Water Column Injury Ephemeral Data Collections: DWHOS
Plan for Adaptive Water Column NOAA-NRDA Sampling (PAWWNS)
Cruise Plan - American Diver 1 and Ocean Veritas 9

Approvals

Approval of this work plan is for the purposes of obtaining data for the Natural Resource Damage Assessment. Parties each reserve its right to produce its own independent interpretation and analysis of any data collected pursuant to this work plan.

for Rob Ricker

Federal Trustee Representative

Rob Ricker (NOAA)

Date 7/21/2010

BP Representative

NRDA Specialist

Date 7/20/2010

FOR KOLAMD GUIDRY

Louisiana Trustee Representative

Date
7/29/10

Water Column Injury Ephemeral Data Collections:
Deepwater Horizon Oil Spill (DWHOS)

Plan for Adaptive Water Column NOAA-NRDA Sampling (PAWNNS)
Cruise Plan – American Diver 1 and Ocean Veritas 9

July 17, 2010

Prepared by: Deborah French-McCay, Jennifer Cragan, Eileen Graham (ASA)

Proposed Cruise Dates:

American Diver 1 – July 17-24, 2010

Ocean Veritas 9 – July 13-17, 2010

Background/Justification

To date there have been significant efforts by both response and damage assessment around the Deepwater Horizon wellhead at MC252 to characterize the spatial and temporal extent of oil released as a result of the Deepwater Horizon Incident. These efforts have been invaluable for near-field detection of submerged hydrocarbons with heavy reliance on discrete techniques to determine water column concentrations. The need for more synoptic continuous sampling techniques able to provide a clearer overall picture is recognized, but ground-truthing of instrumentation for this purpose has not been completed in enough detail to determine what specific instruments are most appropriate to the task.

This NRDA-focused sampling plan is being conducted in coordination with a Response-focused effort. The fundamental tenet of the overall effort, multi-vessel coordination for concerted sampling efforts to improve spatial and temporal understanding of oil distribution, provides information useful in the evaluating the potential impact to the ecosystem in and around the spill site. While there are discrete responsibilities and some limitations, the unique nature of this incident requires closer integration of the Response and Assessment. The respective sampling teams have been working together to maximize cooperation and minimize conflicts.

The key aspects of collaboration are:

- Data management protocols
- Scheduling and personnel
- Methods development
- Situational awareness

Aspects unique to this NRDA-focused sampling plan include:

- Informing specific needs of the damage assessment

- Adaptive sampling strategy using multiple informational sources for location selection
- Variable reoccupation of sampling locations
- Concentrated effort in the near-field around the source (<20km)

This plan is for the first of a series of cruises to be conducted with a similar approach and adaptive sampling strategy. The goals of the two cruises described herein, American Diver 1 and Ocean Veritas 9, are to

1. develop and test sampling protocols for various continuous sampling instruments in characterizing and measuring oil droplet sizes and numerical densities of particulates (oil, detritus, marine snow, plankton);
2. characterize signals identified by acoustics and fluorescence measurements;
3. obtain near-field data on oil droplet size, water chemistry (oil and dissolved hydrocarbon concentrations), and other particulate (detritus, marine snow, plankton) densities.

Approach: Adaptive Sampling Strategy

Sampling is focused on specific areas and times where oil would be expected to occur. We have designed an adaptive focused sampling strategy, targeting particular portions of the water column and in areas where oil is detected by indirect sensors or expected based on transport modeling using measured and/or predicted circulation patterns and an understanding of oil transport. The focus of these efforts will be within 20 km of the wellhead.

In situ sensors, such as fluorometers and acoustic techniques identified as capable of detecting submerged oil at some detection level (concentration threshold) and distance, will be used to provide information for selecting sampling stations and depths. The following categories of data will be collected by direct sampling and measurements:

- CTD for salinity, temperature and water density, dissolved oxygen, and fluorescence;
- Oil droplet size distributions and concentrations (total petroleum hydrocarbons);
- Concentrations of insoluble and semi-soluble hydrocarbons in oil droplets (each filtered sample measured for saturated hydrocarbons and PAHs);
- Concentrations of dissolved hydrocarbons (whole, unfiltered samples analyzed for BTEX plus alkyl benzenes and each individual filtrate measured for PAHs);
- Concentrations of suspended sediments and detritus (marine snow);
- Plankton concentrations (live and dead)
- Pyrosomes.

It is envisioned that the following framework will be implemented over the course of several two-week cycles. The first cruise (American Diver 1) will test the equipment and approach proposed for the larger Adaptive Sampling Strategy Plan. Analysis of in-situ data during and between cruise deployments will determine the need for additional sampling efforts or any modifications required to increase the value of the data. The overall goal will be to augment the efforts outlined for this cruise with in-situ instrumentation on an additional boat to provide a more comprehensive adaptive sampling effort through the near real-time integration of in-situ instrumentation with discrete water sampling and ground-truth measurements.

Overall Objective for the American Diver 1 and Follow-on Cruises

Apply in-situ methods to a larger spatial and temporal domain than previously evaluated to continue to characterize and determine the distribution of subsurface oil at and beyond the immediate area of the MC 252 wellhead.

This will be accomplished by augmenting the vessels currently employed in Response (Brooks McCall, Ocean Veritas, discrete water column sampling efforts) with vessels specifically outfitted for broader spatial coverage and enhanced in-situ chemical and physical detection capabilities. Using a multi-disciplinary, multi-timescale approach, sampling efforts will be coordinated among vessels to provide information on timescales which are relevant to discrete sampling efforts (3-4 hours) to address long term modeling/assessment needs (days to months). The end products of this effort will address the following issues related to the Deepwater Horizon Incident:

1. provide data to better inform oil fate and transport models for the near-field area;
2. Near-term determination of biota exposed to dissolved and dispersed oil; and
3. Context for longer-term biological effects models.

Methodology

We will characterize and determine the distribution of subsurface oil at and beyond the immediate area of the wellhead by deploying multiple specialized assets outfitted to work in tandem. We will conduct casts both within the subsurface oil plume, and outside of it, utilizing an adaptive cruise plan that will be guided by data collected from in-situ instrumentation, as well as oil transport modeling, to identify the location of the plume. Sites will be chosen based on available data (i.e. currents profiles), modeling results, and onboard detection of potential oil targets. The number of stations sampled will be determined by the extent of the plume, rate of sampling and available crew hours.

Adaptive sampling efforts will be directed based on the following data sources and analyses which indicate the possible presence of submerged oil:

1. Onboard analysis of in-situ instrument results and discrete sample data from previous sampling and real-time sensors;
2. External acoustics data acquired aboard other vessels (e.g., the Ridley Thomas, Pisces and/or Bigelow); and
3. Real-time ADCP current data and oil transport modeling utilizing these data.

Upon identification of the location of sample stations and/or transects, using the above data (see specific sampling strategy below), a suite of instrumentation will be deployed to determine the physical, chemical and biological characteristics of the area. Discrete samples will be located in the vertical with the guidance of diagnostic fluorescence measurements and imaging technologies. These samples will be taken to determine the concentrations of chemical components and biota at sampled locations.

The American Diver is being mobilized for approximately 7 days with a departure date of July 17, 2010. This vessel will be outfitted with the following instrumentation complement using methods described here and in appendices:

CTD: We will deploy a CTD profiling package (Malinda Sutor, LSU) equipped with a CTD, chlorophyll fluorometer, CDOM fluorometer, optical backscatter sensor, PAR sensor, and dissolved oxygen sensor (Appendix 1) in vertical profiles to approximately 200 m. There will also be a Seabird 19 Plus CTD which can be deployed to a depth of 6000 meters which will collect CDOM fluorescence, dissolved oxygen, and salinity, temperature, and depth information.

Acoustic Instruments: Under direction of Malinda Sutor (LSU), we will deploy an Acoustic Water Column Profiler (AWCP, 2 frequency, 420 and 778 kHz) and a 1200 KHz ADCP in vertical profiles to approximately 200 m. These will provide data at three frequencies, allowing us to utilize multi-frequency scattering models to identify sources of backscatter and size distribution of scatterers. (See Appendix 1.)

Image-forming Optical Instruments: A color Digital-Automatic Video Plankton Recorder (DAVPR) and an underwater digital holographic imaging camera (Holocam) will be used to survey the distribution of plankton, marine snow, and oil droplets within the near-field region of the well head (Cabell Davis, WHOI). We will tow-yo the DAVPR at 2-4 kts to depths up to 1000m along transects through the near-field region and will deploy the Holocam in vertical profiles and possibly on the DAVPR frame as well. The Holocam is a self-contained holographic camera that can be lowered on the ship's CTD frame or another frame. The internal memory card records the images (taken at specified intervals) for downloading and processing once onboard. See Appendix 2 for a description of the instrument and specifications for the optical instrumentation.

CNES: The Counter Narcotics Environmental Sensor, CNES is a submersible environmental monitoring package that can be used in profiling mode (to 100m depth), for fixed-depth temporal sampling or discrete analysis, and has sensors to measure and log for the following components:

- pH
- Redox, Oxidation Reduction Potential
- Temperature
- Dissolved Oxygen and Oxygen Saturation (Aanderra O_2 Optode)
- Crude Oil (optical sensor) [Turner Cyclops]
- CDOM (optical sensor) [Wetlabs ECO]
- Optical Backscatter
- Chlorophyll (optical sensor)
- Depth

See Appendix 3 for a description of the CNES instrument capabilities. Fred Marin of AIS, a NOAA contractor, will operate the instrument, and perform data processing, backups and storage.

Pyrosome Sampling: Transects to estimate densities of dead floating pyrosomes in the immediate survey area will be performed, as well as specimens collected for size measurements and further identification. See Appendix 4 for the sampling procedures.

Discrete Water Sampling: Samples will be taken to test for the presence of oil and dissolved hydrocarbon components. Water samples at depth will be taken with a rosette sampler that can collect multiple samples at various depths and collect a large enough sample for chemical analysis. Water samples will be collected for analytical chemistry: PAH (complete suite), BTEX, and TPH using the Portable Large Volume Water Sampling System (PLVWSS) (Payne et al., 1999) to separate the particulate/oil phase trapped on a 0.7 μm glass fiber filter and capture the dissolved phase (filtrate) in 3.8 L (1 gal) I-Chem Certified Clean amber glass jugs. The sampling methodology for discrete water sampling for these parameters will follow procedures outlined in Attachments 1, 2 and 3.

Sampling Plan for the American Diver Cruise 1

Sampling data will be collected at stations placed in areas thought to have deepwater oil contamination and surfacing oil from deepwater plumes, as well as surrounding areas. The design will be to sample near the wellhead down-current from the source. The directions from center will be focused in areas identified by:

A. The cumulative down-current direction (over time), as indicated by transport modeling using the current data measured at the DeepDriller III ADCP, the ADCP array deployed at 3 nmiles west of the Wellhead, and other ADCPs in nearby areas. Transport modeling will include rising speeds using modified Stokes Law for assumed droplet size distributions based on measured and estimated droplet sizes.
B. Targets identified with CTD, DO, and/or fluorescence measurements, both on the cruise and from other vessels (at time or in previous cruises). For example, fluorescence profiles and other sensors have indicated the presence of a deepwater plume between 1100 and 1400 m, which is consistent with modeling results using the approach outlined in bullet A above.
C. Targets identified with various acoustical techniques, both on the cruise (high frequency) and from other vessels (potentially Pisces, if available)
D. The estimated locations of surface oil calculated from combined down-wind and down-current transport, as calculated by the vector sum of surface current plus 2% of wind speed directed 0°-20° to the right of downwind.
E. Any available aircraft support as to surface oil locations from USCG, Ocean Imaging, or other over flights (possibly completed in support of response operations).

In view of the 2-km exclusion zone and 5-nmile safety zone imposed by the Incident Command Response Group (ICRG), the sampling stations will include locations between the 2-km and 5 nmile circles, as well as locations outside the 5-nmile circle. Sampling of the freshly-rising oil plume will be focused near the 2-km circle in the down-stream direction unless currents are strong at the time of sampling (in which case sampling will also be performed further from the well).

Figures 1-4 below provide an example for a hypothetical sampling period using data leading up to 1600 CDT on July 10, 2010. Transport modeling indicates a subsurface plume as shown in Figures 1-4. Notice the southeast plume (Figure 1) remains at depth, being composed of primarily small droplets (<100 micron diameter); whereas the southwest plume (Figure 2) is composed of larger droplets (100s of microns in diameter) that rise faster into currents directed SSW instead of SE. The dissolved concentrations from the southeast plume are within and just below the droplets they originated from and in high concentrations; whereas the dissolved concentrations from the southwest plume are well (100s of meters) below the droplets and in more diffuse lower concentrations.

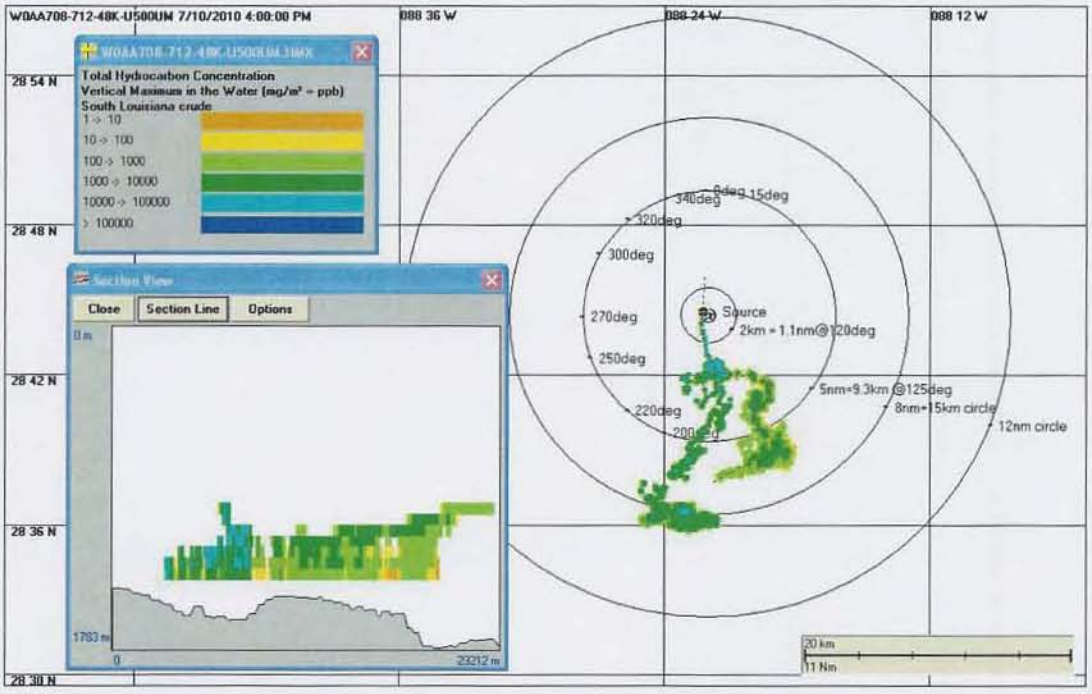

Figure 1. Modeled total hydrocarbon concentrations in oil droplets for Jul 10, 2010 at 1600 CDT – cross-section of SE plume (indicated by the dashed line).

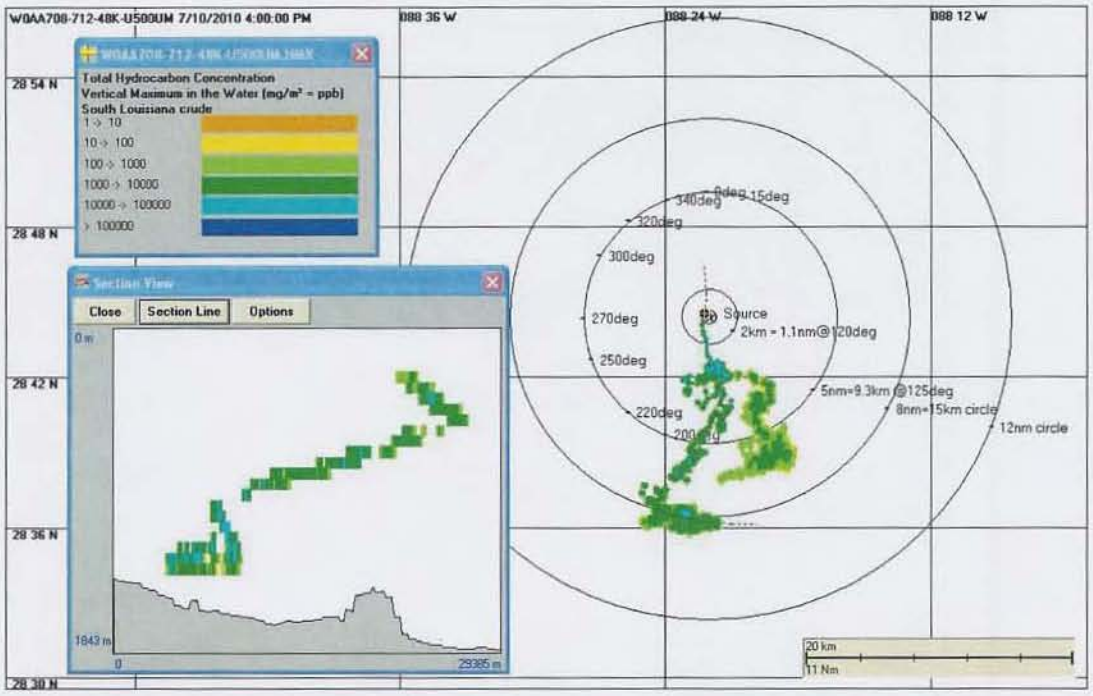

Figure 2. Modeled total hydrocarbon concentrations in oil droplets for Jul 10, 2010 at 1600 CDT – cross-section of SW plume (dashed line).

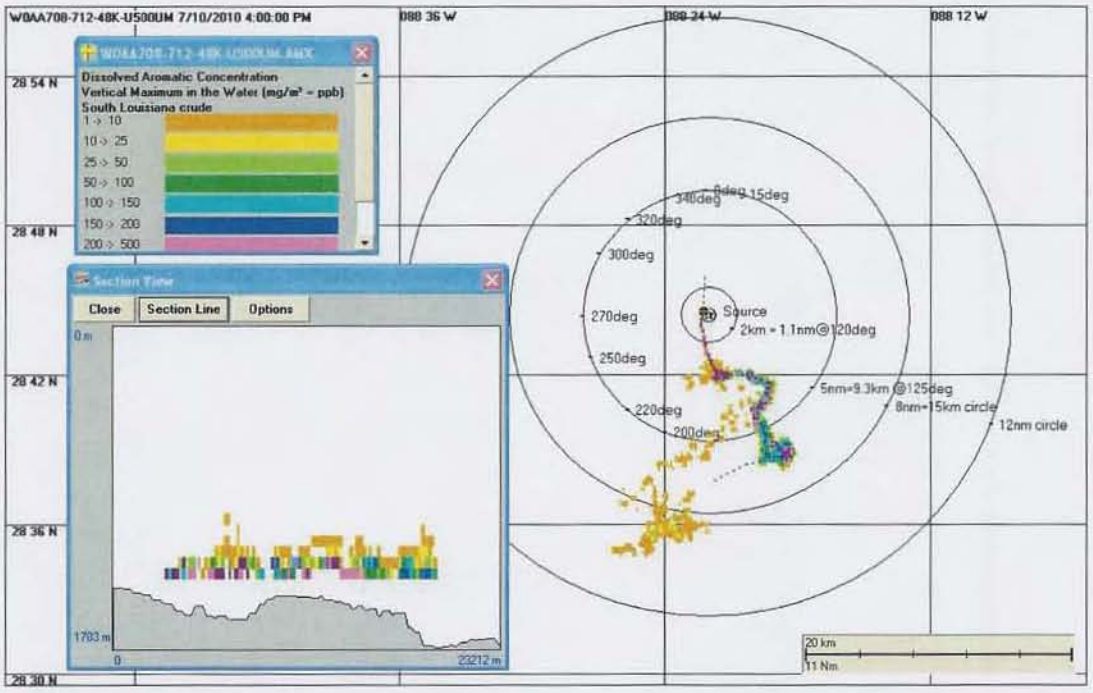

Figure 3. Modeled dissolved aromatic concentrations for Jul 10, 2010 at 1600 CDT – cross-section of SE plume (dashed line).

