne toxins, noise levels, etc.) will be posted to inform individuals of the results of that effort.

- **Placards and Labels (maintained)** - Where chemical inventories have been separated because of quantities and incompatibilities, these areas will be conspicuously marked using DOT placards and acceptable [Hazard Communication 29 CFR 1910.1200(f)] labels.

The purpose of maintaining or posting this information, as stated above, is to allow site personnel quick access. Variations concerning location and methods of presentation are acceptable providing the objective is accomplished.

13.0 ACRONYMS / ABBREVIATIONS

BG	Background
BZ	Breathing Zone
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Chain of Custody
CSP	Certified Safety Professional
CRZ	Contamination Reduction Zone
DPT	Direct Push Technology
FFTA	Former Fire Training Area
FOL	Field Operations Leader
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSM	Health and Safety Manager
IDW	Investigation Derived Waste
MB	Mainbase
ML	Mainland
MSDS	Material Safety Data Sheet
N/A	Not Available
ORC	Oxygen Releasing Compounds
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor)
PID	Photoionization Detector
PPM	Parts Per Million
PHSO	Project Health and Safety Officer
PPE	Personal Protective Equipment
SSO	Site Safety Officer
SWP	Safe Work Permit
TBD	To be determined
PM	Project Manager
TtNUS	Tetra Tech NUS, Inc.
VOCs	Volatile Organic Compounds
WWF	Wallops Flight Facility
WI	Wallops Island
WOD	Waste Oil Dump

ATTACHMENT I

MEDICAL DATA SHEET

MEDICAL DATA SHEET

This Medical Data Sheet must be completed by on-site personnel and kept in the command post during the conduct of site operations. This data sheet will accompany any personnel when medical assistance is needed or if transport to hospital facilities is required.

Project ______________________________

Name ______________________ Home Telephone __________

Address ______________________________

Age __________ Height ______________ Weight ____________

Person to notify in the event of an emergency: Name: ______________________

Phone: ______________________

Drug or other Allergies: ______________________________

Particular Sensitivities : ______________________________

Do You Wear Contacts? ______________________________

What medications are you presently using? ______________________________

____

Name, Address, and Phone Number of personal physician: ______________________

____

____

Note: Health Insurance Portability and Accountability Act (HIPAA) Requirements

HIPAA took effect April 14, 2003. Loosely interpreted, HIPAA regulates the disclosure of Protected Health Information (PHI) by the entity collecting that information. PHI is any information about health status (such as that you may report on this Medical Data Sheet), provision of health care, or other information. HIPAA also requires TtNUS to ensure the confidentiality of PHI. This Act can affect the ability of the Medical Data Sheet to contain and convey information you would want a Doctor to know if you were incapacitated. So before you complete the Medical Data Sheet understand that this form will not be maintained in a secure location. It will be maintained in a file box or binder accessible to other members of the field crew so that the can accompany an injured party to the hospital.

DO NOT include information that you do not wish others to know, only information that may be pertinent in an emergency situation or treatment.

______________________ ______________________ __________

Name (Print clearly) Signature Date

ATTACHMENT II

INCIDENT REPORT FORM

TETRA TECH, INC.
Safety Excellence

TETRA TECH, INC.
INCIDENT REPORT

Report Date	Report Prepared By	Incident Report Number

INSTRUCTIONS:

All incidents (including those involving subcontractors under direct supervision of Tetra Tech personnel) must be documented on the IR Form.

Complete any additional parts to this form as indicated below for the type of incident selected.

TYPE OF INCIDENT (Check all that apply)		Additional Form(s) Required for this type of incident
Near Miss (No losses, but could have resulted in injury, illness, or damage)	☐	Complete IR Form Only
Injury or Illness	☐	Complete Form IR-A; Injury or Illness
Property or Equipment Damage, Fire, Spill or Release	☐	Complete Form IR-B; Damage, Fire, Spill or Release
Motor Vehicle	☐	Complete Form IR-C; Motor Vehicle

INFORMATION ABOUT THE INCIDENT

Description of Incident

____

____

____

Date of Incident	Time of Incident
	____________ AM ☐ PM ☐ *OR* Cannot be determined ☐
Weather conditions at the time of the incident	**Was there adequate lighting?**
	____________________ Yes ☐ No ☐

Location of Incident

____________________ Was location of incident within the employer's work environment? Yes ☐ No ☐

Street Address	City, State, Zip Code and Country
Project Name	**Client:**
Tt Supervisor or Project Manager	**Was supervisor on the scene?**
	Yes ☐ No ☐

WITNESS INFORMATION (attach additional sheets if necessary)

Name	Company
Street Address	**City, State and Zip Code**
Telephone Number(s)	

CORRECTIVE ACTIONS

Corrective action(s) immediately taken by unit reporting the incident:

____

____

____

Corrective action(s) still to be taken (by whom and when):

____

____

____

ROOT CAUSE ANALYSIS LEVEL REQUIRED

Root Cause Analysis Level Required: Level - 1 ☐ Level - 2 ☐ None ☐

Root Cause Analysis Level Definitions

Level - 1	**Definition:** A Level 1 RCA is conducted by an individual(s) with experience or training in root cause analysis techniques and will conduct or direct documentation reviews, site investigation, witness and affected employee interviews, and identify corrective actions. Activating a Level 1 RCA and identifying RCA team members will be at the discretion of the Corporate Administration office. The following events may trigger a Level 1 RCA: ▪ Work related fatality ▪ Hospitalization of one or more employee where injuries result in total or partial permanent disability ▪ Property damage in excess of $75,000 ▪ When requested by senior management
Level - 2	**Definition:** A Level 2 RCA is self performed within the operating unit by supervisory personnel with assistance of the operating unit HSR. Level 2 RCA will utilize the 5 Why RCA methodology and document the findings on the tools provided. The following events will require a Level 2 RCA: ▪ OSHA recordable lost time incident ▪ Near miss incident that could have triggered a Level 1 RCA ▪ When requested by senior management

Complete the Root Cause Analysis Worksheet and Corrective Action form. Identify a corrective action(s) for each root cause identified within each area of inquiry.

NOTIFICATIONS

Title	Printed Name	Signature	Telephone Number	Date
Project Manager or Supervisor				
Site Safety Coordinator or Office H&S Representative				
Operating Unit H&S Representative				
Other: ____________________				

The signatures provided above indicate that appropriate personnel have been notified of the incident.

INSTRUCTIONS:

Complete all sections below for incidents involving injury or illness.
Do NOT leave any blanks.
Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)	

EMPLOYEE INFORMATION

Company Affiliation

Tetra Tech Employee? ☐ TetraTech subcontractor employee (directly supervised by Tt personnel)? ☐

Full Name	**Company (if not Tt employee)**
Street Address, City, State and Zip Code	**Address Type**
____________________ ____________________	Home address (for Tt employees) ☐ Business address (for subcontractors) ☐

Telephone Numbers

Work: ____________	Home: ____________	Cell: ____________

Occupation (regular job title)	**Department**
Was the individual performing regular job duties?	**Time individual began work**
Yes ☐ No ☐	______ AM ☐ PM ☐ *OR* Cannot be determined ☐

Safety equipment

Provided? Yes ☐ No ☐

Used? Yes ☐ No ☐ If no, explain why

____

____

____

Type(s) provided:

- ☐ Hard hat
- ☐ Gloves
- ☐ Eye protection
- ☐ Safety shoes
- ☐ Respirator
- ☐ Protective clothing
- ☐ High visibility vest
- ☐ Fall protection
- ☐ Machine guarding
- ☐ Other (list)

____

NOTIFICATIONS

Name of Tt employee to whom the injury or illness was first reported	**Was H&S notified within one hour of injury or illness?**
	Yes ☐ No ☐
Date of report	**H&S Personnel Notified**
Time of report	**Time of Report**

If subcontractor injury, did subcontractor's firm perform their own incident investigation?