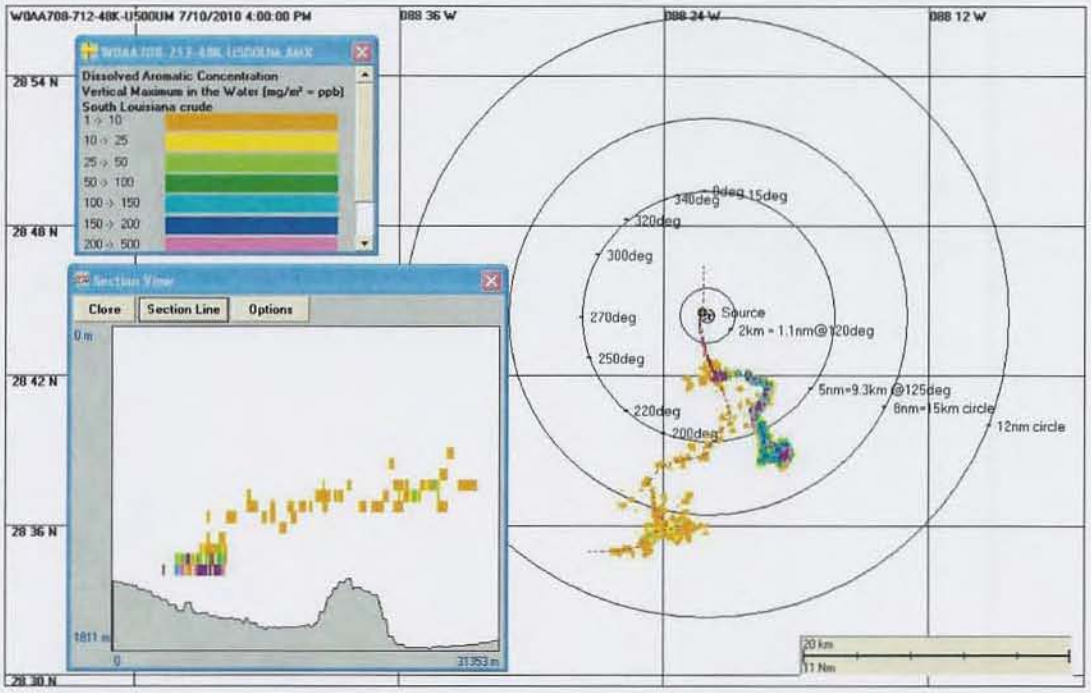

Figure 4. Modeled dissolved aromatic concentrations for Jul 10, 2010 at 1600 CDT – cross-section of SW plume (dashed line).

Figure 5 shows the area of sampling that would occur in this situation, between 135 deg and 200 degrees from the source and at a distance of up to about 10 nmiles. Transects will be made using the DAVPR, tow-yoing to 1000m at a speed of ~3 kts (see Appendix 2) to map droplets and plankton in the zone of interest. During daytime transects, pyrosome counts will be completed. Vertical profiling will be performed using the CTD package (to 200m), the CNES package (to 100m), the Holocam (combined with the CTD or CNES package, or full depth if with water sampling cast), and water sampling (to full depth) for chemistry, CNES and FlowCAM zooplankton analysis from the discrete samples. Where permitted, the high-frequency acoustics package will be combined with the CTD cast (to 200m depth) or CNES cast (to 100m) to map potential zooplankton and oil targets. It is anticipated that the transects will alternate with the vertical profiling, allowing data downloads and analysis between sampling periods. Sampling protocols will be worked out in this shake-down cruise for the combination of investigators and instruments deployed, to evaluate the most efficient and productive approaches and sequences for subsequent days and cruises.

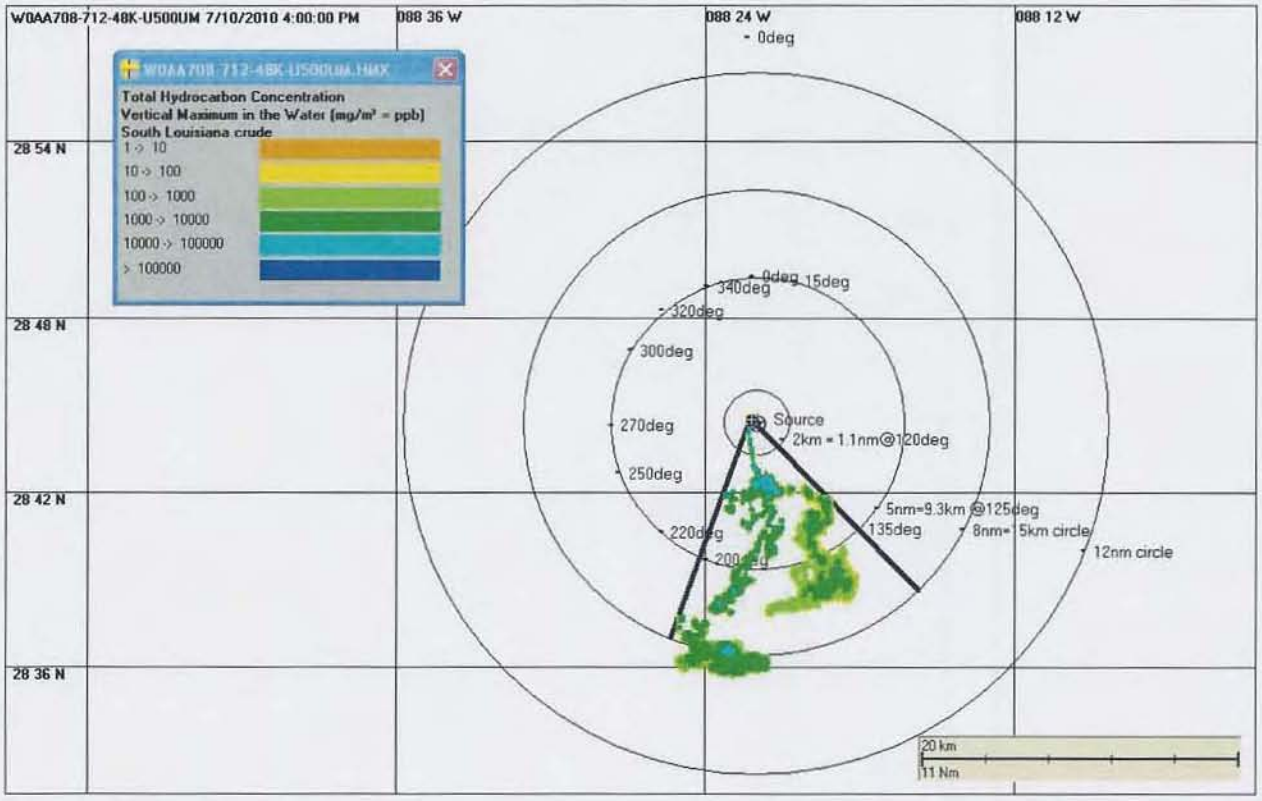

Figure 5. Area of adaptive sampling to occur within the 135 degree and 200 degree radials.

The vessel will coordinate with SIMOPS as it approaches the area, according to current guidance received from SIMOPS. No acoustical techniques will be employed within the 5 nmile circle without permission from SIMOPS.

We plan 6 days of sampling, 1-2 stations per day sampling a range of depths covering the entire water column. We estimate up to 200 discrete water samples (whole water) and approximately 30 filtered water samples will be taken.

Sampling Plan for the Ocean Veritas 9

While the American Diver is mobilizing, NRDA representatives will be deployed on the Ocean Veritas. The Ocean Veritas cruise 9 departs July 13, 2010 for four days of sampling in support of compliance monitoring activities. The Holocam and the CNES will be deployed with appropriate technical staff (C. Davis and F. Marin) to collect data in vertical profiles as described in Appendices 2 and 3. Station locations will be among those selected by the Ocean Veritas cruise chief scientist, sampling at as many stations as feasible considering time constraints and safety concerns. The instruments will be deployed to their maximum depth tolerance (CNES) and to the full depth (Holocam), as possible without disrupting the Ocean Veritas 9 cruise plan.

Personnel for American Diver
8 NOAA contractors
1-3 ENTRIX employees
1 Navigation technician
2 deck hands
1 Industrial Hygienist (supplied by BP)
6 Boat Crew (Captain and mates)

Personnel for Ocean Veritas 9
4 NOAA contractors

Vessel
Operations will be completed on the American Diver and the Ocean Veritas. The American Diver is already contracted under the VOO, and so costs are not included below. The Ocean Veritas costs are covered by Response under another budget. Thus, only personnel and equipment costs are included here.

Estimated Costs: American Diver Cruise 1 and Ocean Veritas Cruise 9

Item	Unit Cost	Unit/Type	Number	Total Cost
Vessel Rental		Days	7	(under VOO)
Mobilization *Invoiced separately by Entrix	$193,625	Quantity	1	$193,625
CNEs (prep)	$4,000	Quantity	1	$4,000
CNEs Direct Cost (Other)	$150	Quantity	1	$150
CNEs Tech	$800	Quantity	15	$12,000
Travel	$3,000	Quantity	1	$3,000
FlowCam	$1,500	Quantity	1	$1,500
High Freq Acoustics	NC			
Mobilization	$2,700	Quantity	1	$2,700
Sutor + 2 techs	$2,400	Days	13	$31,200
Dr. Sutor Data Report Prep	$9,840	Quantity	1	$9,840
Dr. Jim Payne PLVWSS	$150	Days	7	$1,050
Dr. Jim Payne	$2,000	Days	7	$14,000
DAVPR - Rental	$7,600	Quantity	1	$7,600
DAVPR - Misc	$2,500	Quantity	1	$2,500
Cabell Davis Travel	$3,000	Quantity	1	$3,000
Holocam	NC			
Dr. Cabell Davis	$2,000	Days	14	$28,000
CTD/Rosette + Bottles	$7,500	Quantity	1	$7,500
CDOM ECO Fluorometer	$5,000	Quantity	1	$5,000
NOAA sampling Tech	$1,000	Days	7	$7,000
Data Manager	$1,000	Days	7	$7,000
Deck Hand	$1,000.00	Days	7	$7,000
Entrix Staff * Invoiced separetly by Entrix		Days	7	$0
Navigation Tech (CSA)	$1,500	Days	7	$10,500
IH	1500	Days	7	$10,500
Estimated Total				**$368,665.00**

Budgeting

The Parties acknowledge that this budget is an estimate, and that actual costs may prove to be higher due to a number of potential factors. As soon as factors are identified that may increase the estimated cost, BP will be notified and a change order describing the nature and cause for the increase cost in addition to a revised budget for BP's consideration and review.

Safety Plans

BP's full operations and safety plan is attached as Attachment 6. In addition, the NOAA incident site safety plan (which all NOAA employees and contractors must sign prior to the cruise) is attached (Attachment 4).

Transfer of the shared electronic media in the onboard equipment to each of the party's hardware for retention and use.

Upon return to port, the vessel Operations Manager shall produce identical copies of the raw and processed electronic media generated during the cruise and deliver one of those copies each to NOAA (or its QA contractor) and to ENTRIX.

Laboratory

All VOC and water chemistry samples (filters and water samples) for PAH will be sent to Alpha Analytical Laboratories in Mansfield, MA. The RP may take additional unfiltered and toxicity water samples at selected locations, which are not part of the cooperative sampling. These samples will be sent to a laboratory of their choosing. ENTRIX will provide all related sampling supplies for their samples. Some of these unfiltered water samples may also be used for TSS/CHN, PAH/TPH, and dispersant analyses, and if completed, the data will be shared with NOAA and other trustees.

Distribution of Laboratory Results

Each laboratory shall simultaneously deliver raw data, including all necessary metadata, generated as part of this work plan as a Laboratory Analytical Data Package (LADP) to the trustee Data Management Team (DMT), the Louisiana Oil Spill Coordinator's Office (LOSCO) on behalf of the State of Louisiana and to ENTRIX (on behalf of BP). The electronic data deliverable (EDD) spreadsheet with pre-validated analytical results, which is a component of the complete LADP, will also be delivered to the secure FTP drop box maintained by the trustees' Data Management Team (DMT). Any preliminary data distributed to the DMT shall also be distributed to LOSCO and to ENTRIX. Thereafter, the DMT will validate and perform quality assurance/quality control (QA/QC) procedures on the LADP consistent with the authorized Quality Assurance Project Plan, after which time the validated/QA/QC'd data shall be made available to all trustees and ENTRIX. Any questions raised on the validated/QA/QC results shall be handled per the procedures in the Quality Assurance Project Plan and the issue and results shall be distributed to all parties. In the interest of maintaining one consistent data set for use by all parties, only the validated/QA/QC'd data set released by the DMT shall be considered the consensus data set. The LADP shall not be released by the DMT, LOSCO, BP or ENTRIX prior to validation/QA/QC absent a showing of critical operational need. Should any party show a critical operational need for data prior to validation/QA/QC, any released data will be clearly marked "preliminary/unvalidated" and will be made available equally to all trustees and ENTRIX.

Reference:

Payne, J.R., T.J. Reilly, and D.P. French, "Fabrication of a Portable Large-volume Water Sampling System to Support Oil Spill NRDA Efforts," in *Proceedings of the 1999 Oil Spill Conference*, American Petroleum Institute, Washington, D.C., pp. 1179-1184, 1999.

Appendices:

1. Appendix 1 – Sutor Optics and Acoustics
2. Appendix 2 – Davis VPR and Holography
3. Appendix 3 – CNES Specifications
4. Appendix 4 – Pyrosome Sampling Plan

Attachments:

Attachment 1. PLVWSS sampling protocols in support of NRDA Cruises_050510.pdf

Attachment 2. Quality Assurance Guidelines for NRDA Water Column Chemistry Cruise 1 on the M/V American Diver

Attachment 3. Water Sample Handling Procedures 2010-06-11_jrp .doc

Attachment 4. NOAA-NRDA_MC_252_Site_Safety_Plan_5.13.10.pdf

Attachment 5. NRDA_Field_Sampler_Data_Management_Protocol_7_5_2010

Attachment 6. *M/V Jack Fitz* NRDA Cruise 3 HSE Plan Rev 003 Final

Attachment 7. M C 252_Incident_SIMOPS_Plan_

Attachment 8. At sea sample transfer memo

Attachment 9. MC 252 incident reporting document

Attachment 10. MC 252 Analytical QAP V1

Approvals

Approval of this work plan is for the purposes of obtaining data for the Natural Resource Damage Assessment. Parties each reserve its right to produce its own independent interpretation and analysis of any data collected pursuant to this work plan.

Kathleen V Chu for Rob Ricker

Federal Trustee Representative

Rob Ricker (NOAA)

Date 7/21/2010

Scott McDonald

BP Representative

NRDA Specialist

Date 7/20/2010

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Louisiana Trustee Representative
Date

Water Column Injury Ephemeral Data Collections:
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Appendix 1:
M. Sutor (LSU) Sampling Procedures for CTD, Acoustic Profilers and FlowCAM Assessment of Oil Droplets and Plankton Distributions

July 17, 2010

Approach

We will conduct a rapid survey with an imaging system (DAVPR) to characterize the different forms of oil. These data, in combination with any available low-frequency data from surveys on other ships, can be combined to evaluate the composition of the plume(s) (e.g., what portions are in droplets, sheets of emulsified oil, etc.).

We will use a combination of multi-frequency acoustics, image-forming optics, and direct sampling to simultaneously map the distribution of oil droplets and plankton in vertical profiles at stations specified in the overall cruise plan. We will deploy a profiling package equipped with a CTD, chlorophyll fluorometer, CDOM fluorometer, optical backscatter sensor, PAR sensor, oxygen sensor, multifrequency acoustic instruments and the HoloCam imaging system (Appendix 2). We will conduct casts both within subsurface oil, and outside of it, to depths of up to 200m.

We will also utilize a pump sampling system (for near surface to 100 m deep) or bottle sampler (at deeper locations up to full ocean depth) to collect water and analyze it immediately in a FlowCAM imaging microscope. This will allow us to rapidly characterize the smaller size-fraction of the plankton community (phytoplankton, microzooplantkon, and small mesozooplankton). The FlowCAM is also capable of returning size information on oil droplets that are imaged in the water sample.

We will also collect preserved plankton samples for further analysis. We will collect replicate samples, one preserved in Lugols (targeted to preserve soft-bodied ciliates) and one preserved in formalin to allow for bio-optical analysis of the cells utilizing the laser equipped FlowCAM. This will provide data on the pigment content of the cells and can be informative as a metric of cell physiology.

In addition to these whole water samples, we will also pump water through a 20 μm nitex mesh to collect small mesozooplankton and preserve these samples in formalin for later analysis in the lab. A diaphragm pump will be used to pump water from discrete depths. The pump intake will be attached to the CTD frame and lowered to the desired depth. Water will then be pumped from the intake to the deck of the ship where it will be filtered through a nitex bags with a dual layer of 1 mm and 60 μm mesh nitex. The coarser mesh is designed to remove some of the oil from samples taken in oil affected areas. The oil

clings to the fibers of the nitex and large portions of it may be removed from samples through coarse filtration. The small mesozooplankton targeted by the pump sampling will pass through the larger mesh and be trapped on the finer mesh. The nitex sampling bags will be suspended in containers of water to prevent extrusions and damage of mesozooplankton through the mesh. The plankton will be rinsed off the fine mesh and the coarse mesh will be visually inspected for any larger mesozooplankton that may have been captured and these will be removed with forceps and placed in the sample. The sample will then be preserved in 4% formalin solution and returned to the lab for analysis.

Instrumentation:

CTD Package (supplied by Malinda Sutor, LSU): Profiling package equipped with a Seabird 25 CTD, Wetlabs ECO chlorophyll fluorometer, Wetlabs ECO CDOM fluorometer and optical backscatter sensor, Bioshperical PAR sensor, and Seabird 43 dissolved oxygen sensor. This package can be lowered to 200 m to generate vertical profiles.

ASL Environmental Acoustic Water Column Profiler (2 frequency, 420 and 778 kHz, supplied by Malinda Sutor, LSU) and an RDI 1200 KHz Acoustic Doppler Current Profiler (supplied by Mark Benfield, LSU) that has been calibrated with standard hydrophones: These instruments can be mounted on the ship's CTD frame or a frame can be constructed to house the instruments. Vertical profiles to approximately 200 m can be conducted given the depth rating of these instruments. Both instruments are self-contained and require no special power or ship requirements. Data will be generated at three frequencies which will allow us to utilize multi-frequency scattering models to identify sources of backscatter and size distribution of scatterers.

FlowCAM (supplied by Malinda Sutor, LSU). The FlowCAM is an imaging microscope system capable of recording images of plankton from fresh or preserved samples. A sample is passed through a flow cell and high-resolution color images are recorded. Individual particles in the images are located and the software returns a number of particle parameters in including size, transparency, and fluorescence. The images can then be rapidly sorted and identified utilizing the Visual Spreadsheet software.

Principal Investigator:

Dr. Malinda Sutor
Department of Oceanography and Coastal Sciences, Louisiana State University
[redacted]

Dr. Malinda Sutor is a zooplankton ecologist who received her doctorate from the College of Oceanic and Atmospheric Sciences at Oregon State University. She is currently an Assistant Professor, Research in the Department of Oceanography and Coastal Sciences (DOCS) at Louisiana State University and holds an appointment as Guest Investigator in the Biology Department at the Woods Hole Oceanographic Institution (WHOI). Her current research includes studies of the fine-scale patchiness of meso- and micro-zooplankton using optical imaging, direct sampling, and glider-borne acoustics. Dr. Sutor has extensive experience processing and identifying plankton samples and analyzing optical and acoustical data.

Budget Justification:

Labor on Ship:
Malinda Sutor @ $1560/day
Alvaro Armas @ $ 480/day
Kate Lingoni @ $ 360/day

FlowCAM	
Mobilization	$2700
Vehicle Rental and gas	$500
Supplies (preservative, sample jars, flowcells)	$1000

Personnel time for preparation, reports, and initial analysis of the acoustical and CTD data collected on the cruise and the FlowCAM data from fresh water samples collected on the cruise

Malinda Sutor	$7800
Alvaro Armas	$ 960
Kate Lingoni	$1080
Total	$9840

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Appendix 2:
C. Davis (WHOI) Video Plankton Recorder and Holography

July 17, 2010

Approach

Efforts are underway to model the transport and spread of the oil released at the MC252 BOP site. Dispersants have been used to treat the oil and have reduced droplet sizes to some degree. Data on the 3D distribution and sizes of oil droplets are needed to understand and model the fate of the oil. In addition, plankton and marine snow abundance, biomass, and size distributions need to be quantified both on their own and in relation to the subsurface oil. Such information is needed for modeling the impact of the oil on the pelagic ecosystem of the gulf.

As part of the overall assessment effort, Dr. Cabell Davis of Woods Hole Oceanographic Institute (WHOI) will lead deployment of his color digital-automatic Video Plankton Recorder (DAVPR) and an underwater digital holographic imaging camera (holocamera) to survey the distribution of plankton, marine snow, and oil droplets in sampling locations identified in the main. We will tow-yo the DAVPR to depths up to 1000m along transects and will deploy the holocamera on vertical profiling casts and possibly on the DAVPR frame. The DAVPR and holocamera were developed to image plankton and particles ranging in size from a few microns to several centimeters.

The VPR is the original electronic optical plankton imaging system, developed at WHOI (Davis et al., 1992a,b, Davis et al., 2005; Davis and McGillicuddy, 2006), and there are now over 60 scientific publications based on data collected by this system[1]. The VPR was designed to have an undisturbed imaged volume, thus minimizing avoidance (escape behavior) of the sampler by zooplankton, which is well known to create bias in other samplers. The image volume of the DAVPR is calibrated using a tethered plankton and a Lucite grid in the laboratory to measure depth of field and field of view. The DAVPR has been mounted on a MOCNESS plankton net system and shown to give abundances of hardy plankton (copepods) in close agreement between these systems. The DAVPR software automatically processes the video and identifies plankton and particles (including oil droplets, fragile plankton, and marine snow) in the size range of 50

[1] See list of VPR publications at: ftp://ftp.whoi.edu/pub/users/cdavis/vprpapers/vpr_papers_lista.pdf

microns to several cm (selectable magnification settings). The DAVPR is battery powered, self-contained, and includes a plankton camera, strobe, and Seabird SBE37 CTD. The DAVPR has been used worldwide to obtain plankton abundance and biomass patterns in relation to hydrographic properties. The color imaging capability of the DAVPR enables ready identification of oil droplets, plankton, and marine snow (Fig. 1). In addition to the Gulf oil spill sampling, we have used the underwater holocamera in a wide range of habitats, including Pacific and Indian Oceans (Hawaii and Maldives), the Southern Ocean and South Georgia, and coastal temperate waters off Cape Cod, MA.

The DAVPR is tow-yoed (towed in a yo-yo up and down pattern) slowly (2-4 knots) by paying in/out wire from a winch, raising and lowering the instrument to depths up to 1000m at a rate of 1m/s. The internal memory card records the images (taken at specified intervals) is downloaded and images processed once onboard (or later in the lab).

Fig. 1 Digital Automatic Video Plankton Recorder (DAVPR). (left) DAVPR being deployed, (right) example images from the DAVPR (image widths range from 1- 100mm)

Our existing holocam consists of a digital camera back, control electronics, and a fiber-coupled laser diode (Fig. 2). The holocam images plankton, particles, and oil droplets in the size range from 20 microns to cm (Fig 2, example images from the Gulf oil spill site) and is autonomous, powered by a lithium-ion battery, and holograms are presently recorded on 64GB compact flash cards. The holocam image volume is 150ml to 1.0 liter (with potentially larger volumes using multiple exposure), with 9-14 micron resolution in x,y and 200 micron axial resolution. We have written software to quickly and automatically process the holograms. There is no lens on the camera and the size of the pixels in the reconstructed image is 3-9μm, depending on distance from the CCD. The axial resolution of the system (minimum resolvable distance between successive image planes, Fig. 2) is 200μm.

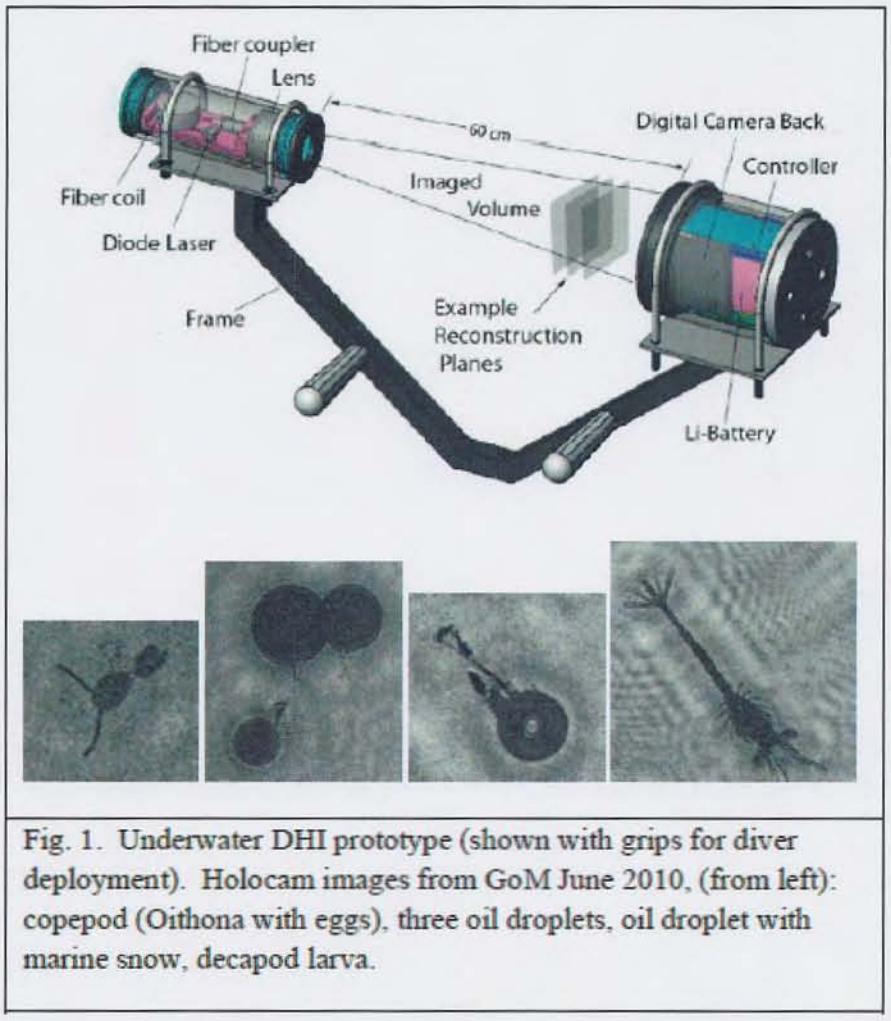


Fig. 1. Underwater DHI prototype (shown with grips for diver deployment). Holocam images from GoM June 2010, (from left): copepod (Oithona with eggs), three oil droplets, oil droplet with marine snow, decapod larva.

The proposed field study will be carried out in collaboration with other field and modeling studies discussed in the main plan. The exact locations and depths of the DAVPR towyo transects, as well as the holocamera deployment stations, will be specified by the needs of the overall plan.

Budget Justification:

Personnel:
Salary support is requested for Davis who is plankton specialist and inventor of optical plankton imaging systems. Davis will lead the VPR and holographic sampling efforts including mobilization, operation, demobilization, and data analysis.

Travel:

Funds are requested for round trip travel for Davis to travel to the ship and back to Woods Hole, including hotel, ground transportation, and meals while on shore.

Other direct costs:
Funds are requested for preparation and rental of the DAVPR from Seascan Inc, round-trip shipping costs to send the DAVPR and holocamera from Woods Hole to the ship and back, and supplies (USB hard drives for data storage).

Budget (for 14 days):

Labor: Davis – 14d @$2000/d	$28,000
DAVPR preparation	$2,500
DAVPR rental $2000 + 16d @ $350/d	$7,600
Travel: $1250 (RT airfare BOS/MSY $500, hotel $150, Per Diem $100, Rental car $400, Excess baggage $100)	
R/T Shipping:	$5,000
USB Hard Drives 1TB 4 each @150	$ 600

Total Requested for 14 day effort: $44,950

Water Column Injury Ephemeral Data Collections:
Deepwater Horizon Oil Spill (DWHOS)

Plan for Adaptive Water Column NOAA-NRDA Sampling (PAWNNS)
Cruise Plan – American Diver 1 and Ocean Veritas 9
Appendix 3:
CNES CTD and Fluorometer Package

July 17, 2010

Instrumentation:

The Counter Narcotics Environmental Sensor, CNES is a submersible environmental monitoring package that was designed for the purpose of data collection for research and analysis for the detection of narcotics production in remote riverine environments. CNES can be used in profiling mode, for fixed depth temporal sampling or discrete analysis and has sensors to measure and log for the following components:

- pH
- Redox, Oxidation Reduction Potential
- Temperature
- Dissolved Oxygen and Oxygen Saturation (Aanderra O_2 Optode)
- Crude Oil (optical sensor) [Turner Cyclops]
- CDOM (optical sensor) [Wetlabs ECO]
- Optical Backscatter
- Chlorophyll (optical sensor)
- Depth

Sampling Methodology:

The package may be lowered on a non-conducting wire from a winch, to depths up to 100 m. The internal memory card (data logger) may record the data to be downloaded once onboard. The unit can also be deployed as a bench-top instrument, making discrete measurement on water samples collected with Niskin bottles or other sampling. Samples are collected from Niskin bottles deployed at discrete depths, transferred to clean glass sampling bottles, and the relevant probes submerged into the sampling solution for data acquisition. The data processing will be performed by Fred Marin. Data reports will be produced.

Budget Justification:

Instrument Costs:
Preparation, calibration, and training by SubChem: $4000

Personnel Labor:

Salary for Fred Marin of AIS (NOAA contractor) at [redacted]
Costs include mobilization, operation, demobilization, and data analysis.

Travel:

Funds are requested for 1 round trip travel to the ship and return; any needed hotel stays, ground transportation, and meals. Estimate = $1250

Other direct costs (per cruise):

USB hard drives for data storage: $150

Water Sampling Protocols in Support of the Ephemera Cruise WATER SAMPLES

Sampling Objectives

- To determine the concentration of oil compounds in the water column.
- To determine the source via fingerprinting, the degree of weathering, and background levels.
- To document exposure of water-column organisms and validate toxicity models.
- To maintain the integrity the sample(s) during sampling, transport, and storage.

Sample Volume

Analysis	*Sample Volume*	*Reporting Limit*
Volatile Aromatic Hydrocarbons (VAH)* by SIM GC/MS (collect in duplicate)	40 mL vials	0.1-1 µg/L (ppb)
Total Hydrocarbon (THC) by GC/FID	1-Liter	15 µg/L (ppb)
PAH (including alkylated PAHs) by SIM GC/MS	1-Liter	0.001 to 0.01 µg/L

*sometimes referred to as VOA or BTEX analysis

Sampling Equipment/Containers

- Collect VAH samples (wearing clean Nitrile gloves) by pouring directly from the collection device (4 or 5 L Go-Flow bottle or other sampler) into HCl-persevered 40 mL septum-capped vials. Ensure that there is no headspace (i.e., bubble) in the vial.
- Collect water samples for THC and PAH in glass containers, certified-clean to be organic-free (solvent rinsed). Amber glass is preferred. Leave headspace of about 1 inch for 1 L jars. If the Portable Large Volume Water Sampling System (PLVWSS) is used, the sample will first be processed by vacuum filtration through a 0.7 µm glass fiber filter as it is vacuum transferred from the Go Flow Bottle into the amber glass jug (see separate PLVWSS Protocol).
- If slicks are present, decon samplers before each use (see separate QA Plan for the NRDA Cruise). Wash with laboratory-grade detergent and clean water, with a triple clean-water rinse (distilled water from a local store is OK but laboratory grade, certified-clean DI water is better. If that cannon be obtained, clean "background" water from an up-current non-contaminated area may be used. If sampler is contaminate by an oil slick, an Alkanox wash followed by solvent rinse with isopropanol (or acetone) and methylene chloride or hexane is appropriate. If solvents are not available, decontamination with a dilute detergent solution and fresh water, followed by a DI water rinse will be employed, (See separate QA Plan for sampler decon and blank protocol/frequency.) Collect waste solvent rinsate for proper disposal.

Sample Collection Methods

- Collect subsurface samples below the water surface so as not to include any surface oil.
- Take "near surface" samples from approximately 1 m below the surface as appropriate given weather conditions.

- Boat maneuvers will be performed to attempt to sweep oil away from the area where the Sampling equipment is to be deployed. If Go-Flow bottles are employed, they are to be deployed and retrieved in the closed position. Also applies to sample jars lowered by hand.
- On each cruise, try to sample the control/least oiled areas first, then more contaminated zones.
- Clear surface slicks with a boat hook or pole prior to deploying the equipment, but carefully so that the surface oil is not physically dispersed into the water column. Sweeping the area with sorbents may also be effective.

Preservation/Holding Times

- VAH (VOA vial): With no preservative the samples may be held for 7 days at 4°C in the dark. Addition of HCl can extend the holding time to 14 days at 4°C in the dark without loss of sample integrity.
- THC and PAH: No preservative added. Can be held at 4°C in the dark for up to 7 days.
- Immediately place all water samples in cooler and keep at 4° C (do not freeze).
- Use packing material around containers to prevent breakage.
- Ship to the laboratory ASAP with complete COCs. They need at least one day to process prior to holding time expiration.
- **Volatile hydrocarbons** (benzene, toluene, ethylbenzene, and xylene, or BTEX). For oil spill applications, the standard EPA Method 8240 (purge & trap) should be modified by running the GC/MS in selected ion monitoring mode and expanding the scan list (retention times and ions) to include the higher alkylated (C3 and C4) benzenes. Detection limits should be 1 ppb for individual analytes; 0.1 ppb is possible.
- **Total hydrocarbons** (THC). Often referred to as total petroleum hydrocarbons, but most methods do not differentiate among petroleum, petrogenic, and biogenic hydrocarbons. THC by GC-FID (total area of FID gas chromatogram of combined f_1 and f_2 fractions after column chromatography) is often the preferred method because of the low detection limit (compared to other THC methods) and the direct measurement of individual hydrocarbons. This method does not detect low boiling compounds (below n-C_8). For NRDA, THC analyses generally will not provide the data needed to support calculation of toxic effects from PAH exposure, and will have to be corrected to equivalent PAHs. The THC results, however, can be used to tract oil weathering and map extent of exposure of water column resources, if meaningful detection limits can be reached. So, get a copy of the GC "trace." Detection limits are usually higher than those needed for aquatic injury assessment.
- **Polycyclic aromatic hydrocarbons** (PAH). Since most of the toxicity in oil is due to the PAHs, it is often the preferred analysis for NRDA. However, PAHs are expensive and require special laboratory skills. If PAHs are to be measured, it is important that the analytes include the alkyl-substituted PAH homologs, in addition to the standard PAH "priority pollutants." This method is referred to as Modified EPA Method 8270, because the list of PAHs is expanded to include the alkylated homologs, using GC/MS in the selected ion monitoring (SIM) mode. Detection levels should be 1-2 ng/L (ppt) for individual PAHs to support injury assessment using toxicity thresholds. Have the lab also run the source oil.

Other Considerations

- Contamination by surface slicks is of great concern. Document presence of slicks, weather, wave conditions, etc. which might suggest mixing of surface oil during sampling.
- Be aware of sources of contamination on the sampling vessel (exhaust fumes, engine cooling systems, oily surfaces). Work up-wind of any exhausts. Segregate dirty/clean areas. Lay out clean substrates to work on and replace frequently.
- Collect background samples from clean sites representative of pre-oiling conditions, as well as areas not yet oiled but in the potential path of the oil.
- Preservation chemicals should be provided by the lab.
- Use a computer or conceptual model of the extent of water-column contamination to determine the number and location of samples. Minimum guidelines are at least three samples per area of relatively uniform exposure or sub-waterbody. Also, sample along exposure gradients, starting in the cleanest zone, at regular intervals proportional to the exposure area.

Contact James R. Payne at PECI for questions or additional information

[redacted]

SubChem Systems, Inc.

CNES

OPERATING MANUAL

Version: 1.1
Date: 070209

[redacted]

Website: http://www.subchem.com

STATEMENT OF LIMITED LIABILITY

Extreme caution should be exercised when using or servicing this equipment. It should only be used or serviced by personnel with knowledge of and training in the safe use and maintenance of chemical and oceanographic electronic equipment.

SubChem Systems, Inc. disclaims all product liability risks arising from the use or servicing of this system. SubChem Systems has no way of controlling the use of this equipment or of choosing the personnel to operate it, and therefore cannot take steps to comply with laws pertaining to product liability, including laws which impose a duty to warn the user of any dangers involved in operating this equipment. Therefore, acceptance of this system by the customer shall be conclusively deemed to include a covenant by the customer to defend, indemnify, and hold SubChem Systems, Inc. harmless from all product liability claims arising from the use or servicing of this system.

TABLE OF CONTENTS

1) INTRODUCTION

a) Overview

The Counter Narcotics Environmental Sensor, CNES is a submersible environmental monitoring package designed for the purpose of data collection for research and analysis for detection of narcotics production. This analyzer is designed to be rapidly deployed to measure and log the following:

- pH
- Redox, Oxidation Reduction Potential
- Temperature
- Dissolved Oxygen and Oxygen Saturation
- Kerosene
- CDOM
- Optical Backscatter
- Chlorophyl
- Depth

The above parameters are believed to be crucial to the detection of narcotics production. The primary objective of the CNES is to log this data during production to provide data for detection algorithm development.