Yes ☐ No ☐ If yes, request a copy of their completed investigation form/report and attach it to this report.

INJURY / ILLNESS DETAILS

What was the individual doing just before the incident occurred? Describe the activity as well as the tools, equipment, or material the individual was using. Be specific. Examples: “Climbing a ladder while carrying roofing materials”; “Spraying chlorine from a hand sprayer”; “Daily computer key-entry”

____

____

____

What Happened? Describe how the injury occurred. Examples: “When ladder slipped on wet floor and worker fell 20 feet”; “Worker was sprayed with chlorine when gasket broke during replacement”; Worker developed soreness in wrist over time”

____

____

____

____

Describe the object or substance that directly harmed the individual: Examples: “Concrete floor”; “Chlorine”; “Radial Arm Saw”. If this question does not apply to the incident, write “Not Applicable”.

____

____

MEDICAL CARE PROVIDED

Was first aid provided at the site: Yes ☐ No ☐ If yes, describe the type of first aid administered and by whom?

____

Was treatment provided away from the site: Yes ☐ No ☐ If yes, provide the information below.

Name of physician or health care professional	**Facility Name**
Street Address, City State and Zip Code	**Type of Care?**
________________________ ________________________	Was individual treated in emergency room? Yes ☐ No ☐ Was individual hospitalized overnight as an in-patient? Yes ☐ No ☐ Did the individual die? Yes ☐ No ☐ If yes, date: __________ Will a worker’s compensation claim be filed? Yes ☐ No ☐
Telephone Number	

NOTE: Attach any police reports or related diagrams to this report.

SIGNATURES

I have reviewed this report and agree that all the supplied information is accurate

Affected individual (print)	**Affected individual (signature)**	**Telephone Number**	**Date**

This form contains information relating to employee health and must be used in a manner that protects the confidentiality of the employee to the extent possible while the information is being used for occupational safety and health purposes.

INSTRUCTIONS:

Complete all sections below for incidents involving property/equipment damage, fire, spill or release.
Do NOT leave any blanks.
Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)	

TYPE OF INCIDENT (Check all that apply)

Property Damage ☐ Equipment Damage ☐ Fire or Explosion ☐ Spill or Release ☐

INCIDENT DETAILS

Results of Incident: Fully describe damages, losses, etc.

____

____

____

Response Actions Taken:

____

____

____

Responding Agency(s) (i.e. police, fire department, etc.)	**Agency(s) Contact Name(s)**

DAMAGED ITEMS (List all damaged items, extent of damage and estimated repair cost)

Item:	**Extent of damage:**	**Estimated repair cost**

SPILLS / RELEASES (Provide information for spilled/released materials)

Substance	**Estimated quantity and duration**	**Specify Reportable Quantity (RQ)**
		____________ Exceeded? Yes ☐ No ☐ NA ☐

FIRES / EXPLOSIONS (Provide information related to fires/explosions)

Fire fighting equipment used? Yes ☐ No ☐ If yes, type of equipment: ______________________________

NOTIFICATIONS

Required notifications	**Name of person notified**	**By whom**	**Date / Time**
Client: ____________ Yes ☐ No ☐			
Agency: ____________ Yes ☐ No ☐			
Other: ____________ Yes ☐ No ☐			

Who is responsible for reporting incident to outside agency(s)? Tt ☐ Client ☐ Other ☐ Name: ________________

Was an additional written report on this incident generated? Yes ☐ No ☐ If yes, place in project file.

INSTRUCTIONS:

Complete all sections below for incidents involving motor vehicle accidents. Do NOT leave any blanks. Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)	

INCIDENT DETAILS

Name of road, street, highway or location where accident occurred	**Name of intersecting road, street or highway if applicable**

County	**City**	**State**

Did police respond to the accident?	**Did ambulance respond to the accident?**
Yes ☐ No ☐	Yes ☐ No ☐
Name and location of responding police department	**Ambulance company name and location**
Officer's name/badge #	

Did police complete an incident report? Yes ☐ No ☐ If yes, police report number: ____________________
Request a copy of completed investigation report and attach to this form.

VEHICLE INFORMATION

How many vehicles were involved in the accident? ______________ (Attach additional sheets as applicable for accidents involving more than 2 vehicles.)

Vehicle Number 1 – Tetra Tech Vehicle		**Vehicle Number 2 – Other Vehicle**	
Vehicle Owner / Contact Information		**Vehicle Owner / Contact Information**	
Color		**Color**	
Make		**Make**	
Model		**Model**	
Year		**Year**	
License Plate #		**License Plate #**	
Identification #		**Identification #**	
Describe damage to vehicle number 1		**Describe damage to vehicle number 2**	
Insurance Company Name and Address		**Insurance Company Name and Address**	
Agent Name		**Agent Name**	
Agent Phone No.		**Agent Phone No.**	
Policy Number		**Policy Number**	

DRIVER INFORMATION

Vehicle Number 1 – Tetra Tech Vehicle		Vehicle Number 2 – Other Vehicle	
Driver's Name		**Driver's Name**	
Driver's Address		**Driver's Address**	
Phone Number		**Phone Number**	
Date of Birth		**Date of Birth**	
Driver's License #		**Driver's License #**	
Licensing State		**Licensing State**	
Gender	Male ☐ Female ☐	**Gender**	Male ☐ Female ☐
Was traffic citation issued to Tetra Tech driver? Yes ☐ No ☐		Was traffic citation issued to driver of other vehicle? Yes ☐ No ☐	
Citation #		**Citation #**	
Citation Description		**Citation Description**	

PASSENGERS IN VEHICLES (NON-INJURED)

List all non-injured passengers (excluding driver) in each vehicle.
Driver information is captured in the preceding section.
Information related to persons injured in the accident (non-Tt employees) is captured in the section below on this form.
Injured Tt employee information is captured on FORM IR-A

Vehicle Number 1 – Tetra Tech Vehicle		Vehicle Number 2 – Other Vehicle	
How many passengers (excluding driver) in the vehicle? ____		How many passengers (excluding driver) in the vehicle? ____	
Non-Injured Passenger Name and Address		**Non-Injured Passenger Name and Address**	
Non-Injured Passenger Name and Address		**Non-Injured Passenger Name and Address**	
Non-Injured Passenger Name and Address		**Non-Injured Passenger Name and Address**	

INJURIES TO NON-TETRATECH EMPLOYEES

Name of injured person 1				Address of injured person 1		
Age	**Gender**	**Car No.**	**Location in Car**	**Seat Belt Used?**	**Ejected from car?**	**Injury or Fatality?**
	Male ☐ Female ☐			Yes ☐ No ☐	Yes ☐ No ☐	Injured ☐ Died ☐
Name of injured person 2				**Address of injured person 2**		
Age	**Gender**	**Car No.**	**Location in Car**	**Seat Belt Used?**	**Ejected from car?**	**Injury or Fatality?**
	Male ☐ Female ☐			Yes ☐ No ☐	Yes ☐ No ☐	Injured ☐ Died ☐

OTHER PROPERTY DAMAGE

Describe damage to property other than motor vehicles	
Property Owner's Name	**Property Owner's Address**

COMPLETE AND SUBMIT DIAGRAM DEPICTING WHAT HAPPENED

National Aeronautics and Space Administration

NASA Mishap Report

MASTER FILE NO.