The CNES can be deployed in lakes, rivers, estuaries, and other shallow water coastal marine waters. The CNES may be deployed alone or co-deployed on a variety of observation platforms and sensor systems for vertical or horizontal profiling or time series measurements.

b) System Components

The CNES is comprised of several components:

1. SIIS2: The SubChem Instrument Interface System. The SIIS is basically a data handler and sensor controller for onboard logging and power management. This controller can be programmed for more advanced autonomy. This also contains a lithium battery pack for untethered and/or moored applications.
2. An electro-polished stainless steel frame.
3. SBE 27 with ORP sensor
4. Wetlabs ECOPUCK
5. Cyclops 7 fluorometer. This fluorometer is used primarily for the detection of kerosene. It has three gain settings, 1X, 10X and 100X. Currently, it is set for 100X to provide the greatest range possible. For finer range in lower concentrations, the gain settings can be changed at the factory.
6. AANDERAA Oxygen Optode 3835
7. The LabView Graphical User Interface (MS Windows compliant) operating

on a host computer (computer not included).

8. A Pelican Case for storage and shipping.
9. A Deckbox with test cable for power, communications, and charging.

Constituent	Parameter	Range
pH	Acidity or Basicity	0~7
ORP	Oxidation Reduction Potential	-1250mv~1250mV
DO(Sat)	O_2 Concentration	0~500uM
DO(%)	Air Saturation	0~120
Temp	Temperature	0~36ºC
CO	Kerosene	10~2000ppb *(high gain)*
CDOM	Color dissolved organic matter	0.3~375ppb
NTU	Optical turbidity	0~25m^{-1}
CHL	Chlorophyll Concentration	0.02~50.0ug/l
D	Depth	0~60dBar 0~60M

TABLE 1: Parameters recorded by the CNES analyzer.

2) TECHNICAL DESCRIPTION

The baseline CNES comes with a Deck Box capable of supplying 12V 60W power from a standard 120VAC 50/60Hz outlet. DC power options are also available on request. A multi-conductor cable connects the CNES to the deck box that provides DC power and a data communications interface with the host computer (MS Windows XP). The power supply cable has a keyed connector on the case mating end to provide an easy connection to the main panel for operation. The power supply is then plugged directly into a standard wall outlet. A submersible test cable is also supplied with the CNES. This test cable has a keyed plug on the Deck unit side and has an Impulse MCBH-8M on the CNES mating side.

The baseline CNES 8-pin bulkhead connector has the following pin outs:

Pin	Description
1	Ground
2	+12 VDC
3	RS232 TX (From CNES)
4	RS232 RX (To CNES)
5	Charger (-)
6	Charger (+)
7	Not Connected
8	Not Connected

Table 2: CNES bulkhead pinout.

A serial DB9 male to female cable is supplied with the CNES as well. The software for the CNES, ChemView, is a stand-alone executable (developed with National Instruments, LabView™) and graphical user interface (GUI) that facilitates user-friendly remote control of all CNES functions. The data acquisition rate is one reading per second.

Communication is accomplished either by RS232 with the user laptop or host platform. Running the supplied ChemVIEW software, the user laptop communicates on an available COM port with the following settings:

Baud	115200
Data bits	8
Parity	None
Stop bits	1
Flow Control	None

Some deck boxes have extra serial connector ports for serial communication with other third-party components (i.e CTDs, other sensors, or deployment platforms).

Accommodations for ancillary instruments are made upon customer request. An AC to DC power supply, located in the deck box, remotely supplies the power requirements for the CNES. The voltage and power outputs of the main power supply and the length and gauge of the conducting wires in the sea cable are designed to account for any voltage drop due to resistance losses over the length of the underwater cable. DC-DC converters convert the unregulated underwater DC supply into stabilized power within the CNES.

The CNES currently contains a 11.1V 6600mAH rechargeable lithium battery pack. In its suspended or sleep mode, it will draw only 128uA. In its low power mode, it will draw 22mA. When sampling with all sensors enabled, it will draw up to 300mA.

Endurance Example

Cold Start Delay of 60 seconds
Sampling for 15 seconds
4 times daily

CNES will sample for approximately 220 days

Equation for calculating endurance:

Cs = Cold Start Delay
Sa = Sampling duration
T = Samples per day
Ah = Equivalent Amp hours

$$Ah = [86400 - T(Cs + Sa)] * 1.483e^{-9} + T(Cs + Sa) * 3.5875e^{-6}$$

$$\text{Operational Hours} = {}^{6.6}/_{Ah}$$

3) GETTING STARTED

Description: The ChemVIEW CD provided with the CNES contains the host software programs and default configuration file (CNES.CFG) with parameters specific to your instrument and factory default information. The CNES.CFG file will be explained in detail later in this manual. This software is to be installed on a host PC (MS Windows 2000, or XP operating systems recommended) with an operational RS232 DB9 Serial Port or serial port adapter.

The host program, called ChemVIEW, contains the run-time engine, and the ChemVIEW Application.

Installation Procedure:

1. Insert the ChemVIEW CD into an available CD drive.
2. The CD should automatically load.
3. Click on the link for "Install ChemVIEW".
4. If prompted to run/save/cancel, click on "Run" in the one or two windows.
5. Click "NEXT".
6. Follow the on-screen instructions to auto-install the run-time engine, and the ChemVIEW application into the default directory or browse to desired location.
7. Click "NEXT".
8. Click "NEXT.
9. Application will install. This may take up to several minutes.
10. Click "FINISHED".
11. Refer to section 4 of this User's manual for proper operation of the Analyzer.

4) OPERATION

a) Startup

At the start of this procedure, the CNES is not connected and the Deck Unit is opened as shown in Figure 1.

1. Click on the following:
   START MENU
   \Programs
   \Chemview
   \Chemview.exe

Figure 1: CNES Deck Unit.

2. The Chemview application load and you will be prompted to select one of two options, Test Mode and Plotter. Plotter will be discussed later in this manual.
3. Click on Test Mode.
4. A new Configure Serial Port window will pop up with a pull down menu on the left side labeled "Select Serial Port". Select the appropriate serial port from the pull down menu. Most computers with a 9 pin serial port built in will default to "ASRL1::INSTR".
5. Using the pull down menu on the right, select the serial baud rate too which you will communicate with the CNES. The default baud rate is 115200.
6. Click OK when finished.
7. Connect the serial cable female end to the laptop or user computer.
8. Connect the serial cable male end to the Deck unit panel COM port labeled "HOST".
9. Connect the power supply connector to the Deck unit panel "120 VAC" connector.
10. Connect the power supply to a 120VAC 50/60Hz wall outlet.
11. Connect the supplied submersible test cable to the Deck unit panel "CNES" connector.
12. Connect the MCBH-8F wet connector socket to the CNES bulkhead connector plug.

13. ChemVIEW should have loaded the RESPONSE tab at this point.
14. Turn power ON using the main orange power switch.
15. Remove the SIIS magnet to enable startup of the CNES.
16. If everything has been connected appropriately, you should see data appear in the CNES RESPONSE text box while all the plots to the right are updating once per second.
17. NOTE: Several responses can be seen. These indicate that there was a clean start and the CNES is time stamped and synchronized with the host platform.
18. The CNES is now operating and at idle.

b) Navigating ChemView

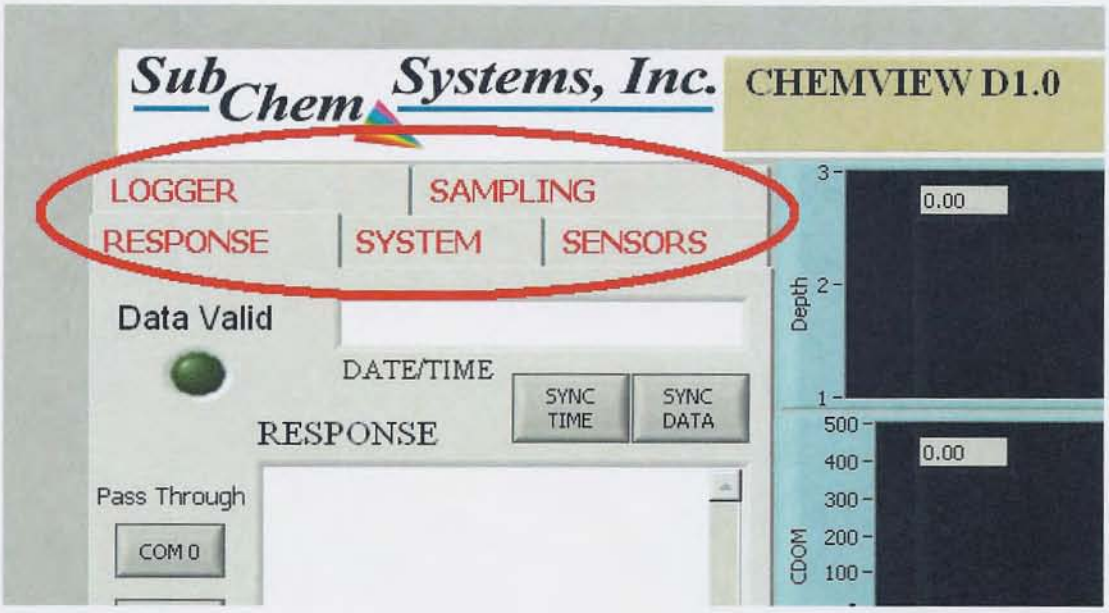


Figure 2: ChemVIEW Tabs are located in the red circled area of Test Mode.

The SubChem Systems ChemVIEW software is meant to be as self explanatory as possible to provide easy use of the instrumentation. The following "TAB" information will help provide a synopsis of the functions available to the operator under each ChemVIEW Tab (see figure 2):

Response Tab (Figure 3): This tab provides the operator a set of functions to view the serial communication from the instrument. This will include the 1Hz data stream as well as the acknowledge commands and error messages.

Figure 3: Response Tab.

The Response Tab contains the current date and time from the CNES in the "Date/Time" text box.

SYNC TIME button: This synchronizes the instrument with the operator's computer. After the button is pressed the local host time is sent to the CNES.

SYNC DATA: This button is used to synchronize the data to the specific mode you are operating in. Use this button when switching between Test Mode and Auto Mode.

SEND button: On occasion, it may be necessary to manually send a command to the CNES. This is more or less the command line for the CNES. Type in the command into the text box and then press SEND.

PASS THROUGH: The user may communicate directly to any of the instruments by pressing the Pass Through button on the appropriate COM Port. Check CNES.INI for a description of which instrument is on each COM Port. Once directly connected to a serial instrument, type '#' in the Command Line text box and press SEND to disconnect.

NOTE: To enable data output of the sensor you wish to connect to, you must enable power to the sensor first. Therefore, when attempting to connect, send the $PSCSA,TM* command by pressing the SYNC DATA button first. Then send

the pass through command.

RESET button: The reset button is provided to allow the operator to bring the instrument to the command prompt. This will only be necessary for troubleshooting.

EXIT button: This will end the Test Mode session and bring you back to the point where you can select which mode to operate in.

Logger Tab (Figure 4): The Logger tab is meant to give the operator the means to log the data coming from the instrument.

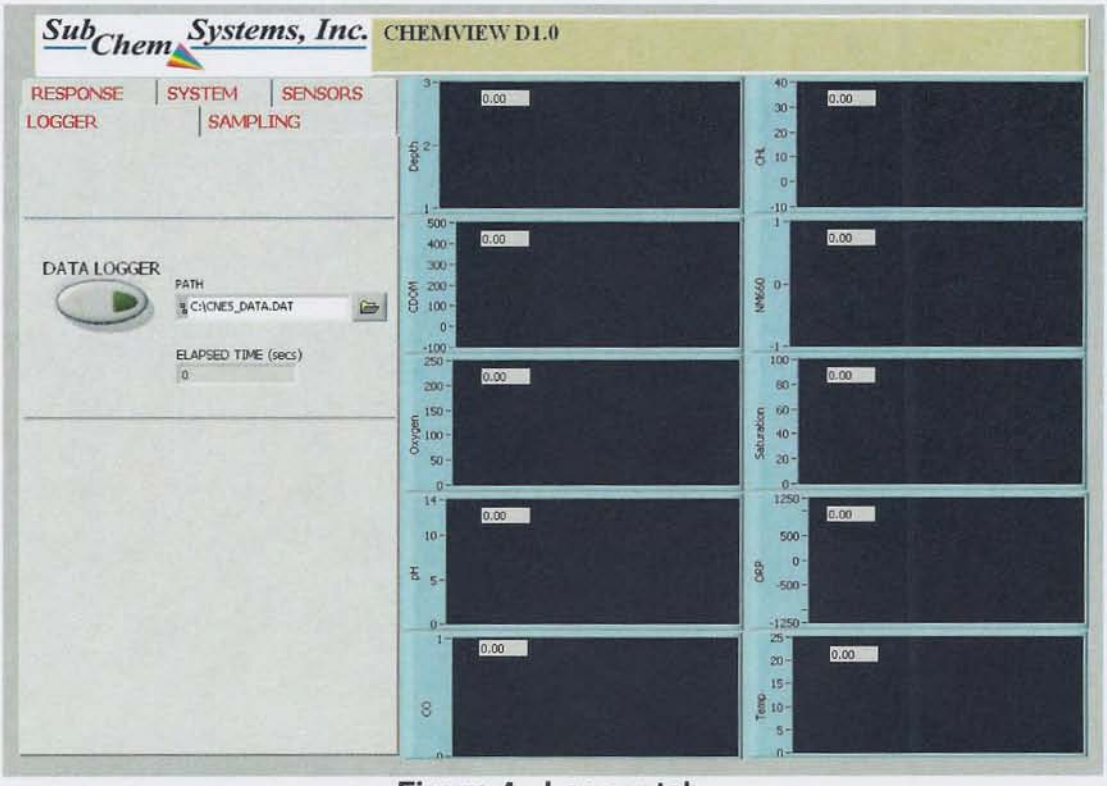


Figure 4: Logger tab.

DATA LOGGER button: When the Data Logger button is pressed, it will illuminate green and the ELAPSED TIME text box will start to increment in seconds of the total logging time. A *.DAT file will be written to the C:\ as show in the PATH box. Prior to pressing the Data Logger button, the operator can browse to a new log file directory location.

NOTE: The SIIS logs all of the data internally once the Cold Start Delay has completed. The Logging capability of Chemview D1.0 does not account for this.

Sensors Tab (Figure 5): The Sensors Tab is meant to relay to the operator all the CNES log and digital signals and other ancillary sensor values from the instrumentation. Such values will include Depth (m), CHL (ug/l), CDOM (QSDE), NM660 turbidity (m^-1), Oxygen (umol), Saturation (%), Temperature (°C), pH, ORP (mV), and CO. If certain equipment is not present, then the values should remain 0.

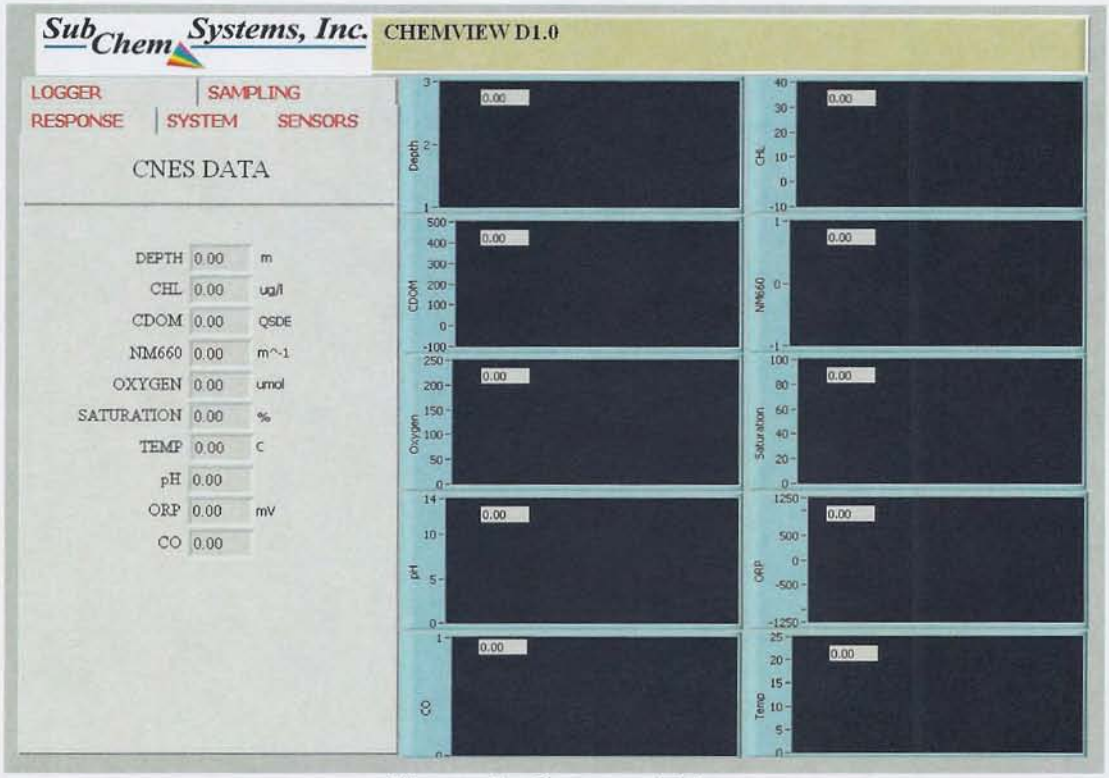


Figure 5: Sensors Tab.

System Tab (Figure 6): The systems tab provides the operator with the low level hardware functions to the instrumentation. It is under this tab that the operator is able to switch power to each instrument on and off and put the CNES into low power mode and sleep mode. Any buttons or switches that are visible but faded are available to the operator if the hardware is present.

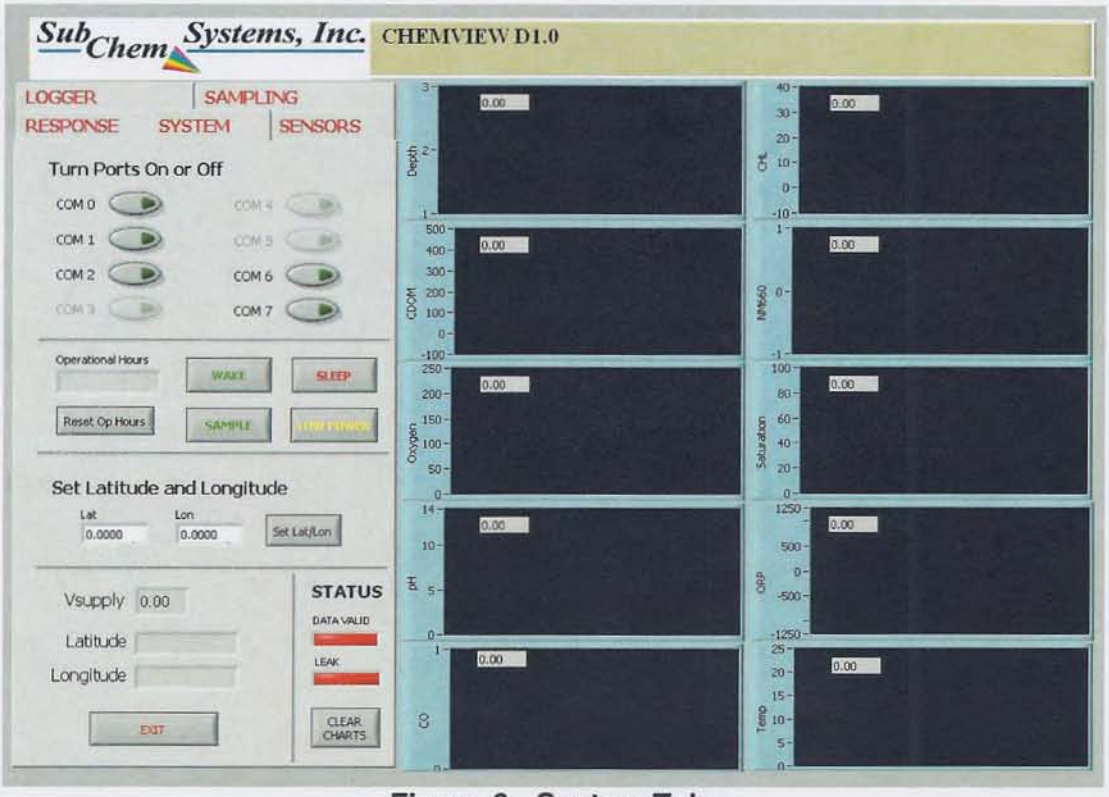


Figure 6: System Tab.

Turn Ports On or Off: Toggle these switches to power on and off instrumentation associated with the appropriate COM Ports.

Reset Op Hours: Pressing the Reset Op Hours button will reset the operation hours of use logged on the CNES. The OP HOUR counter is an onboard odometer used to determine the amount of time the instrument has been in use. The value of Op Hours is displayed above the Reset Op Hours button, labeled Operational Hours.

WAKE: This button will wake the CNES from a Low-Power mode or a sleep mode.

SLEEP: The Sleep button will set the CNES to a low power sleep mode and stop sampling. The instrument will draw approximately 120uA. Once in sleep mode, the next command sent will wake the CNES. A pop-up dialogue will alert the user when the CNES has been taken out of sleep mode.

LOW POWER: This button will set the CNES to a low-power mode but not to sleep. Sampling will cease.

SAMPLE: Pressing this button will tell the CNES to start its continuous sampling routine.

Set Latitude and Longitude: This button will set the Latitude and Longitude position for the data logger. This enables the future use of a GPS with the instrument upon customer request for an integrated GPS.

Status Indicators: These values will go green when valid. The Data Valid indicator will flash once per second. The Leak indicators should appear green. If not, consult the factory. When at idle, this value will remain red.

Sampling Tab (figure 7): The Sampling tab allows the operator the ability to start sampling after a specified delay. The user may choose to start sampling now or in a specified number of seconds, minutes, hours, or days. Pressing the GO button next to the sampling will command the CNES to start sampling after the delay.

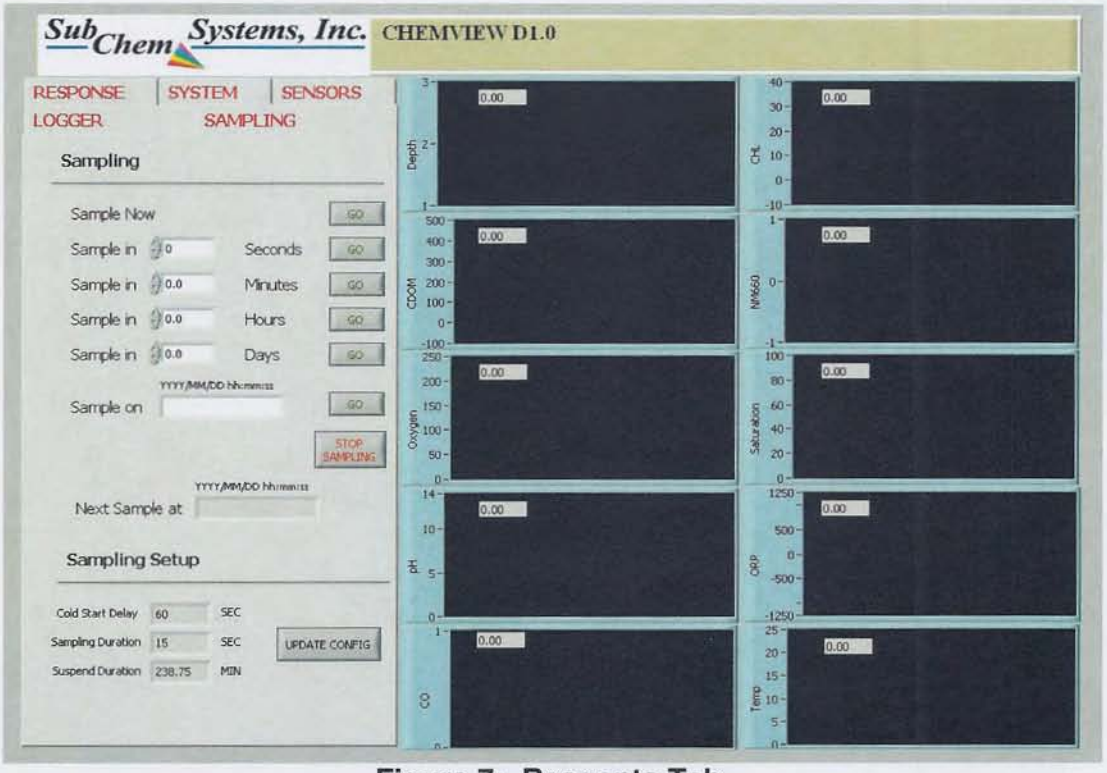


Figure 7: Reagents Tab.

Once the GO command is sent, the CNES will perform intermittent sampling with a suspended power state in between samples. The following sequence is performed:

1. GO command is received
2. CNES waits desired time delay

3. After delay has lapsed, CNES will send the enable power message, "$PSCSA,TM,PWRENABLED*"
4. 1 Hz data message can be seen in the Response tab
5. After the cold start delay has lapsed, the CNES will send the log start message, "$PSCSA,TM,LOG_START*"
6. After sampling duration has elapsed, the CNES will send the log stop message, "$PSCSA,TM,LOG_STOP*"
7. The CNES will send a message containing the current time and the delay until the next sample. The time of the next sample is displayed in the Next Sample At indicator box in YYYY/MM/DD hh:mm:ss format.
8. The CNES will be in a low-power mode until either woken up or until the next sample.

UPDATE CONFIG: Sampling parameters from CNES.CFG such as the Cold Start Delay, Sampling Duration, and Suspend Duration are displayed in the Sampling Setup section on the Sampling tab. Pressing the UPDATE CONFIG button will read and display the sampling parameters from CNES.CFG.

Additional tools are available in the pull down menus above the tabs. Locate the pull down menu labeled Tools. Available tools include:

File Transfer: Use this tool to upload and download single files to the CNES such as the CNES.CFG and CNES.INI files.

Zero Pressure Sensor: Selecting this tool will effectively normalize the pressure transducer to ambient pressure. Make sure that the CNES has been at idle long enough for the pressure transducer value to stabilize. Then use this tool.

c) Transferring files with the CNES

The operator is able to send and receive single files to and from the CNES using the file transferring capabilities built into ChemVIEW. This was meant to allow the operator the ability to modify the CNES.CFG, CNES.INI and CNES.SSF files for specific deployments. Batch file transferring is used to download entire data sets. When sampling in Test Mode, the CNES will generate ASCII DAT files. For each sample taken, if configured for intermittent sampling, the CNES will generate a single file. Over the course of several weeks, the CNES may generate several tens or hundreds of files.

Test Mode File transferring

Receive a file:

1) Follow section 4.0 to arrive at Test Mode with the CNES operating at idle.
2) Using the Tools pull down menu, select File Transfer.

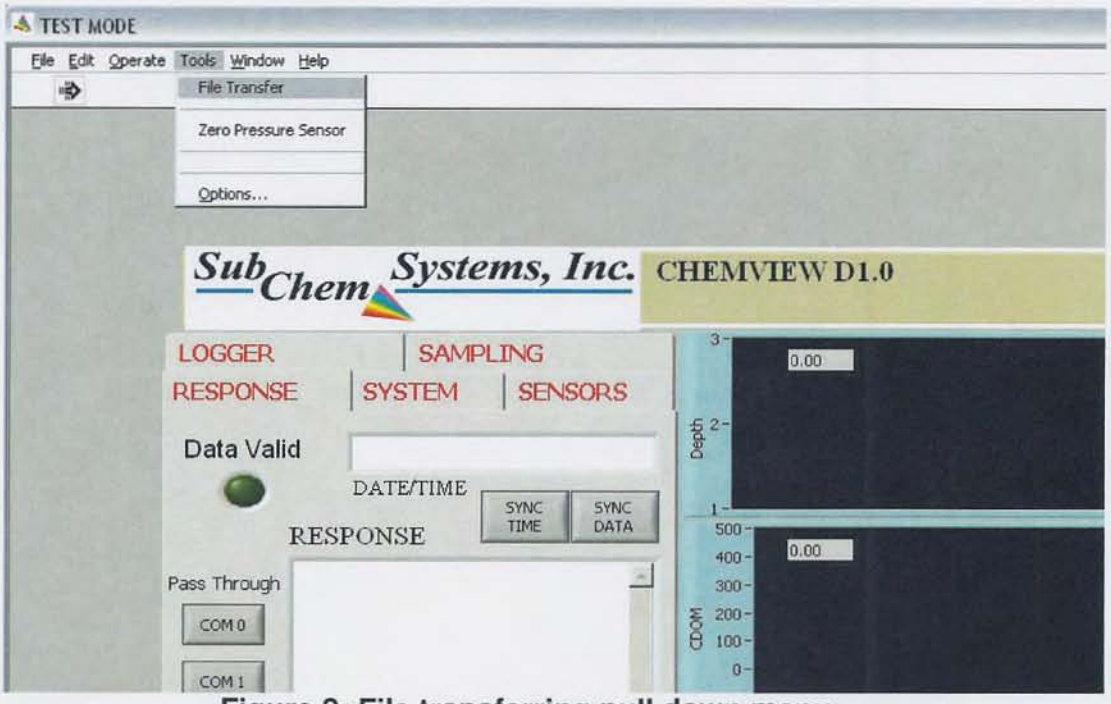


Figure 8: File transferring pull down menu.

3) You should observe a directory listing in the text box from the CNES displaying the files located on the root C:\ drive.

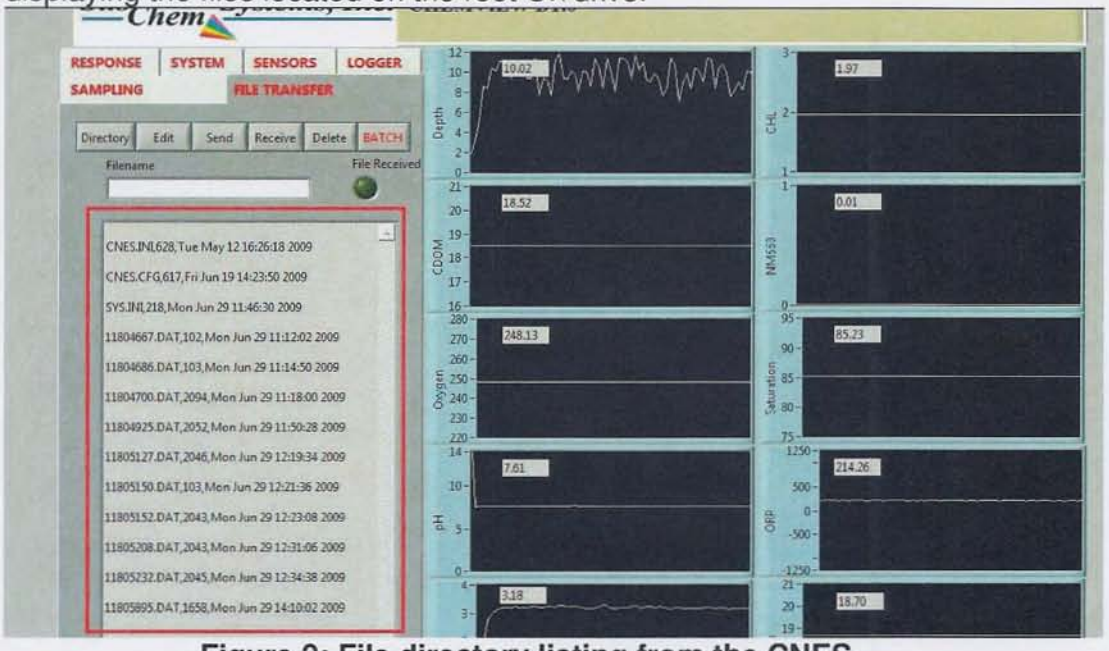


Figure 9: File directory listing from the CNES.

4) You can, at any point, click on the Directory button to re-display this information.

5) To download the CNES.CFG file, type file name into the text box.

6) Then click the Receive button.
7) The CNES.CFG file should take a few seconds to download.
8) You will be prompted with a Save As dialog box. Navigate to the ChemVIEW Support folder on your computer and then click the "Select Cur Dir" button.

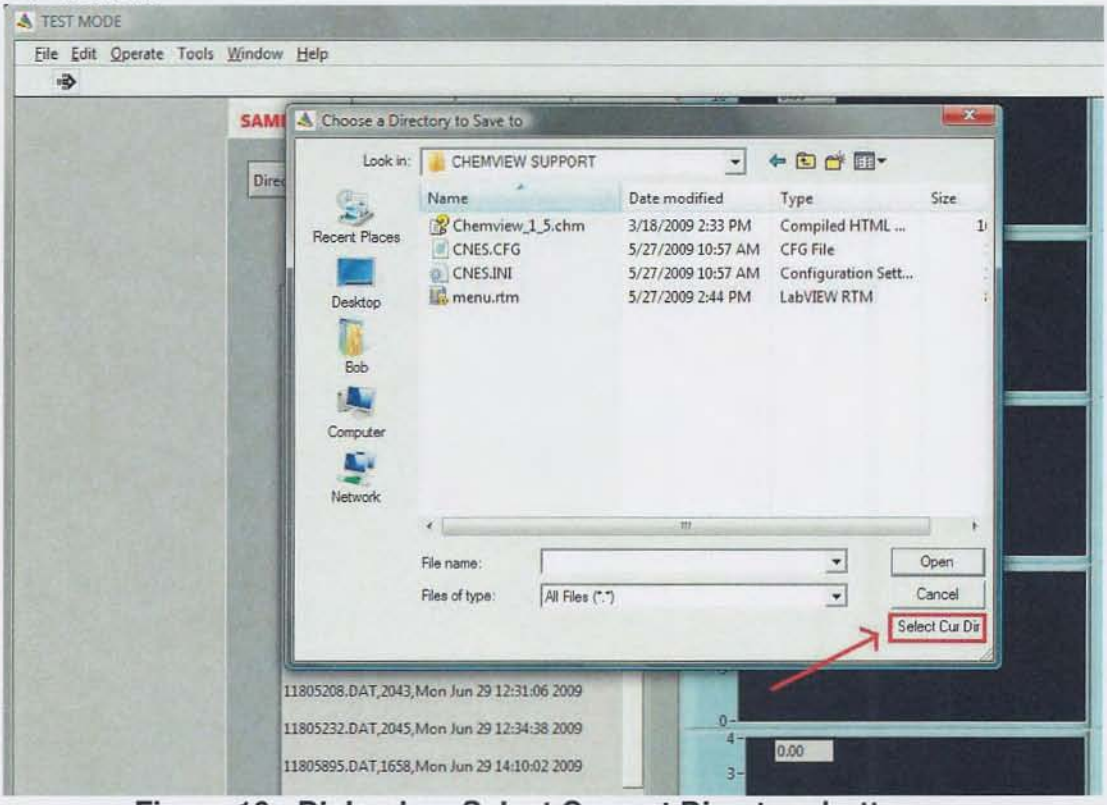


Figure 10: Dialog box Select Current Directory button.

9) Once complete, a window will appear stating the download was successful and you will be prompted with the option of editing the file or continuing.

Edit a file:

1) If you've recently received a file, you can edit the file right after the download is successful.
2) Or, simply click on the Edit button. You will be prompted to locate the file to edit and your computer's notepad will appear containing the file.

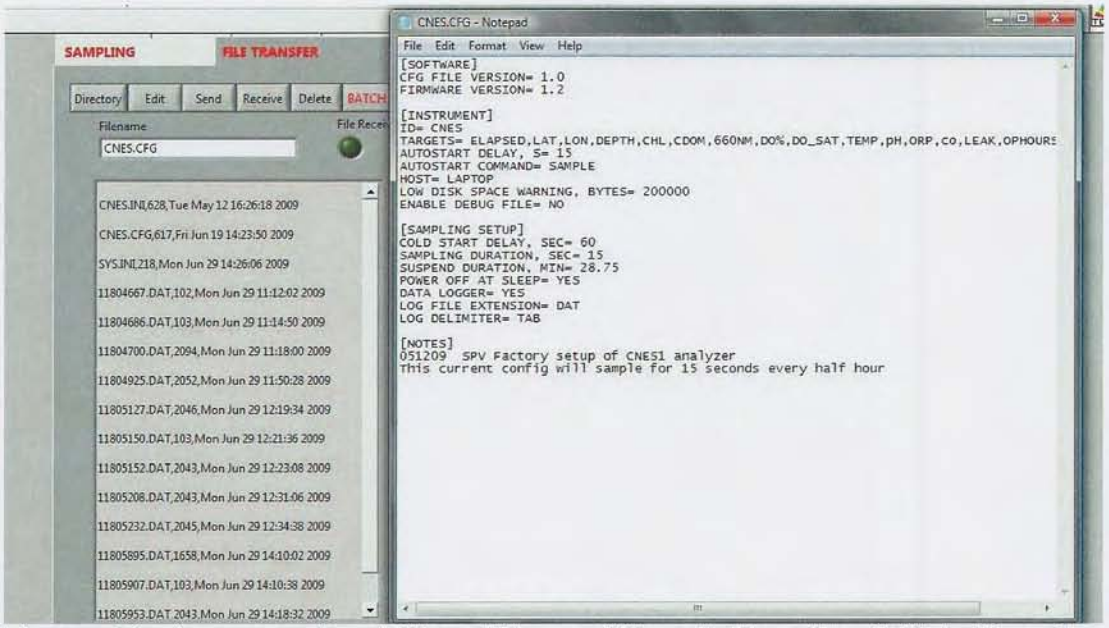


Figure 11: An example of file editing. After clicking the Edit button, the operator can select the file to edit. Once selected, ChemVIEW will open NOTEPAD to edit the file.

Sending a file:

1) Click on the Send button.
2) A window will launch asking that you Open the file.
3) Navigate to the file you would like to send to the CNES then double click on the file name.
4) The File should upload to the CNES.
5) A window should appear stating the file has been successfully transferred.

To delete a file:

1) Enter the file name to be deleted into the filename text box.
2) Click on the Delete button.
3) You will be prompted to verify you really want to delete the file.
4) Click Ok.