NOTE: Fill in unshaded blocks within 24 hours. Please print or type. See reverse for instructions.

GENERAL INFORMATION

1. NAME OF ORGANIZATION	2. MISHAP DATE *(MMDDYYYY)*	3. MISHAP TIME *(24 hrs.)*	4. ORG. FILE NO.

5. MISHAP CATEGORY *(Check as appropriate)*

TYPE A	TYPE B	TYPE C	INCIDENT
1 ☐ DEATH	2 ☐ LOST TIME	2 ☐ LOST TIME	4 ☐ INJURY
2 ☐ LOST TIME	3 ☐ PERM. DISABILITY	4 ☐ INJURY	6 ☐ DAMAGE
4 ☐ INJURY	4 ☐ INJURY	6 ☐ DAMAGE	
6 ☐ DAMAGE	5 ☐ HOSPITALIZATION	7 ☐ TEST FAILURE	MISSION FAILURE ☐
7 ☐ TEST FAILURE	6 ☐ DAMAGE		
	7 ☐ TEST FAILURE		

6. CLOSE CALL ☐

7. LEVEL OF POTENTIAL

8. BLDG. NO./LOCATION

9. SPECIFIC AREA

10. MISSION AFFECTED

11. PROGRAM IMPACT

12. DESCRIPTION OF MISHAP *(Sequence of events, extent of damage and injuries, cause, if known, etc. Use additional sheets if necessary.)*

PERSONNEL INVOLVED

13. NAME *(Last, first, middle initial)*	14. AGE	15. SEX	16. ORGANIZATION *(CODE)*/POSITION
		☐ M ☐ F	

17. SHIFT WORKED	18. HOURS OF CONTINUOUS DUTY BEFORE MISHAP	19. FIRST AID ONLY	20. FATALITY	21. INJURY TYPE *(Code)*
☐ 1 ☐ 2 ☐ 3		☐ YES ☐ NO	☐ YES ☐ NO	

22. BODY PART(S) AFFECTED *(Codes)*

23. DAYS LOST		24. CAUSE(S) OF INJURY *(Codes)*			25. MISHAP ENVIRONMENT *(Codes)*	
NO.	☐ TOTAL ☐ CONTINUING	PRIMARY	CONTRIB.	POTENTIAL	AGENCY	ACTIVITY

26. HAS EMPLOYEE RECEIVED TRAINING/CERTIFICATION APPLICABLE TO TASK? ☐ YES ☐ NO

EQUIPMENT/PROPERTY DAMAGED

27. CLASS OF EQUIPMENT/PROPERTY DAMAGED

1 ☐ FLIGHT HARDWARE	4 ☐ PRESSURE VESSEL	7 ☐ OTHER
2 ☐ GROUND SUPPORT EQUIPMENT (GSE)	5 ☐ MOTOR VEHICLE	
3 ☐ FACILITY	6 ☐ AIRCRAFT	

28. SPECIFIC ITEM DAMAGED

29. SERIAL/NEMS NO.	30. SYSTEM/SUBSYSTEM AFFECTED	31. CAUSE(S) OF DAMAGE *(Codes)*			32. COST	
		PRIMARY	CONTRIB.	POTENTIAL	ESTIMATE	FINAL

33. SUBMITTED BY *(Name, title, mail code)*	SIGNATURE	PHONE NO.	DATE

CORRECTIVE ACTION

34. ACTION PLAN *(Provide estimated completion date for each action. Use extra sheets if necessary)*

35. APPROVED *(Name, title, mail code)*	SIGNATURE	PHONE NO.	DATE

36. NASA SAFETY CONCURRENCE WITH CORRECTIVE ACTION PLAN *(Branch chief or higher)*

CONCUR *(Name, title, mail code)*	SIGNATURE	PHONE NO.	DATE

NASA SAFETY OFFICE USE ONLY

37. LESSONS LEARNED ☐ YES ☐ NO

REF. NO. *(If Yes)*

38. TYPE OF INVESTIGATION 1 ☐ BOARD 2 ☐ TEAM 3 ☐ INVESTIGATOR

39. STATUS ☐ OPEN ☐ CLOSED

40. APPROVAL FOR CLOSURE

NAME AND TITLE	PHONE NO.
SIGNATURE	DATE

CODES

ITEM 21. **INJURY TYPE** - Enter one of the following codes to identify the category of injury:

(H01)	Abrasion	(H04)	Contusion, Bruise	(I09)	Internal Injuries
(C02)	Avulsion	(I03)	Dermatitis	(H06)	Laceration
(C01)	Amputation	(I96)	Multiple Injuries	(P00)	Pain
(H02)	Bites, Stings	(E06)	Electrical Shock	(J00)	Oxygen Deficiency
(H07)	Punctures	(I04)	Exhaustion	(Z68)	Shock, Trauma
(A00)	Burn, Chemical	(F07)	Fracture	(G03)	Strain, Sprain
(B00)	Burn, Thermal	(I06)	Hernia	(T06)	Toxicosis
(Z76)	Concussion	(I00)	Inhalation, Absorption, Ingestion	(Z98)	Other/Unknown
(G06)	Exposure				

ITEM 22. **BODY PART(S) AFFECTED** - Enter up to 3 of the following body part codes. (The first code entered should indicate Section of Body.):

Section of Body		Part of Body					
(A00)	Body in general	(D10)	Abdomen	(F35)	Foot	(B16)	Mouth/Teeth
(D00)	Torso (Chest)	(F21)	Ankle	(E22)	Forearm	(C05)	Neck
(B00)	Head/Facial	(E13)	Upper Arm	(D53)	Groin	(B06)	Nose
(E00)	Upper Extremities	(D30)	Back	(E30)	Hand	(E11)	Shoulder
(F00)	Lower Extremities	(F22)	Calf/Skin	(D43)	Heart	(D46)	Side/Rib(s)
		(B03)	Ear(s)	(F33)	Heel	(D32)	Spine
		(E12)	Elbow	(D54)	Hip	(F34)	Toe(s)
		(B12)	Eye(s)	(B14)	Jaw	(D33)	Vertebra(e)
		(B10)	Face	(F11)	Knee	(E21)	Wrist
		(E31)	Finger(s)	(F10)	Leg		

ITEMS 24 AND 31. **CAUSES OF INJURY AND/OR DAMAGE** - Select up to 3 of the following codes to identify the causes of injury and/or damage: (Refer to NMI 8621.1E for definitions of Primary, Contributing and Potential Causes.) NOTE: Primary Cause must be indicated.