Once you upload a CNES.CFG or CNES.INI, the CNES will reboot. The CNES recognizes these files as system files and will reboot to update with its new parameters. To exit from file transferring, simply click on any of the other Tabs.

d) Configuration

On the root drive of the instrument "C:\", several files can be seen. One of which is a file named CNES.CFG. This file is used to configure the hardware of SubChem System controller based instruments. This file can be updated to suit the needs of each intended deployment. There are many parameters

which are factory set and will likely not be modified by the operator. This section will make those distinctions.

[SOFTWARE]
CFG FILE VERSION= 1.0 This holds the configuration file version currently in use. Pervious and future version may differ.
FIRMWARE VERSION= 1.2 This holds the current firmware version in use.

[INSTRUMENT]
ID= CNES This holds the instrument ID.
TARGETS=
CTIME,LAT,LON,DEPTH,CHL,CDOM,660NM,DO%,DO_SAT,TEMP,pH,ORP,co,LEAK,OPHOURS,VSUPPLY
It is in this line that the target data to be measured are called out. This represents the format of the data output in the log file.

AUTOSTART DELAY, S= 15
AUTOSTART COMMAND= SAMPLE
HOST= LAPTOP
LOW DISK SPACE WARNING, BYTES= 200000
ENABLE DEBUG FILE= NO

[SAMPLING SETUP]
COLD START DELAY, SEC= 60 This specifies the duration of time in seconds needed for proper sensor warmup.
SAMPLING DURATION, SEC= 15 This specifies the duration of sampling.
SUSPEND DURATION, MIN= 238.75 This specifies the time between samples.
POWER OFF AT SUSPEND= YES Specify whether the system is suspended between samples.
DATA LOGGER= YES Set data logging capabilities on/off
LOG FILE EXTENSION= DAT Specifies the file extension of the output log file.
LOG DELIMITER= TAB Specifies the delimiter between fields in the output log file.

[NOTES] In this section, you can type any text you want to make notes on the file. For example, the deployment time and revision of the file can be contained here as well as the author and a description of the test.

Example of a CNES CNES.CFG File

```
[SOFTWARE]
CFG FILE VERSION= 1.0
FIRMWARE VERSION= 1.2

[INSTRUMENT]
ID= CNES
TARGETS=
CTIME,LAT,LON,DEPTH,CHL,CDOM,660NM,DO%,DO_SAT,TEMP,pH,ORP,co,
LEAK,OPHOURS,VSUPPLY
AUTOSTART DELAY, S= 15
AUTOSTART COMMAND= SAMPLE
HOST= LAPTOP
LOW DISK SPACE WARNING, BYTES= 200000
ENABLE DEBUG FILE= NO

[SAMPLING SETUP]
COLD START DELAY, SEC= 60
SAMPLING DURATION, SEC= 15
SUSPEND DURATION, MIN= 238.75
POWER OFF AT SUSPEND= YES
DATA LOGGER= YES
LOG FILE EXTENSION= DAT
LOG DELIMITER= TAB

[NOTES]
051209      SPV Factory setup of CNES1 analyzer
```

In the event there is a problem with instrument operations as a result of modifying the CNES.CFG file, delete the file. Navigate to the RESPONSE tab and press the RESET button. Then enter the following text at the command line, "C:\DEL CNES.CFG". Restart the instrument and the default CNES.CFG file should be loaded.

e) Fixed Moored Deployment

To deploy the CNES is fairly straight forward:

1) Once the CNES has been properly configured for sampling, determine the operational depth of the CNES.
2) Attach the anchor line and surface float lines to the bottom and top of the CNES frame respectively.
3) Ensure that the SIIS magnet is installed.
4) Remove the deck cable and attach the dummy plug to the SIIS end cap.

NOTE: If the CNES is programmed to sampling immediately, you can use this to determine that it is operating prior to deployment without connecting with the tether.

5) Remove the white ECOPUCK cover.

6) Remove the SBE 27 pH probe guard.

7) Remove the SBE 27 pH probe bottle.

NOTE: When removing the probe bottle, the bottle is removed from its lid. The lid remains on the probe.

8) Remove the SIIS magnet.
9) Verify that the ECOPUCK lights are flashing.

The CNES is now ready for deployment.

When recovering the CNES, always place the SIIS magnet in the cradle. This will stop the internal logger and halt any sampling. Once on deck, always install the SBE 27 pH probe bottle and ECOPUCK cover. The probe bottle should have an acidic buffer solution in it that will ensure the probe does not dry out and remains clean. The ECOPUCK cover will prevent the ECOPUCK LED face from getting scratched.

f) Batch File transferring

Receive a data set:

1) Follow the steps outlined in section 4.0.
2) Click on the Batch button and a new window will appear as in Figure 12.
3) To receive the DAT files on the CNES after a deployment, click on the GET FILE(S) button.

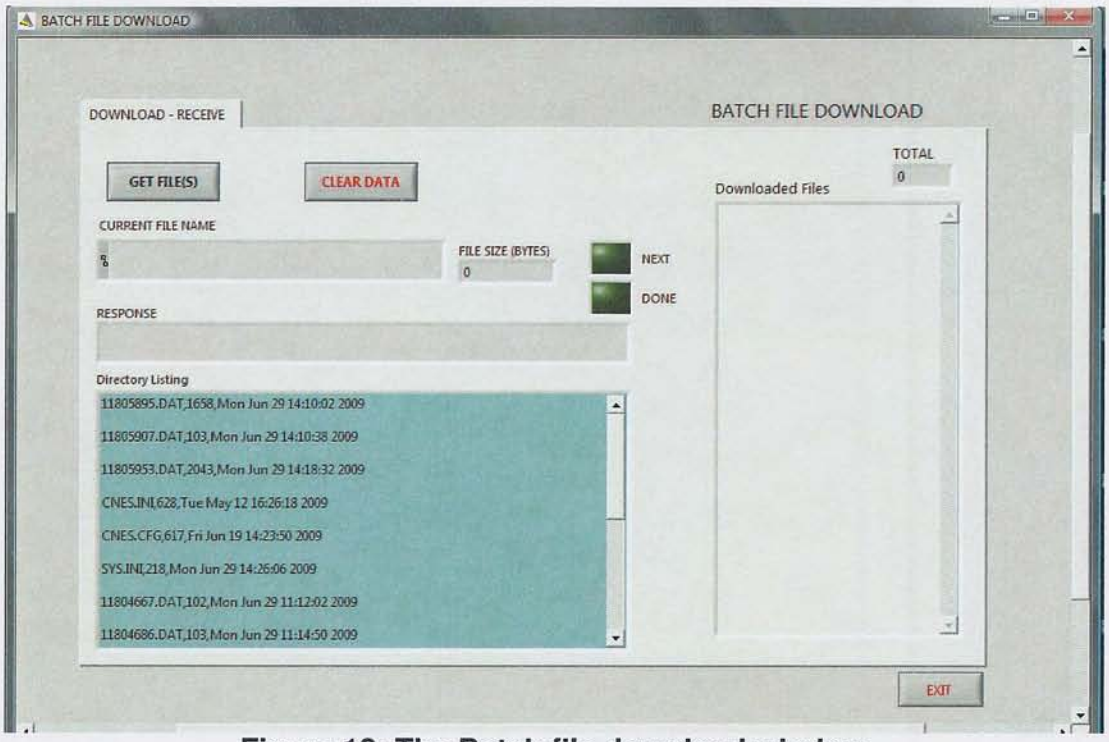


Figure 12: The Batch file download window

4) Next, you will be prompted to locate the directory to store the data set. Navigate to that directory then click the Select Cur Dir button.

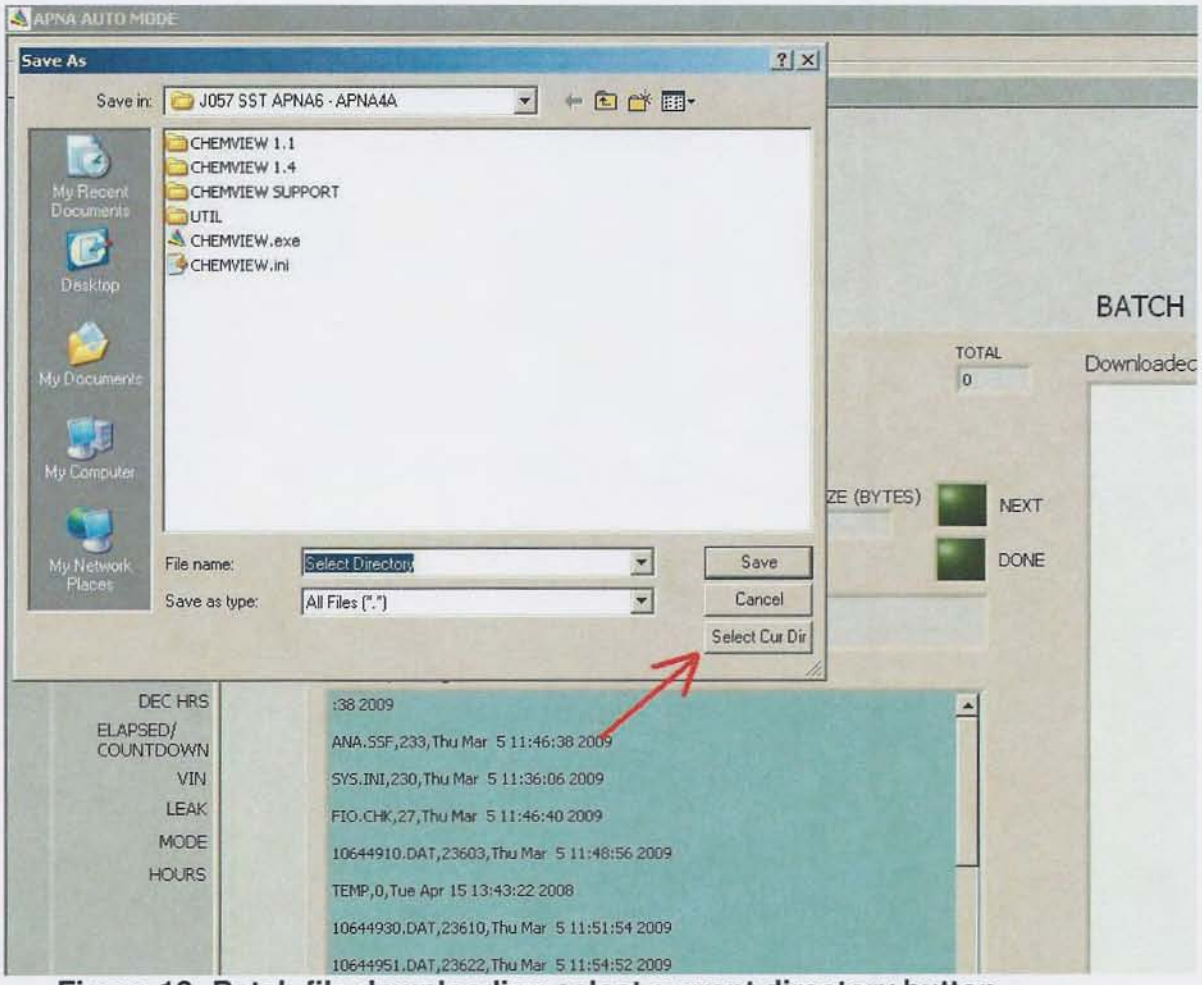


Figure 13: Batch file downloading select current directory button.

5) The data set will now be downloaded. As each file is downloaded successfully, it will be listed under the Downloaded Files list box.
6) Once the data set has been downloaded, a new window will appear stating that the Batch File Download is complete.

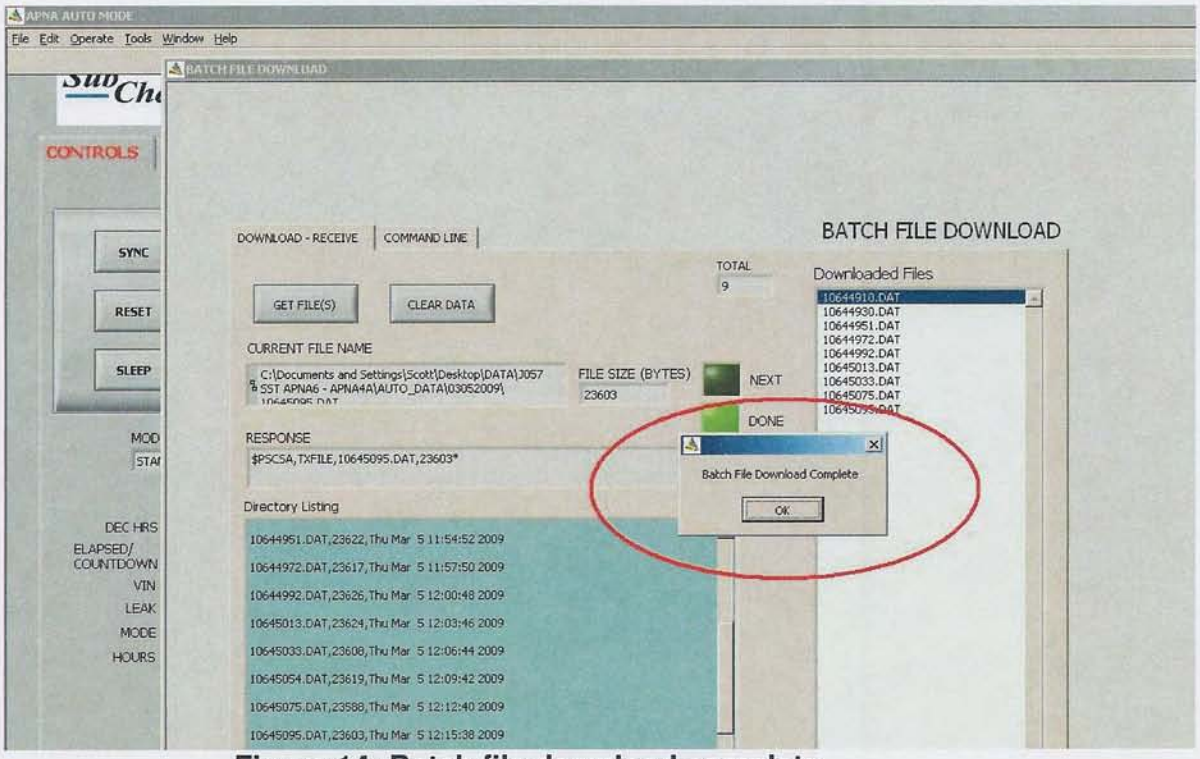


Figure 14: Batch file download complete.

g) Plotter Operation

The Plotter was designed to be a tool to observe the raw data as downloaded from the CNES. Operators can get an initial assessment of the performance of the CNES to aid in decision-making to either recovery or re-deploy the CNES. The plotter incorporates the ability to view all the parameters recorded in the CNES DAT files as well as compare and contrast plots. Please note, the CNES is not needed for this application and can therefore remain off or can otherwise be used elsewhere.

To open the Plotter application, click the following:

START MENU
\Programs
\Chemview
\Chemview.exe

A window will appear prompting the operator to select the CNES operation mode. At this point, click on the PLOTTER button. The PLOTTER application will now load.

To view a recently downloaded data set:

1) In most cases, ChemVIEW will create a folder called AUTO_DATA. Data sets retrieved will be date stamped in an additional folder with DAT files within. To facilitate looking at multiple data sets, the user can set the working directory to a folder containing many data sets by clicking on the folder icon next to the 'Choose Working Directory' path indicator. Then navigate to the folder of interest and press 'Select Cur Dir' once in the folder. See Figure 15 for help.
2) Next the user may click on 'New File', 'Prev File', 'Next File', 'First File', or 'Last File' to load a data set. Pressing 'New File' will allow the user to navigate to the desired file to open and load. Pressing 'Prev File' or 'Next File' will open and load the previous or next data file in the current working directory without opening a dialogue box. Likewise, pressing 'First File' or 'Last File' will open and load the first or last file in the current working directory.

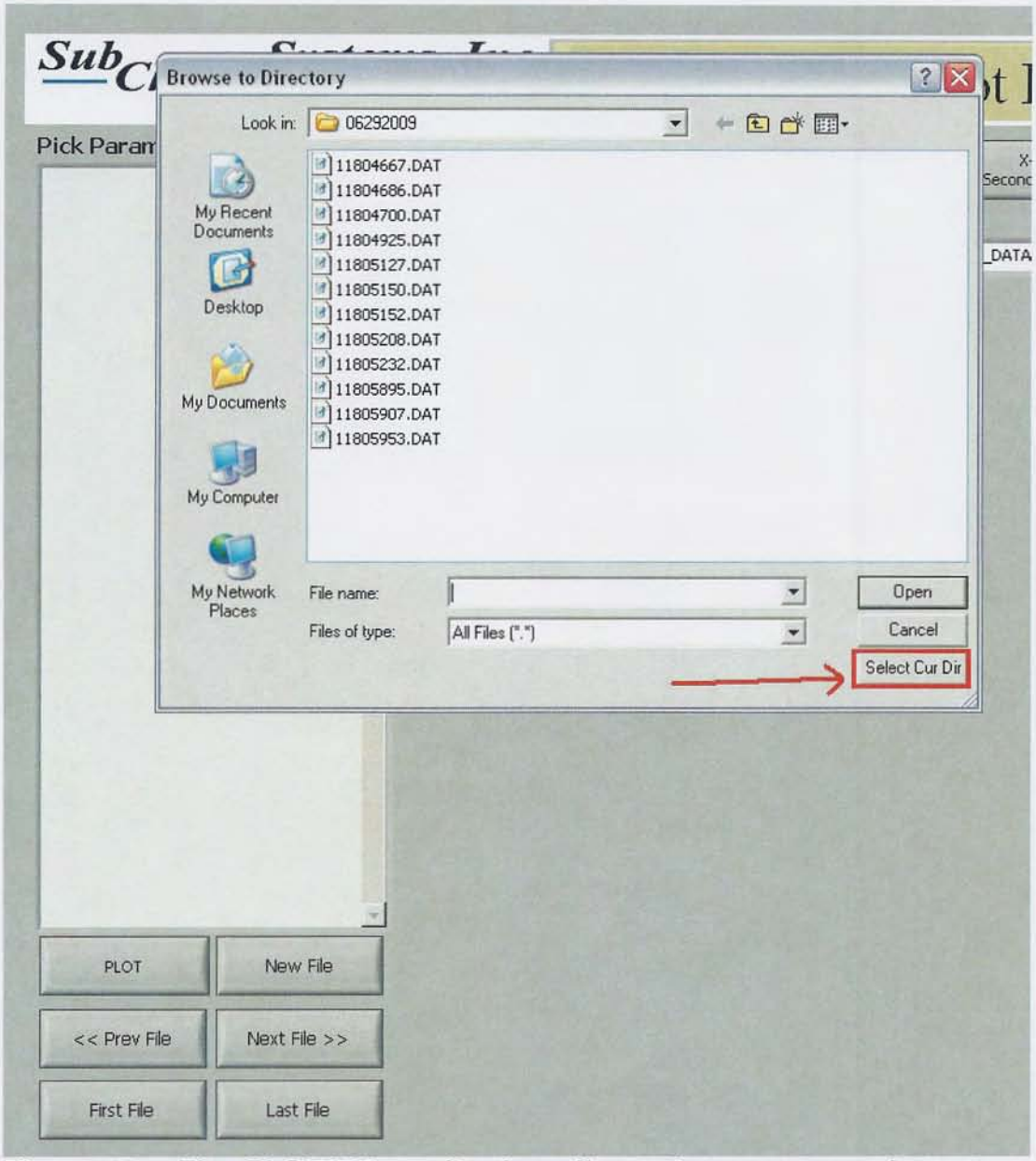


Figure 15: The PLOTTER application allows the user to navigate to a working directory

Each DAT file is named with a specific naming convention unique to when it was recorded. The PLOTTER application will decode this file name and display the information contained within.