(C) Communications
- (1) Paging Warning Inadequate
- (2) Problem Reporting/ Tracking Inadequate
- (3) Schedule Conflicts
- (4) Task Coordination/ Planning Inadequate
- (5) Task Supervision Inadequate
- (6) Test Team Briefing Inadequate

(E) Equipment Failure
- (1) Design Deficiency
- (2) Maintenance
- (3) Material Failure
- (4) Material Defects

(F) Fire/Explosion
- (1) Chemical Change
- (2) Fuel/Oxidizer Near Ignition Source
- (3) Pressure Release/Implosion
- (4) High Heat Source

(A) Handling
- (1) Design Deficiency
- (2) Deviation from Procedure

(O) Hazardous Operation
- (1) Arrangement
- (2) Improper Illumination
- (3) Improper Ventilation
- (4) Improper Clothing
- (5) Improper Guarding
- (6) Unsafe Equipment
- (7) Deviation from Procedure
- (8) Improper Protection

(H) Human Factors
- (1) Distraction
- (2) Fatigue
- (3) Safety Violation
- (4) Lack of Experience
- (5) Working Environment
- (6) Lack of Authority
- (7) Lack of Attention
- (8) Misjudgment of Conditions

(N) Natural Phenomenon
- (1) Lightning
- (2) Wind
- (3) Rain
- (4) Hail
- (5) Earthquake

(T) Organizational Deficiency
- (1) Lack of Training
- (2) Lack of Certification
- (3) Expired Certification

(P) Procedure
- (1) Requirements Inadequate
- (2) Procedure Deficiency
- (3) Technical Data Deficiency

(M) Toxic Material
- (1) Design Deficiency
- (2) Improper Handling

ITEM 25. **MISHAP ENVIRONMENT**

AGENCY - Enter up to 3 Agency codes:

- (A) Animals
- (B) Boilers/Pressure Vessels
- (C) Chemicals
- (D) Conveyors
- (E) Dust
- (F) Electrical Apparatus
- (G) Elevators
- (H) Hand Tools
- (I) Highly Flammable, Hot/ Toxic Substances
- (J) Hoisting Apparatus Cranes, Winches, etc.)
- (K) Machines
- (L) Material
- (M) Mechanical Power/ Transmission Apparatus
- (N) Prime Movers and Pumps
- (O) Radiation/Radiating Substances
- (P) Vehicles
- (Q) Working/Walking Surfaces (Stairs, Platforms, etc.)
- (S) Temperature Extremes
- (T) Electrical Current
- (Z) Agency Not Elsewhere Classified

ACTIVITY - Enter up to 3 Activity codes:

- (A) Striking Against
- (B) Struck By
- (C) Caught In/On/Between
- (D) Fall on Same Level
- (E) Fall to Different Level
- (F) Slip (not fall)/Trip
- (M) Dropped, Spilled, Splashed
- (N) Lifting, Moving
- (P) Ascending/Descending
- (Q) Twisting/Turning
- (R) Over-Exertion
- (S) Pushing/Pulling
- (Z) Activity Not Elsewhere Classified

ATTACHMENT III

EQUIPMENT INSPECTION

Unit/Serial No#:____________________________________ **Inspection Date:** _____/_____/_____

Equipment Inspection Checklist for Drill Rigs

Company:____

Unit/Serial No#:________________________________

Inspection Date: _____/_____/_____ **Time:**______:_____

Equipment Type:______________________________
(e.g, Drill Rigs Hollow Stem, Mud Rotary, Direct Push, HDD)

Project Name:______________________________________

Project No#:__________________________________

Yes	No	NA	Requirement	Comments
			Emergency Stop Devices	
☐	☐	☐	• Emergency Stop Devices (At points of operation)	
☐	☐	☐	• Have all emergency shut offs identified been communicated to the field crew?	
☐	☐	☐	• Has a person been designated as the Emergency Stop Device Operator?	
			Highway Use	
☐	☐	☐	• Cab, mirrors, safety glass?	
☐	☐	☐	• Turn signals, lights, brake lights, etc. (front/rear) for equipment approved for highway use?	
☐	☐	☐	• Seat Belts?	
☐	☐	☐	• Is the equipment equipped with audible back-up alarms and back-up lights?	
☐	☐	☐	• Horn and gauges	
☐	☐	☐	• Brake condition (dynamic, park, etc.)	
☐	☐	☐	• Tires (Tread) or tracks	
☐	☐	☐	• Windshield wipers	
☐	☐	☐	• Exhaust system	
☐	☐	☐	• Steering (standard and emergency)	
☐	☐	☐	• Wheel Chocks?	
☐	☐	☐	• Are tools and material secured to prevent movement during transport? Especially those within the cab?	
☐	☐	☐	• Are there flammables or solvents or other prohibited substances stored within the cab?	
☐	☐	☐	• Are tools or debris in the cab that may adversely influence operation of the vehicle (in and around brakes, clutch, gas pedals)	

Unit/Serial No#:____ **Inspection Date: ______/_____/_____**

Yes	No	NA	Requirement	Comments
☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐	Fluid Levels: • Engine oil • Transmission fluid • Brake fluid • Cooling system fluid • Hoses and belts • Hydraulic oil	
☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	High Pressure Hydraulic Lines • Obvious damage • Operator protected from accidental release • Coupling devices, connectors, retention cables/pins are in good condition and in place	
☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐	Mast Condition • Structural components/tubing • Connection points • Pins • Welds • Outriggers • Operational • Plumb (when raised)	
☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐	Hooks • Are the hooks equipped with Safety Latches? • Does it appear that the hook is showing signs of wear in excess of 10% original dimension? • Is there a bend or twist exceeding 10% from the plane of an unbent hook? • Increase in throat opening exceeding 15% from new condition • Excessive nicks and/or gouges • Clips • Number of U-Type (Crosby) Clips (cable size 5/16 – 5/8 = 3 clips minimum) (cable size 3/4 – 1 inch = 4 clips minimum) (cable size 1 1/8 – 1 3/8 inch = 5 clips minimum)	

Unit/Serial No#:____________________________________ **Inspection Date:** _____/_____/_____

Yes	No	NA	Requirement	Comments
			Power cable and/or hoist cable	
☐	☐	☐	• Reduction in Rope diameter π (5/16 wire rope>1/64 reduction nominal size -replace) (3/8 to 1/2 wire rope>1/32 reduction nominal size-replace) (9/16 to 3/4 wire rope>3/64 reduction nominal size-replace)	
☐	☐	☐	• Number of broken wires (6 randomly broken wires in one rope lay) (3 broken wires in one strand)	
☐	☐	☐	• Number of wire rope wraps left on the Running Drum at nominal use (≥3 required)	
☐	☐	☐	- Lead (primary) sheave is centered on the running drum	
☐	☐	☐	• Lubrication of wire rope (adequate?)	
☐	☐	☐	• Kinks, bends – Flattened to > 50% diameter	
			Hemp/Fiber rope (Cathead/Split Spoon Hammer)	
☐	☐	☐	• Minimum ¾; maximum 1 inch rope diameter (Inspect for physical damage)	
☐	☐	☐	• Rope to hammer is securely fastened	
			Safety Guards –	
☐	☐	☐	• Around rotating apparatus (belts, pulleys, sprockets, spindles, drums, flywheels, chains) all points of operations protected from accidental contact?	
☐	☐	☐	• Hot pipes and surfaces exposed to accidental contact?	
☐	☐	☐	• High pressure lines	
☐	☐	☐	• Nip/pinch points	
			Operator Qualifications	
☐	☐	☐	• Does the operator have proper licensing where applicable, (e.g., CDL)?	
☐	☐	☐	• Does the operator, understand the equipment's operating instructions?	
☐	☐	☐	• Is the operator experienced with this equipment?	
☐	☐	☐	• Is the operator 21 years of age or more?	

Unit/Serial No#:______________________________________ **Inspection Date:** _____/_____/_____

Yes	No	NA	Requirement	Comments
			PPE Required for Drill Rig Exclusion Zone	
☐	☐	☐	• Hardhat	
☐	☐	☐	• Safety glasses	
☐	☐	☐	• Work gloves	
☐	☐	☐	• Chemical resistant gloves______________________________	
☐	☐	☐	• Steel toed Work Boots	
☐	☐	☐	• Chemical resistant Boot Covers	
☐	☐	☐	• Apron	
☐	☐	☐	• Coveralls Tyvek, Saranex, cotton)__________________________	
			Other Hazards	
☐	☐	☐	• Excessive Noise Levels? ___________dBA	
☐	☐	☐	• Chemical hazards (Drilling supplies - Sand, bentonite, grout, fuel, etc.)	
☐	☐	☐	- MSDSs available?	
☐	☐	☐	• Will On-site fueling occur	
☐	☐	☐	- Safety cans available?	
☐	☐	☐	- Fire extinguisher (Type/Rating -__________ _)	

Approved for Use ☐ Yes ☐ No ☐ See Comments

______________________________________ ________________________________

Site Health and Safety Officer Operator

ATTACHMENT IV

SAFE WORK PERMITS

SAFE WORK PERMIT FOR
MOBILIZATION AND DEMOBILIZATION
NASA WALLOPS FLIGHT FACILITY

Permit No. _______________ Date: ___________________ Time: From __________ to _______

I. Work limited to the following (description, area, equipment used): Mobilization and Demobilization activities

II. Primary Hazards lifting; pinches and compression; slip, trip, and fall hazards, heavy equipment; vehicle and foot traffic; ambient temperature extremes; insect animal bites and stings and poisonous plants, and inclement weather.

III. Field Crew: ______________________________

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____________TtNUS
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____________TtNUS

V. Protective equipment required
Level D ☒ Level B ☐
Level C ☐ Level A ☐

Respiratory equipment required
Yes ☐ Specify on the reverse
No ☒

Modifications/Exceptions: ______________________________

VI. Chemicals of Concern	**Hazard Monitoring**	**Action Level(s)**	**Response Measures**
None anticipated	None required		

Primary Route(s) of Exposure/Hazard: Contaminants are not anticipated to be encountered during these tasks. Refer to manufacturer MSDS to determine necessary protective measures for any chemical brought on site in support of site activities.

(Note to FOL and/or SHSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

Hard-hat	☐ Yes	☐ No	Hearing Protection (Plugs/Muffs)	☐ Yes	☐ No
Safety Glasses	☐ Yes	☐ No	Safety belt/harness	☐ Yes	☒ No
Chemical/splash goggles	☐ Yes	☒ No	Radio/Cellular Phone	☐ Yes	☐ No
Splash Shield	☐ Yes	☒ No	Barricades	☐ Yes	☒ No
Splash suits/coveralls	☐ Yes	☒ No	Gloves (Type – (cotton/leather)	☐ Yes	☐ No
Impermeable apron	☐ Yes	☒ No	Work/rest regimen	☐ Yes	☐ No
Steel toe Work shoes/boots	☒ Yes	☐ No	Chemical resistant boot covers	☐ Yes	☒ No
High Visibility vest	☐ Yes	☐ No	Tape up/use insect repellent	☐ Yes	☐ No
First Aid Kit	☒ Yes	☐ No	Fire Extinguisher	☒ Yes	☐ No
Safety Shower/Eyewash	☒ Yes	☐ No	Other	☐ Yes	☐ No

Modifications/Exceptions: Safety glasses will be required if eye hazard are present. Reflective vests for high traffic areas. Tyvek coverall if there is a potential for soiling work clothes. Hard hats at SSO discretion if overhead hazards exist. Hearing protection at SSO discretion.

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☒
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☒
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc).	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.). ☐ Yes ☐ No
If yes, SHSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: Obtain MSDS for chemicals brought on site, add them to Chemical Inventory, and review them for any additional PPE requirements. Use safe lifting practices. Preview work locations for slip, trip, fall and other hazards that need to be communicated to field personnel.

Permit Issued by:______________________________ Permit Accepted by:______________________

SAFE WORK PERMIT FOR
MONITORING WELL INSTALLATION AND ORC® INJECTION
NASA WALLOPS FLIGHT FACILITY

Permit No. _______________ Date: ____________________ Time: From _____________ to _________

I. Work limited to the following (description, area, equipment used): Monitoring well installation using DPT technique and ORC® injection using direct push technology (DPT) technique .

II. Primary Hazards: Contact with site cont aminants; transfer of cont amination; pinc h/compression; noise; en ergized systems; heavy lifting; slip, trip and fall; vehicular and foot traffic; ambient temper ature extremes; insect/animal bites and stings, poisonous plants, inclement weather

III. Field Crew: ____

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____TtNUS
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____TtNUS

V. Protective equipment required
Level D ☒ Level B ☐
Level C ☐ Level A ☐

Respiratory equipment required
Yes ☐ Specify on the reverse
No ☒

Modifications/Exceptions: ____

VI.

Chemicals of Concern	Hazard Monitoring	Action Level(s)	Response Measures
Benzene and Vinyl Chloride	PID with 10.6 eV lamp	Any sustained readings > 10 ppm in the worker breathing zone	Evacuate area until levels return to background
Dust from ORC		visible dust	no dust is visible

Primary Route(s) of Exposure/Hazard: Inhalation of airbor ne co ntaminants is m ost likel y ro ute or e xposure. Incidental ingestion and contact with contaminants will be prevented through the use of PPE and safe work practices. Airborne dusts are unlikely to be generated during this activity, if present control through area wetting methods

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(Note to FOL and/or SSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

Hard-hat	☒ Yes	☐ No	Hearing Protection (Plugs/Muffs)	☒ Yes	☐ No
Safety Glasses	☒ Yes	☐ No	Safety belt/harness	☐ Yes	☒ No
Chemical/splash goggles	☐ Yes	☒ No	Radio/Cellular Phone	☐ Yes	☐ No
Splash shield	☐ Yes	☒ No	Barricades	☐ Yes	☐ No
Splash suits/coveralls	☒ Yes	☐ No	Gloves (Type – nitrile/work)	☒ Yes	☐ No
Impermeable apron	☒ Yes	☒ No	Work/rest regimen	☐ Yes	☐ No
Steel toe work shoes/boots	☒ Yes	☐ No	Chemical resistant boot covers	☐ Yes	☐ No
High visibility vest	☐ Yes	☐ No	Tape up/use insect repellent	☐ Yes	☐ No
First Aid Kit	☐ Yes	☐ No	Fire extinguisher	☒ Yes	☐ No
Safety Shower/Eyewash	☐ Yes	☒ No	Other	☐ Yes	☐ No

Modifications/Exceptions: Coveralls if the potential for s oiling work clothing exists. Other PPE is possible based o n conditions (rain gear, rubber boots, etc.)

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc).	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.). ☐ Yes ☒ No
If yes, SSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: Review MSDS for ORC Prod ucts in Atta chment VI. Use safe lifting/carr ying techniques. Inspect equipment prior to use. Ensure emergency stop devices are functional and test daily.

Permit Issued by:______________________________ Permit Accepted by:______________________________

SAFE WORK PERMIT FOR
MULTIMEDIA SAMPLING
NASA WALLOPS FLIGHT FACILITY

Permit No. ______________ Date: __________________ Time: From ______________ to _______

I. Work limited to the following (description, area, equipment used): Multi-media sam pling including groundwater and IDW.

II. Primary Hazards: Chemical contamin ation; trans fer contamin ation; pi nches an d com pressions; noi se; lifting; slips, trips and falls; vehi cular and foot t raffic amb ient temper ature extremes; i nsect/animal b ites, stings, poisonous plants and inclement weather.