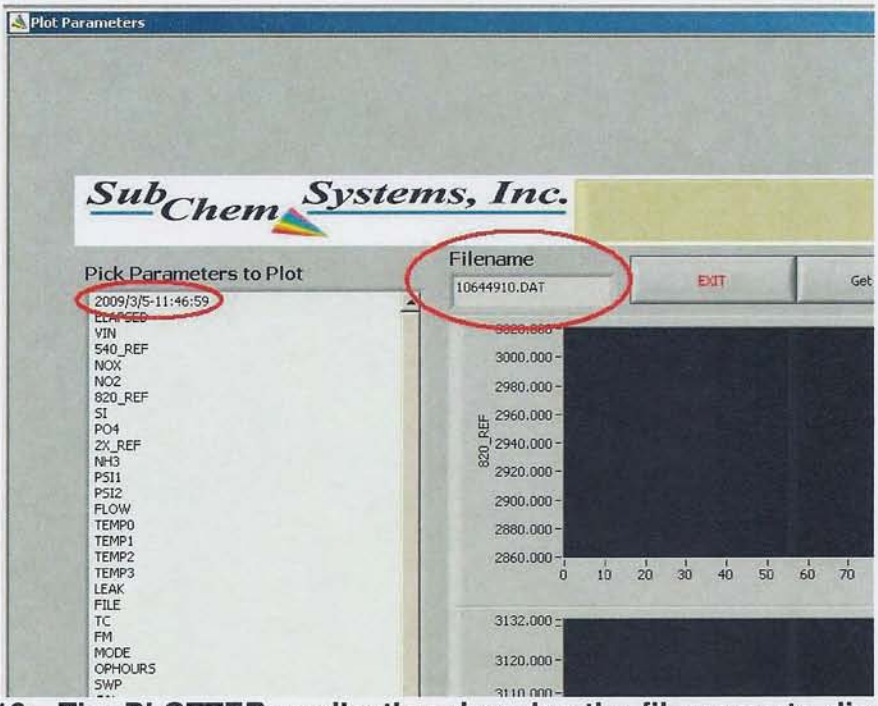


Figure 16: The PLOTTER application decodes the file name to display the start Date/Time of each file.

The parameters recorded in the DAT file will be listed in the list box labeled "Pick Parameters to Plot". Select a parameter to plot by clicking the parameter once to highlight it. Then click the PLOT button beneath the list box to plot the values. To plot two parameters together, select both by holding the SHIFT key, and clicking on both parameters. Then click the PLOT button. A second plot with appear with the values from the second parameter. Up to 13 parameters at a time may be plotted. If three or more parameters are selected for plotting, a single plot with all of the selected parameters will be generated, with a legend to label each parameter.

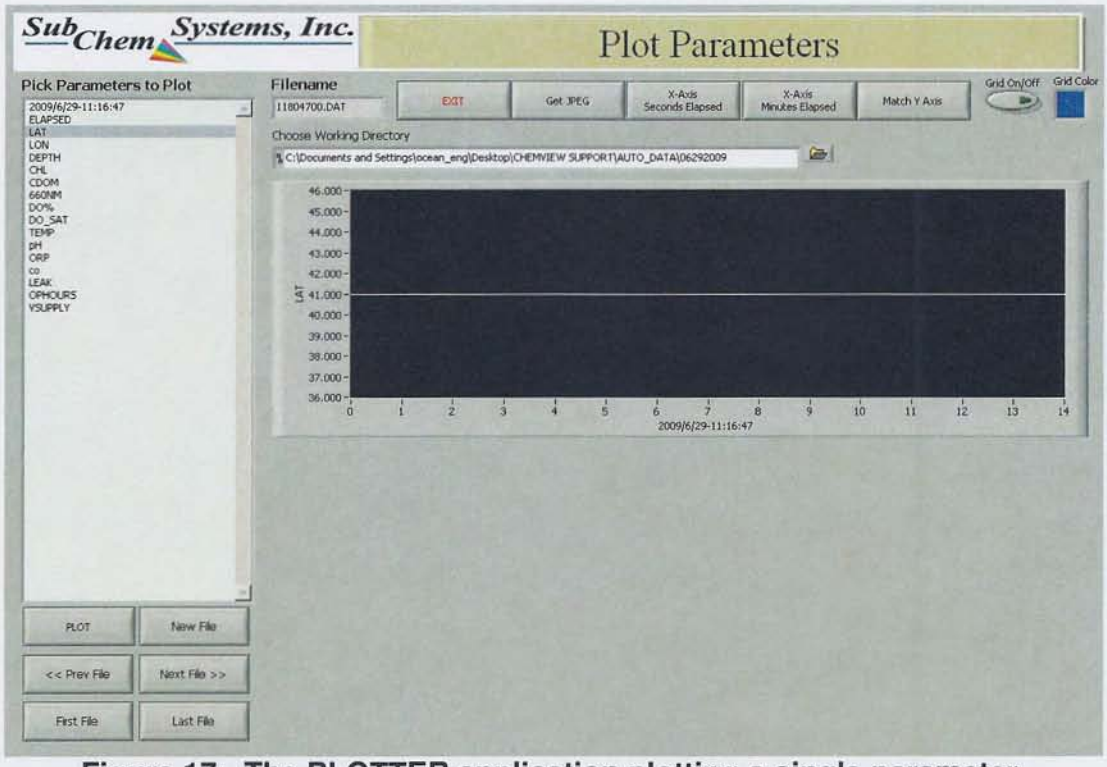


Figure 17: The PLOTTER application plotting a single parameter.

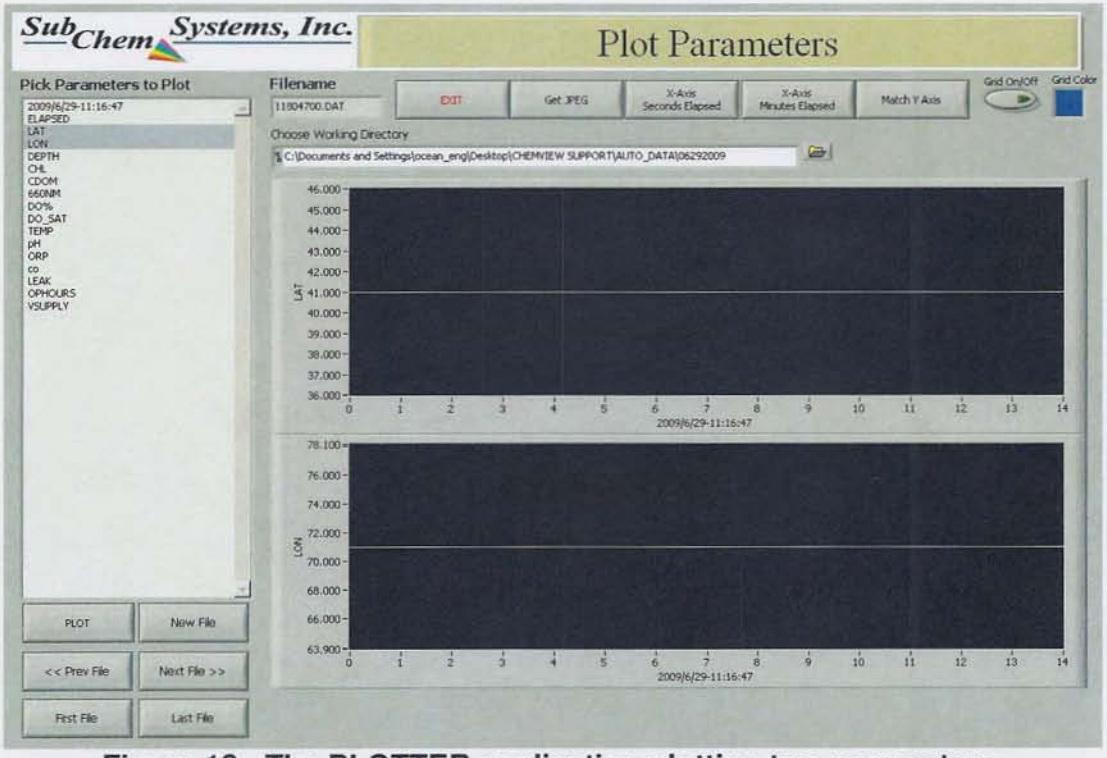


Figure 18: The PLOTTER application plotting two parameters.

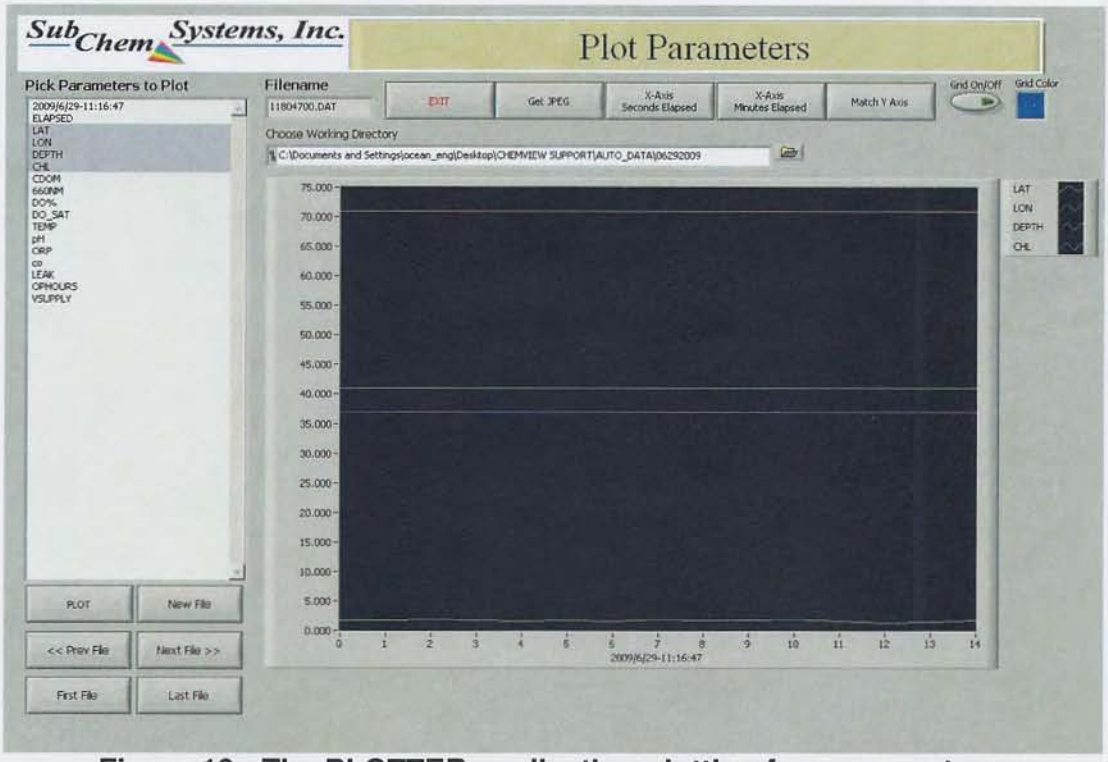


Figure 19: The PLOTTER application plotting four parameters.

Once values appear plotted, several features are now available to enhance the plots. Above the plots are several buttons:

EXIT button: This button will exit the PLOTTER application and bring the operator back to the mode selection window.

Get JPEG button: This button will store the two plots as individual JPEG files. Click on the Get JPEG button and a Save As dialog box will appear. Enter a name for the plot(s). For example, enter the file name too which the plots were derived then the parameter plotted (i.e. 10644910_PSI1.DAT). If creating JPEG images of two plots, enter the second plot name first.

X-Axis Seconds Elapsed button: This button converts the time axis to elapsed seconds since the start of the file.

X-Axis Minutes Elapsed button: This button converts the time axis to elapsed minutes since the start of the file.

Match Y Axis button: This button will match the y axis of the second plot to the first plot.

To adjust the scale on the x or y axis, double click the top and/or bottom numbers of the scale, once they are highlighted, you can edit those numbers.

Grid On/Off button: This toggle button will enable and disable a grid. Once enabled, the grid will overlay on all plots.

Grid Color: Click on the color to bring up a color palette to change the grid color.

New File button: This button is located underneath the parameter list box. Once clicked, a new DAT file can be selected.

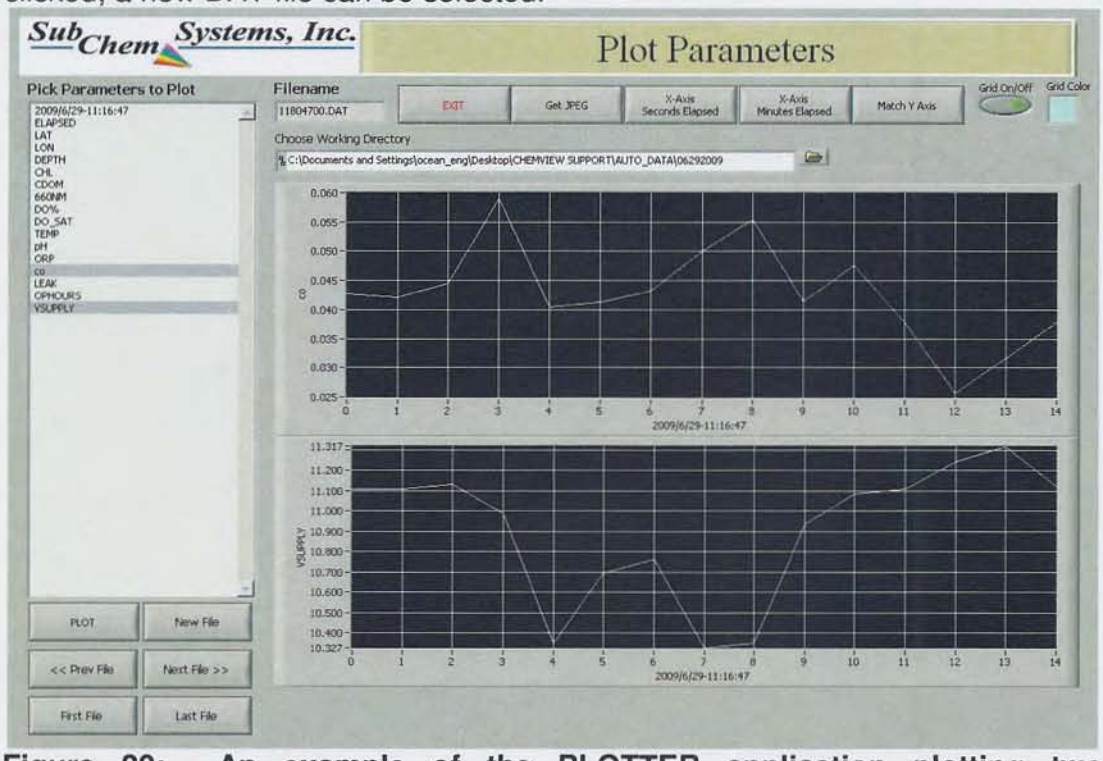


Figure 20: An example of the PLOTTER application plotting two parameters with grid overlay.

h) Charging

The CNES is equipped with one 11.1V lithium battery pack. The battery is assembled with a built in printed circuit board and poly-switch fuse for added protection. It can be charged directly from the CNES deck box. The CNES deck box has a built in low current smart lithium battery charger. The charger and battery are equipped with over charge and over discharging cut off circuits. The battery will have a maximum of 13V and a cut off voltage of 7.2V.

To charge the CNES simply connect the CNES to the deck box as outlined in section 4. Verify that the charger switch is in the ON position. Then switch the deck box to the ON position. Anytime the deck box is ON while the charger switch is ON, the CNES will be charging regardless of the SIIS magnet position.

The SIIS controller is designed to switch the power supply from the battery to the deck box if the deck box power is on.

NOTE: The CNES can run off the battery and connect to the deck box for communication only. This is a good way to check the charge of the battery using the VIN value in ChemVIEW. The battery will take approximately 6 hours to recharge after being fully depleted.

Water Column Injury Ephemeral Data Collections:
Deepwater Horizon Oil Spill (DWHOS)

Plan for Adaptive Water Column NOAA-NRDA Sampling (PAWNNS)
Cruise Plan – American Diver 1 and Ocean Veritas 9
Appendix 4:
Sampling for Floating Dead Pyrosomes in the Vicinity of the MC252 Incident Site

July 17, 2010

Observations by researchers and workers on boats in close proximity of the MC252 Incident Site have reported numerous sightings of long tube-like floating dead organisms. These organisms are presumed to be *Pyrosoma*, a genus of colonial tunicates, and are common in the Gulf of Mexico. They are an important component of the food web; they are filter feeders and are a major food source for leatherback sea turtles[1]. These tunicates are typically found at depth in the upper meso- and epi– pelagic water column and may engage in daily diel migration. Floating at the sea surface is not a normal phase of their life cycle and is an indication of mortality.

Figure A-1. Dead pyrosome collected during the *Ocean Veritas* Cruise Leg 4: June 14th – 16th.

[1] McMahon, C.R., C.J.A. Bradshaw, G.C. Hays. 2007. Satellite tracking reveals unusual diving characteristics for a marine reptile, the olive ridley turtle *Lepidochelys olivacea*. Marine Ecology Progress Series 329: 239-252.

Figure A-2. Dead pyrosomes floating at the ocean surface observed during the *Ocean Veritas* Cruise Leg 4: June 14th – 16th.

Objectives:
This sampling plan proposes to quantify and measure the size distribution of dead surface floating pyrosomes in the vicinity of the incident site. In addition, specimens will be collected for tissue sampling and other anatomical analyses to determine bodily PAH levels as well as other anomalous conditions.

Sampling Plan:

Quantifying dead pyrosomes on ocean surface

It is a priority to quantify the number and size frequency distribution of these organisms found in the vicinity of the incident site. To quantify number, a video recorder will be placed on the boat to record the number of dead pyrosomes encountered during timed, measured transects. Pyrosome counts will be carried out while the DAVPR is being towed (speed 3 knots; see main plan for description of transect locations; the number of transects performed will depend on time available for such sampling, but at least once daily). The vessel will be rigged for obtaining HD video with a fixed view (approximately 2-3 meters off the side of the vessel), with counts conducted from the video in the lab following the cruise. A video camera will be hung from the side of the vessel with a fixed angle and fixed height above the sea. It will be necessary to use a reference pole or other similar scale to estimate number observed through the video. One individual on the vessel will be responsible for the video sampling effort. An additional observer will take visual counts during each videoed transect for reference and comparison to the counts processed from the footage. The observer will watch the same swath of water, or field of view, as the mounted camera using the reference pole or scale to gage the area of observation. The observer will take counts and record hash

marks in a log sheet as pyrosomes pass by. From the photographic evidence examined thus far of these floating pyrosomes, density appears to be low enough that visual counts are realistic and would be accurate. The observer data will be used to validate the video counts. If the results from the observer counts are not statistically different from the video counts, the video counts will regarded as the more accurate data set.