III. Field Crew: ____________________

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector ____________TtNUS

Equipment Inspection required ☐ Yes ☐ No Initials of Inspector ____________TtNUS

V. Protective equipment required

Level D ☒ Level B ☐
Level C ☐ Level A ☐

Respiratory equipment required

Yes ☐ Specify on the reverse
No ☒

Modifications/Exceptions: Minimum requ irement include sleeved shirt and long pants, safety shoes, and surgical style gloves. Coveralls and snake chaps will be worn near insect/snake areas.

VI.

Chemicals of Concern	Hazard Monitoring	Action Level(s)	Response Measures
Benzene and Vinyl Chloride	PID with 10.6 eV lamp	Any sustained readings > 10 ppmin the worker breathing zone	Evacuate area until levels return to background
Dust from ORC		visible dust	no dust is visiblel

Primary Route(s) of Exposure/Hazard: Inhalation.

(Note to FOL and/or SHSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

	Yes	No		Yes	No
Hard-hat	☐	☐	Hearing Protection (Plugs/Muffs)	☐	☐
Safety Glasses	☒	☐	Safety belt/harness	☐	☒
Chemical/splash goggles	☐	☐	Radio/Cellular Phone	☐	☒
Splash Shield	☐	☒	Barricades	☐	☐
Splash suits/coveralls	☐	☐	Gloves (Type – Nitrile Surgeons)	☒	☐
Impermeable apron	☐	☒	Work/rest regimen	☐	☐
Steel toe Work shoes or boots	☒	☐	Chemical Resistant Boot Covers	☐	☐
High Visibility vest	☒	☐	Tape up/use insect repellent	☐	☐
First Aid Kit	☒	☐	Fire Extinguisher	☐	☐
Safety Shower/Eyewash	☐	☐	Other	☐	☐

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety shoes, and surgical style gloves. Coveralls and snake chaps will be worn near insect/snake areas.

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc).	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.). ☐ Yes ☒ No

If yes, SHSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: Potential e xposures via skin c ontact an d ha nd to mouth activities will be prevented through the use of PPE and appropriate decontamination and personal hygiene practices. Avoid areas of known or suspected insect/animal nesting or habitat, tape up, and use repellants.

Permit Issued by:______________________ Permit Accepted by:______________________

SAFE WORK PERMIT FOR
GEOGRAPHIC SURVEYING
NASA WALLOPS FLIGHT FACILITY

Permit No. ______________ Date: __________________ Time: From ____________ to ________

I. Work limited to the following (description, area, equipment used): Geographic Survey

II. Primary Hazards: Slips, trips and falls, ambient temperature extremes, inclement weather, insect/animal bites or stings, poisonous plants.

III. Field Crew: ______________________

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____TtNUS
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____TtNUS

V. Protective equipment required
Level D ☒ Level B ☐
Level C ☐ Level A ☐
Modifications/Exceptions: ______________________

Respiratory equipment required
Yes ☐ Specify on the reverse
No ☐

VI. Chemicals of Concern	**Hazard Monitoring**	**Action Level(s)**	**Response Measures**
None expected during this task.			

Primary Route(s) of Exposure/Hazard: ______________________

(Note to FOL and/or SSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

	Yes	No		Yes	No
Hard-hat	☐	☒	Hearing protection (Plugs/Muffs)	☐	☒
Safety glasses	☐	☒	Safety belt/harness	☐	☒
Chemical/splash goggles	☐	☒	Radio/cellular phone	☐	☐
Splash shield	☐	☒	Barricades	☐	☐
Splash suits/coveralls	☐	☒	Gloves (Type – _________)	☐	☒
Impermeable apron	☐	☒	Work/rest regimen	☐	☐
Steel toe work shoes or boots	☒	☐	Chemical resistant boot covers	☐	☒
High visibility vest	☐	☐	Tape up/use insect repellent	☐	☐
First aid kit	☐	☐	Fire extinguisher	☐	☐
Safety shower/eyewash	☐	☒	Other	☐	☐

Modifications/Exceptions: ______________________

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc).	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.). ☐ Yes ☐ No
If yes, SHSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: ______________________

Permit Issued by: ______________________ Permit Accepted by: ______________________

SAFE WORK PERMIT FOR
DECONTAMINATION ACTIVITIES
NASA WALLOPS FLIGHT FACILITY

Permit No. _______________ Date: ____________________ Time: From _______________ to _______

I. Work limited to the following (description, area, equipment used): Decontamination sampling equipment activities .

II. Primary Hazards: Chemical contamin ation; decontamination flui ds; nois e; lifting; fl ying projectil es; sli p, trip, and fall ; vehicle and foot traffic; ambient temperature extremes and inclement weather.

III. Field Crew: ________________________________

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____________TtNUS
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____________TtNUS

V. Protective equipment required
Level D ☒ Level B ☐
Level C ☐ Level A ☐
Modifications/Exceptions: ________________________

Respiratory equipment required
Yes ☐ Specify on the reverse
No ☒

VI. Chemicals of Concern	**Hazard Monitoring**	**Action Level(s)**	**Response Measures**
Benzene and Vinyl Chloride	PID with 10.6 eV lamp	Any sustained readings > 10 ppmin the worker breathing zone	Evacuate area until levels return to background
Dust from ORC		visible dust	no dust is visiblel

Primary Route(s) of Exposure/Hazard: Contaminants ar e not antici pated to be pr esent at conc entrations th at pos e a health threat to site workers.

(Note to FOL and/or SHSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

Hard-hat	☐ Yes	☒ No	Hearing Protection (Plugs/Muffs)	☐ Yes	☒ No
Safety Glasses	☒ Yes	☐ No	Safety belt/harness	☐ Yes	☒ No
Chemical/splash goggles	☐ Yes	☐ No	Radio/Cellular Phone	☐ Yes	☐ No
Splash Shield	☐ Yes	☐ No	Barricades	☐ Yes	☐ No
Splash suits/coveralls	☐ Yes	☐ No	Gloves (Type – Nitrile)	☒ Yes	☐ No
Impermeable apron	☐ Yes	☐ No	Work/rest regimen	☐ Yes	☐ No
Steel toe Work shoes/boots	☒ Yes	☐ No	Chemical Resistant Boot Covers	☒ Yes	☐ No
High Visibility vest	☒ Yes	☐ No	Tape up/use insect repellent	☐ Yes	☐ No
First Aid Kit	☐ Yes	☐ No	Fire Extinguisher	☐ Yes	☐ No
Safety Shower/Eyewash	☐ Yes	☐ No	Other	☐ Yes	☐ No

Modifications/Exceptions: PPE selection is largely dependent upon conditions and tasks being performed.

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc).	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.). ☐ Yes ☐ No
If yes, SHSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: Potential exposures via skin contact and hand to mouth activities will be prevent through the use of PPE and appropriate decontamination and personal hygiene practices.

Permit Issued by:_______________________ Permit Accepted by:_______________________

SAFE WORK PERMIT FOR
DECONTAMINATION ACTIVITIES
NASA WALLOPS FLIGHT FACILITY

Permit No. _______________ Date: ___________________ Time: From _____________ to _________

I. Work limited to the following (description, area, equipment used): IDW management, moving and storage

II. Primary Hazards: Potential hazards associated with this task: spill; strains and sprains; back injuries compressions

III. Field Crew: ______________________________

IV.

On-site Inspection conducted	☐ Yes	☐ No	Initials of Inspector _____TtNUS
Equipment Inspection required	☐ Yes	☐ No	Initials of Inspector _____TtNUS

V. Protective equipment required
Level D ☒ Level B ☐
Level C ☐ Level A ☐

Respiratory equipment required
Yes ☐ Specify on the reverse
No ☒

Modifications/Exceptions: ______________________________

VI.

Chemicals of Concern	**Hazard Monitoring**	**Action Level(s)**	**Response Measures**
None expected during this task			

Primary Route(s) of Exposure/Hazard: absor ption

(Note to FOL and/or SSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

Hard-hat	☐ Yes	☐ No	Hearing Protection (Plugs/Muffs)	☐ Yes	☒ No
Safety Glasses	☐ Yes	☐ No	Safety belt/harness	☐ Yes	☒ No
Chemical/splash goggles	☐ Yes	☒ No	Radio/Cellular Phone	☐ Yes	☐ No
Splash Shield	☐ Yes	☒ No	Barricades	☐ Yes	☒ No
Splash suits/coveralls	☐ Yes	☐ No	Gloves (Type – work)	☒ Yes	☐ No
Impermeable apron	☐ Yes	☒ No	Work/rest regimen	☐ Yes	☐ No
Steel toe work shoes or boots	☒ Yes	☐ No	Chemical Resistant Boot Covers	☐ Yes	☒ No
High Visibility vest	☐ Yes	☐ No	Tape up/use insect repellent	☐ Yes	☐ No
First Aid Kit	☐ Yes	☐ No	Fire Extinguisher	☐ Yes	☒ No
Safety Shower/Eyewash	☐ Yes	☒ No	Other	☐ Yes	☐ No

Modifications/Exceptions: ______________________________

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc).	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.). ☐ Yes ☒ No
If yes, SSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: Inspect drums used to store IDW prior to use. Disperse IDW evenly. Use proper lifting practices and obtain assistance when handling heavy drums.

Permit Issued by: ______________________ Permit Accepted by: ______________________

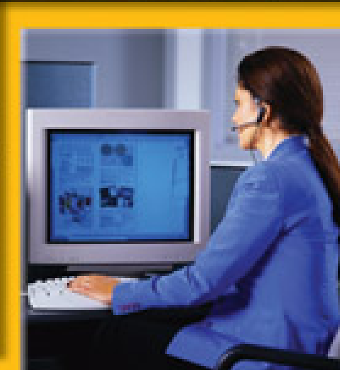
ATTACHMENT V

OSHA POSTER

Job Safety and Health

It's the law!

Occupational Safety and Health Administration
U.S. Department of Labor



EMPLOYEES:

- You have the right to notify your employer or OSHA about workplace hazards. You may ask OSHA to keep your name confidential.
- You have the right to request an OSHA inspection if you believe that there are unsafe and unhealthful conditions in your workplace. You or your representative may participate in that inspection.
- You can file a complaint with OSHA within 30 days of retaliation or discrimination by your employer for making safety and health complaints or for exercising your rights under the *OSH Act*.
- You have the right to see OSHA citations issued to your employer. Your employer must post the citations at or near the place of the alleged violations.
- Your employer must correct workplace hazards by the date indicated on the citation and must certify that these hazards have been reduced or eliminated.
- You have the right to copies of your medical records and records of your exposures to toxic and harmful substances or conditions.
- Your employer must post this notice in your workplace.
- You must comply with all occupational safety and health standards issued under the *OSH Act* that apply to your own actions and conduct on the job.

EMPLOYERS:

- You must furnish your employees a place of employment free from recognized hazards.
- You must comply with the occupational safety and health standards issued under the *OSH Act*.

This free poster available from OSHA –
The Best Resource for Safety and Health

Free assistance in identifying and correcting hazards or complying with standards is available to employers, without citation or penalty, through OSHA-supported consultation programs in each state.

1-800-321-OSHA
www.osha.gov

OSHA 3165-12-06R

ATTACHMENT VI

MSDS ORC INJECTION

Oxygen Release Compound – Advanced (ORC *Advanced*™)
MATERIAL SAFETY DATA SHEET (MSDS)

Last Revised: March 13, 2007

Section 1 - Material Identification

Supplier:

REGENESIS

1011 Calle Sombra
San Clemente, CA 92673

Phone:	**949.366.8000**
Fax:	**949.366.8090**
E-mail:	**info@regenesis.com**

Chemical Description:	A mixture of Calcium OxyHydroxide [$CaO(OH)_2$] and Calcium Hydroxide [$Ca(OH)_2$].
Chemical Family:	Inorganic Chemical
Trade Name:	Advanced Formula Oxygen Release Compound (ORC *Advanced*™)
Chemical Synonyms	Calcium Hydroxide Oxide; Calcium Oxide Peroxide
Product Use:	Used to remediate contaminated soil and groundwater (environmental applications)

Section 2 – Composition

CAS No.	**Chemical**
682334-66-3	**Calcium Hydroxide Oxide [$CaO(OH)_2$]**
1305-62-0	**Calcium Hydroxide [$Ca(OH)_2$]**
7758-11-4	**Dipotassium Phosphate (HK_2O_4P)**
7778-77-0	**Monopotassium Phosphate (H_2KO_4P)**

Section 3 – Physical Data

Form:	Powder
Color:	White to Pale Yellow
Odor:	Odorless
Melting Point:	527 °F (275 °C) – Decomposes
Boiling Point:	Not Applicable (NA)
Flammability/Flash Point:	NA
Auto- Flammability:	NA
Vapor Pressure:	NA
Self-Ignition Temperature:	NA
Thermal Decomposition:	527 °F (275 °C) – Decomposes
Bulk Density:	0.5 – 0.65 g/ml (Loose Method)
Solubility:	1.65 g/L @ 68° F (20° C) for calcium hydroxide.
Viscosity:	NA
pH:	11-13 (saturated solution)
Explosion Limits % by Volume:	Non-explosive
Hazardous Decomposition Products:	Oxygen, Hydrogen Peroxide, Steam, and Heat
Hazardous Reactions:	None

Section 4 – Reactivity Data

Stability:	Stable under certain conditions (see below).
Conditions to Avoid:	Heat and moisture.
Incompatibility:	Acids, bases, salts of heavy metals, reducing agents, and flammable substances.
Hazardous Polymerization:	Does not occur.

Section 5 – Regulations

TSCA Inventory List:	Listed

CERCLA Hazardous Substance (40 CFR Part 302)

Listed Substance:	No
Unlisted Substance:	Yes
Reportable Quantity (RQ):	100 pounds
Characteristic(s):	Ignitibility
RCRA Waste Number:	D001

SARA, Title III, Sections 302/303 (40 CFR Part 355 – Emergency Planning and Notification)

Extremely Hazardous Substance:	No

SARA, Title III, Sections 311/312 (40 CFR Part 370 – Hazardous Chemical Reporting: Community Right-To-Know

Hazard Category:	Immediate Health Hazard Fire Hazard
Threshold Planning Quantity:	10,000 pounds

Section 5 – Regulations (cont)

SARA, Title III, Section 313 (40 CFR Part 372 – Toxic Chemical Release Reporting: Community Right-To-Know

Extremely Hazardous Substance:	No	
WHMIS Classification:	C	Oxidizing Material Poisonous and Infectious Material
	D	Material Causing Other Toxic Effects – Eye and Skin Irritant
Canadian Domestic Substance List:	Not Listed	

Section 6 – Protective Measures, Storage and Handling

Technical Protective Measures

Storage:	Keep in tightly closed container. Store in dry area, protected from heat sources and direct sunlight.
Handling:	Clean and dry processing pipes and equipment before operation. Never return unused product to the storage container. Keep away from incompatible products. Containers and equipment used to handle this product should be used exclusively for this material. Avoid contact with water or humidity.

Section 6 – Protective Measures, Storage and Handling (cont)

Personal Protective Equipment (PPE)

Engineering Controls:	Calcium Hydroxide ACGIH® TLV® (2000) 5 mg/m^3 TWA OSHA PEL Total dust–15 mg/m^3 TWA Respirable fraction– 5 mg/m^3 TWA NIOSH REL (1994) 5 mg/m^3
Respiratory Protection:	For many conditions, no respiratory protection may be needed; however, in dusty or unknown atmospheres use a NIOSH approved dust respirator.
Hand Protection:	Impervious protective gloves made of nitrile, natural rubbber or neoprene.
Eye Protection:	Use chemical safety goggles (dust proof).
Skin Protection:	For brief contact, few precautions other than clean clothing are needed. Full body clothing impervious to this material should be used during prolonged exposure.
Other:	Safety shower and eyewash stations should be present. Consultation with an industrial hygienist or safety manager for the selection of PPE suitable for working conditions is suggested.
Industrial Hygiene:	Avoid contact with skin and eyes.
Protection Against Fire & Explosion:	NA

Section 7 – Hazards Identification

Emergency Overview:	Oxidizer – Contact with combustibles may cause a fire. This material decomposes and releases oxygen in a fire. The additional oxygen may intensify the fire.
Potential Health Effects:	Irritating to the mucous membrane and eyes. If the product splashes in ones face and eyes, treat the eyes first. Do not dry soiled clothing close to an open flame or heat source. Any

	clothing that has been contaminated with this product should be submerged in water prior to drying.
Inhalation:	High concentrations may cause slight nose and throat irritation with a cough. There is risk of sore throat and nose bleeds if one is exposed to this material for an extended period of time.
Eye Contact:	Severe eye irritation with watering and redness. There is also the risk of serious and/or permanent eye lesions.
Skin Contact:	Irritation may occur if one is exposed to this material for extended periods.
Ingestion:	Irritation of the mouth and throat with nausea and vomiting.

Section 8 – Measures in Case of Accidents and Fire

After Spillage/Leakage/Gas Leakage:	Collect in suitable containers. Wash remainder with copious quantities of water.
Extinguishing Media:	See next.
Suitable:	Large quantities of water or water spray. In case of fire in close proximity, all means of extinguishing are acceptable.
Further Information:	Self contained breathing apparatus or approved gas mask should be worn due to small particle size. Use extinguishing media appropriate for surrounding fire. Apply cooling water to sides of transport or storage vessels that are exposed to flames until the fire is extinguished. Do not approach hot vessels that contain this product.
First Aid:	After contact with skin, wash immediately with plenty of water and soap. In case of contact with eyes, rinse immediately with plenty of water and seek medical attention. Consult an opthalmologist in all cases.

Section 8 – Measures in Case of Accidents and Fire

Eye Contact:	Flush eyes with running water for 15 minutes, while keeping the eyelids wide open. Consult with an ophthalmologist in all cases.
Inhalation:	Remove subject from dusty environment. Consult with a physician in case of respiratory symptoms.

Ingestion:	If the victim is conscious, rinse mouth and admnister fresh water. DO NOT induce vomiting. Consult a physician in all cases.
Skin Contact:	Wash affected skin with running water. Remove and clean clothing. Consult with a physician in case of persistent pain or redness.
Special Precautions:	Evacuate all non-essential personnel. Intervention should only be done by capable personnel that are trained and aware of the hazards associated with this product. When it is safe, unaffected product should be moved to safe area.
Specific Hazards:	Oxidizing substance. Oxygen released on exothermic decomposition may support combustion. Confined spaces and/or containers may be subject to increased pressure. If product comes into contact with flammables, fire or explosion may occur.

Section 9 – Accidental Release Measures

Precautions:	Observe the protection methods cited in Section 3. Avoid materials and products that are incompatible with product. Immediately notify the appropriate authorities in case of reportable discharge (> 100 lbs).
Cleanup Methods:	Collect the product with a suitable means of avoiding dust formation. All receiving equipment should be clean, vented, dry, labeled and made of material that this product is compatible with. Because of the contamination risk, the collected material should be kept in a safe isolated place. Use large quantities of water to clean the impacted area. See Section 12 for disposal methods.

Section 10 – Information on Toxicology

Toxicity Data

Acute Toxicity:	Oral Route, LD_{50}, rat, > 2,000 mg/kg (powder 50%) Dermal Route, LD_{50}, rat, > 2,000 mg/kg (powder 50%) Inhalation, LD_{50}, rat, > 5,000 mg/m^3 (powder 35%)
Irritation:	Rabbit (eyes), severe irritant

Sensitization:	No data
Chronic Toxicity:	In vitro, no mutagenic effect (Powder 50%)
Target Organ Effects:	Eyes and respiratory passages.

Section 11 – Information on Ecology

Ecology Data	
Acute Exotoxicity:	10 mg $Ca(OH)_2$/L: pH = 9.0 100 mg $Ca(OH)_2$/L: pH = 10.6 Fishes, Cyprinus carpio, LC_{50}, 48 hrs, 160 mg/L Crustaceans, Daphnia sp., EC_{50}, 24 hours, 25.6 mg/L (Powder 16%)
Mobility:	Low Solubility and Mobility
Abiotic Degradation:	Water – Slow Hydrolysis. Degradation Products: Calcium Hydroxide Water/soil – complexation/precipitation. Carbonates/sulfates present at environmental concentrations. Degradation products: carbonates/sulfates sparingly soluble
Biotic Degradation:	NA (inorganic compound)
Potential for Bioaccumulation:	NA (ionizable inorganic compound)

Section 11 – Information on Ecology (cont)

Comments:	Observed effects are related to alkaline properties of the product. Hazard for the environment is limited due to the product properties of: • No bioaccumulation • Weak solubility and precipatation as carbonate or sulfate in an aquatic environment. Diluted product is rapidly neutralized at environmental pH.
Further Information:	NA

Section 12 – Disposal Considerations

Waste Disposal Method:	Consult current federal, state and local regulations regarding the proper disposal of this material and its emptied containers.

Section 13 – Shipping/Transport Information

D.O.T Shipping Name:	Oxidizing Solid, N.O.S [A mixture of Calcium OxyHydroxide [$CaO(OH)_2$] and Calcium Hydroxide [$Ca(OH)_2$].
UN Number:	1479
Hazard Class:	5.1
Label(s):	5.1 (Oxidizer)
Packaging Group:	II
STCC Number:	4918717

Section 14 – Other Information

HMIS® Rating	Health – 2 Flammability – 0	Reactivity – 1 PPE - Required

HMIS® is a registered trademark of the National Painting and Coating Association.

NFPA® Rating	Health – 2 Flammability – 0	Reactivity – 1 OX

NFPA® is a registered trademark of the National Fire Protection Association.

Reason for Issue: Update toxicological and ecological data

Section 15 – Further Information

The information contained in this document is the best available to the supplier at the time of writing, but is provided without warranty of any kind. Some possible hazards have been determined by analogy to similar classes of material. The items in this document are subject to change and clarification as more information become available.