To attain data on size distribution, a group of these organisms representative of the sizes floating at the surface will be captured and measured. Using a dip net observers will collect up to ~50 individuals on each transect, collecting them at even time intervals (such as every 5 min), depending on the time required for the dip-net operation and expected duration of the transect. The transect length for pyrosome counts and collections will be determined by other sampling priorities (i.e., by the DAVPR transect sampling).

Number collected per transect will be recorded in field logs. Once on deck, measurements of length and volume will be recorded. Length will be recorded as total length (mm) and volume will be recorded as displaced volume (mL) in a graduated cylinder (or other viable volume measure). After measurement, 10 organisms per transect will be frozen in sample freezers for later tissue and other anatomical analyses and the rest will be returned to the environment.

Sample Chain of Custody

Sample collection methodology, handling, chain of custody (COC) and decontamination procedures will follow accepted standards to ensure the highest quality data will be collected. NOAA NRDA COC forms will be used for collected samples. COC standard operating procedures as outlined in the "NRDA Field Sampler Data Management Protocol" (Attachment 5) will be followed. Discrete samples will be tested at an approved laboratory or laboratories (most likely TDI Brooks).

Vessel requirements:

A vessel capable of being deployed offshore is required for this sampling event. No specialized deck gear are required.

PORTABLE LARGE-VOLUME SEAWATER SAMPLING SYSTEM (PLVWSS)

05/05/10

PLVWSS Specifications, Sampling Protocols, and Power Requirements

Container	Contents	Dimensions (inches)	Weight (lbs)	Power Requirements
Cruise Box No.1	Vacuum pump, in-line charcoal filter and water trap, vacuum gauge, support rack for 1 gallon amber-glass bottles, Teflon® stopper and suction tubing	24¼ W x 21¾ D x 19½ H	60	110 volts AC (from ship's AC outlet or portable generator)
Cruise Box No. 2	14.2 cm stainless steel Millipore® filter holder, Tygon® tubing, Teflon® solvent squirt bottles for equipment rinsing, Pall-Gelman Sciences 14.2 cm glass fiber filters, electrical extension cord, stainless steel forceps and spatula for filter manipulation	23¾ W x 23 ¾ D x 21¼ H	50	None

INSTRUCTIONS FOR SAMPLE COLLECTION AND FILTRATION

1) Place the Tygon® sampling tubing attached to the upper side of the filtration unit into the water (for near-surface samples if direct suction sampling is desired) or attach to the sampling port of the Go Flow Bottle used to collect samples at depth.

2) Plug in the vacuum pump (there is no on/off switch), and hold the Teflon® stopper firmly in the neck of the sample bottle. DO NOT FORCE THE STOPPER COMPLETELY INTO THE BOTTLE. The Viton® O-ring on the stopper is intended to make the seal with the upper lip of the sample bottle. Forcing the stopper into the neck of the bottle may cause the bottle to break, and it will certainly make it difficult to remove the stopper at the termination of sampling operations.

3) Press the Viton® O-ring on the stopper onto the top lip of the amber-glass bottle until a vacuum reading of 20 to 24 inches of Hg is obtained on the vacuum gauge attached to the pump. If the stopper starts to get sucked into the sample bottle, gently pull it out part way while still maintaining 20 to 24 inches of vacuum. Hold the stopper in place until water can be observed bubbling about 3 to 4 inches from the top of the amber glass bottle. This entire process may take from 5 to 7 minutes.

4) At this point, carefully watch the upper water level to ensure that the bottle does not become completely filled. Also, watch the vacuum tubing running from the Teflon® stopper to the in-line charcoal filter and water trap to see signs of water droplets starting to be drawn across into the trap. Stop collecting the sample when the water level is about 2 to 3 inches from the top of the 1-gallon bottle or when frequent water droplets are observed going over into the in-line trap.

5) To stop sampling, simply pull up on the Teflon® stopper to break the vacuum seal with the sample bottle. DO NOT TURN OFF THE VACUUM PUMP FIRST. This can damage the vacuum pump, and cause back diffusion of materials trapped in the in-line water trap back into the sample.

6) After the seal with the sample bottle is broken and the vacuum pressure has dropped back to ambient, unplug the vacuum pump.

7) Disconnect the Teflon® stopper from the transfer tubing coming from the bottom of the Millipore® filtration unit and wrap both ends of the tubes from the two-holed Teflon® stopper with aluminum foil. Place the original cap from the amber-glass bottle back on the bottle to seal it. Leave the sample in the pump box for safe storage until all other sampling operations are secure.

8) Drain any excess water from the tube running from the bottom of the filtration unit before opening the Millipore® filter housing. This will prevent any of the filtered material (SPM, sand, and free oil droplets) from being washed off the filter when the unit is opened. After all the water has drained from the bottom of the filtration unit, cap the tubing with aluminum foil and wrap the tubing around the legs for temporary storage.

9) Open the Millipore® filtration unit and carefully remove the outer ¼-inch circle of the glass-fiber filter from the perforated blue support base. Discard the outer edge of the filter. Using the stainless steel forceps and spatula provided with the PLVWSS, carefully fold the filter (while still on the blue support base) in half (and then in half again) to make a quarter-pie shape and then one more time making an eighth of a pie wedge. This entire operation should be done with the filter still resting on the perforated blue support base.

10) Place the folded filter wedge into a 125 mL Certified-Clean I-Chem bottle, seal and label it. The filters may be stored on ice or frozen in the field, if dry ice is available. Store frozen.

11) If another water sample is to be collected right away, place another glass-fiber filter into the Millipore® filtration unit, return the filtration unit to the cruise box/container, and proceed to the next station.

Finally, put the filtered water sample in the 1-gallor amber glass jug in a refrigerator (4°C) or cooler with frozen Blue Ice packs for storage before transfer to the analytical laboratory. Alternatively, the dissolved-phase water sample may be preserved by acidification (pH < 2 with HCl) or poisoned with 50 to 100 mL of methylene chloride. Because of air-freight shipping considerations, preservation with refrigeration and shipment with Blue Ice is preferred, particularly if next-day air delivery to the laboratory is available.

Contact James R. Payne at PECI for questions or additional information
[redacted]

Attachment 2:

Quality Assurance Guidelines for NRDA Water Column Chemistry Cruise 1 on the M/V American Diver

Purpose

This document provides general guidance for field sampling data quality assurance for the collection of NRDA field samples for planned sampling cruise on July 17-24, 2010 to assist in the validation of 3-dimensional modeling of subsurface plume structure aboard the M/V American Diver.

The current sampling plan involves sampling multiple depths at numerous stations directed by Dr. D. French-McCay (based on measured currents, SIMAP modeling, and input from the Subsurface Monitoring Unit (SMU)) for BTEX, THC, PAHs and free oil droplet size. Sampling requirements as outlined for basic sampling to address field program objectives for adequate description of locations are presented in Table 1. This sampling scheme is derived from the Field Plan and Sampling Protocol documents.

Table 1: Required Analytical Samples for 3-dimensional modeling data support

Sample Type	Volume Needed	**Minimum** # of samples per location
BTEX	40 mL	2 per depth
THC and PAH	1 gallon	1 per depth
Oil Droplet distribution	10 mL	10 per sample depth

In addition to basic site description, additional sampling requirements for data verification and validation, as well as equipment and procedural validation are required. These samples and the suggested frequency are described below.

Laboratory Notebook

All errata and observations that do not have a logical spot on the Chain of Custody form shall be documented in a bound lab notebook with numbered pages. Additional notation shall be written in black or blue ink. Entry errors shall be crossed out with a single line, initialed, and dated.

Blank Samples

Laboratory Grade de-ionized (DI) water in certified clean glass containers will be provided by Pace Laboratories. Sampling blanks shall be collected, where practical, using the laboratory provided water, according to the described methodology for BTEX and THC/PAH analyses (including filtration) at each sample location. These samples shall be handled and stored in accordance with the accepted methodology for each sample type. At stations where two DI samples are collected, one shall be collected before Go-Flo bottle sample collection, and one shall be collected after the last seawater sample is collected.

Storage Procedure Monitoring
Aqueous samples shall be refrigerated to 4 °C (+/- 0.5 °C). DO NOT FREEZE. Refrigeration temperature shall be recorded when samples are stored, and periodically monitored and recorded to ensure proper refrigeration. A thermometer will be available to remain with the aqueous samples in storage for monitoring purposes.

Filter samples shall be frozen for storage. Storage temperature shall be kept at 0 °C or below. Refrigeration temperature shall be recorded when samples are stored, and periodically monitored and recorded to ensure proper refrigeration. A thermometer will be available to remain with the filter samples in storage for monitoring purposes.

Methods for sample replicates/splits
To accomplish random sample splits, two methods can be employed during the cruise. Method One will be simultaneous deployment of two 5 L Go-Flo bottles which will be closed at the same depth in order to collect sample water as similar as practical. Method Two involves deploying a single 10 L Go-Flo bottle (if available) and collecting samples in series from the same bottle upon retrieval. Method One will be the preferred method. Method choice must be documented on the Chain of Custody form as **Replicate** (Method One) or **Split** (Method Two).

Sampling Equipment Monitoring
All tubing used with the PLVWSS shall be visually inspected before sampling. Sampling tubing shall be changed when contamination is visually obvious. Tubing changes shall be documented in a separate laboratory notebook (date, time, location).

Sample Depth Determination and Verification
Sample depths shall be chosen to best elucidate modeling data needs. For all samples (except ROV collected samples where depth is dependent on visual observations of TV feed to facilitate collection of observed dispersed oil droplets in the water column), depths for Go-Flow samplers must be preset (based on CTD and fluorometry data) and the depth selections recorded. Verification of triggering sequence of the CTD shall be made and documented in order to verify samples were collected as expected. Go-Flo bottles shall be numbered and numbers documented with sample station and on Chain of Custody forms. Any malfunction of the triggering of the Go-Flo bottle operation shall be documented.

Water Sampling Protocols in Support of the Broader GOM Water Column Study
WHOLE WATER SAMPLES

Sampling Objectives

- To estimate the concentration of oil compounds in the water column.
- To evaluate the source of oil compounds via fingerprinting, the degree of weathering, and background levels.
- To document exposure of water-column organisms and validate toxicity models.
- To maintain the integrity the sample(s) during sampling, transport, and storage.

Sample Volume

Analysis	*Sample Volume*	*Reporting Limit*
Volatile Organic Aromatics (VOAs)* by SIM GC/MS (collect in duplicate)	40 mL vials	0.1-1 µg/L (ppb)
Total Petroleum Hydrocarbons (TPH) by GC/FID	1-Liter	15 µg/L (ppb)
PAH (including alkylated PAHs) by SIM GC/MS	1-Liter	0.001 to 0.01 µg/L

*sometimes referred to as VAH or BTEX analysis

Sampling Equipment/Containers

- Collect VOA samples (wearing clean Nitrile gloves) by pouring directly from the collection device (4 or 5 L Go-Flow bottle or other sampler) into HCl-preserved 40 mL septum-capped vials. Ensure that there is no headspace (i.e., bubble) in the vial by creating a "reverse meniscus". Take care not to overfill vial so preservative is not lost during the transfer.
- Collect water samples for TPH and PAH in glass containers, certified-clean to be organic-free (solvent rinsed). Amber glass is preferred. Leave headspace of about 1 inch for 1 L jars. If the Portable Large Volume Water Sampling System (PLVWSS) is used, the sample will first be processed by vacuum filtration through a 0.7 µm glass fiber filter as it is vacuum transferred from the Go Flow Bottle into the amber glass jug (see separate PLVWSS Protocol).
- If petroleum sheens or slicks are present, decon samplers before each use (see separate QA Plan for the NRDA Cruise). Wash with laboratory-grade detergent and clean water, with a triple clean-water rinse (distilled water from a local store is OK but laboratory grade, certified-clean DI water is better). If that cannot be obtained, clean "background" water from an up-current non-contaminated area may be used. If sampler is contaminated by an oil slick, an Alconox wash followed by a triple DI water rinse will be employed, (See separate QA Plan for sampler decontamination and blank protocol/frequency.)

Sample Collection Methods

- Collect near and subsurface samples below the water surface in a manner that does not include any surface oil/sheens (see fifth bullet below).
- Take "near surface" samples from approximately 1 m below the surface as appropriate given weather conditions.

- Boat maneuvers will be performed to attempt to sweep oil away from the area where the Sampling equipment is to be deployed. If Go-Flow bottles are employed, they are to be deployed and retrieved in the closed position. Also applies to sample jars lowered by hand.
- On each cruise, try to sample the control/least oiled areas first, then more contaminated zones.
- Clear surface slicks with a boat hook or pole prior to deploying the equipment, but carefully so that the surface oil is not physically dispersed into the water column. Sweeping the area with sorbents may also be effective.

Preservation/Holding Times

- VOA (VOA vial): With no preservative the samples may be held for 7 days at 4°C in the dark. Addition of HCl can extend the holding time to 14 days at 4°C in the dark without loss of sample integrity.
- TPH and PAH: No preservative added. Can be held at 4°C in the dark for up to 7 days.
- Immediately place all water samples in cooler and keep at 4° C (do not freeze).
- Use packing material around containers to prevent breakage.
- Ship to the laboratory ASAP with complete COCs. They need at least one day to process prior to holding time expiration.
- **Volatile hydrocarbons** (benzene, toluene, ethylbenzene, and xylene, or BTEX). For oil spill applications, the standard EPA Method 8260 (purge & trap) should be modified by running the GC/MS in selected ion monitoring mode and expanding the scan list (retention times and ions) to include the higher alkylated (C3 and C4) benzenes. Detection limits should be 1 ppb for individual analytes; 0.1 ppb is possible.
- **Total hydrocarbons** (TPH). Often referred to as total petroleum hydrocarbons, but most methods do not differentiate among petroleum, petrogenic, and biogenic hydrocarbons. TPH by GC-FID (total area of FID gas chromatogram of combined f_1 and f_2 fractions after column chromatography) is often the preferred method because of the low detection limit (compared to other TPH methods) and the direct measurement of individual hydrocarbons. This method does not detect low boiling compounds (below n-C_8). The TPH results, however, can be used to track oil weathering and map extent of exposure of water column resources, if meaningful detection limits can be reached. A copy of the chromatogram should be obtained.
- **Polycyclic aromatic hydrocarbons** (PAH). It is important that the target analytes include the alkyl-substituted PAH homologs, in addition to the standard PAH "priority pollutants." This method is referred to as Modified EPA Method 8270, because the list of PAHs is expanded to include the alkylated homologs, using GC/MS in the selected ion monitoring (SIM) mode. Detection levels should be 1 ppb for individual PAHs to support injury assessment using toxicity thresholds. The laboratory will also analyze a sample of oil from the source.

Laboratory analytical methods and a detailed chemical of concern (COC) list can be found in the project analytical quality assurance plan for the Mississippi Canyon 252 (Deepwater Horizon) Natural Resource Damage Assessment Version 2.0.

Other Considerations

- Contamination by surface slicks is of great concern. Document presence of slicks, weather, and wave conditions, etc. which might suggest mixing of surface oil during sampling.
- Be aware of sources of contamination on the sampling vessel (exhaust fumes, engine cooling systems, oily surfaces). Work up-wind of any exhausts. Segregate dirty/clean areas. Lay out clean substrates to work on and replace frequently.
- Collect background samples from clean sites representative of pre-oiling conditions, as well as areas not yet oiled but in the potential path of the oil.
- Preservation chemicals should be provided by the lab.
- Use a computer or conceptual model of the extent of water-column contamination to determine the number and location of samples. Minimum guidelines are at least three samples per area of relatively uniform exposure or sub-waterbody. Also, sample along exposure gradients, starting in the cleanest zone, at regular intervals proportional to the exposure area.

MS CANYON 252 SAFETY CONFIRMATION

NAME: _____

CELL PHONE NUMBER: _____

EMAIL ADDRESS: _____

I HAVE READ AND UNDERSTAND THE MS CANYON 252 SITE SAFETY PLAN

_____ SIGNATURE

_____ DATE

I HAVE COMPLETED THE FOLLOWING LEVEL OF HAZWOPER TRAINING:

□ NONE □ 24 HOUR □ 40 HOUR

I HAVE COMPLETED THE FOLLOWING BP SAFETY TRAINING MODULE(S):

*NOTE: IF YOU HAVE COMPLETED THE ON-LINE TRAINING, YOU HAVE COMPLETED MODULE 3

□ MODULE 1 □ MODULE 2 □ MODULE 3

I HAVE COMPLETED FACE-TO-FACE TRAINING DURING THIS RESPONSE AT HOUMA

□ YES □ NO

EMERGENCY CONTACT INFORMATION

NAME: _____

PHONE NUMBER: _____

Please return this form, completed in its entirety, to either:
□ The drop box in Room G401 at the Houma Command Center, or
□ The following email address: dwhnrda@gmail.com

SUBJECT: Safety Plan

PREPARED FOR: NRDA (Natural Resources Damage Assessment),
Shore Survey Operations

1. INTENT

1.1. The intent of this Field Safety Plan is to establish a structured process and disciplined approach to the mitigation of health, safety and environmental risks associated with our operations and activities. This safety plan applies to the Natural Resources Damage Assessment (NRDA) Team.

2. COMMUNICATIONS

2.1. A daily pre-operations meeting will be conducted on-site with each team. Job Hazard Analysis' are located at the end of this document. Specific topics of discussion will include:

- Lessons learned from the prior day's mission.
- Current weather and short-term forecast.
- PPE requirements.
- Communications.
- Food and Water.
- Potential hazards to watch out for.

2.2. Each team is equipped with a cellular phone and/or a satellite phone. NRDA Field Teams will contact NRDA Operations (located at ICP Houma) as identified below to help ensure personnel accountability.

2.2.1. Departing for field sampling area.

2.2.2. Arriving field sampling area.

2.2.3. Four hour intervals during operations.

2.2.4. Departing field sampling area for day/shift.

2.2.5. Termination of operations (e.g. transition to over-the-road vehicle and/or arrival place of lodging).

2.2.6. As soon as practical to report any health, safety, security, or environmental incident.

2.2.7. Use one of the following NRDA Ops (ICP Houma) contact numbers:

2.2.7.1. PRIMARY - 985-746-4916

2.2.7.2. For non-routine issues and the above number can not be reached, CALL Nir Barnea (NOAA Safety) - 206-369-5015.

2.3. NRDA Team Members at ICP Houma will update the Shore Survey Teams Status Display upon notification from a NRDA Shore Survey Field Team.

2.4. Each NRDA Shore Survey Field Team will be provided with a copy of this safety plan.

3. VEHICLE SAFETY

3.1. Pre-Trip Plan (Maps, directions)

3.2. Seat Belt use is mandatory

3.3. Observe posted safety notifications and speed limits.

3.4. DRIVER - Cell phone use both hand-held and hands-free, texting, and e-mailing is prohibited while driving. If necessary, park in a safe location (off the road) and use while parked.

4. ACCIDENTS – INJURIES – SPILLS – NEAR MISSES

4.1. Accidents, injuries, spills or near misses must be reported to the NRDA Operations Supervisor as soon as practical. Required documentation will be managed by the NRDA Operations Supervisor with assistance by involved personnel. The NRDA Operations Supervisor will notify appropriate Incident Management Team personnel including the BP Safety Officer at the Incident Command Post in Houma.

5. TRAINING

5.1. Any member of a NRDA Field Team is required to have the following Safety Training.

- Required BP Safety Training
- HAZWOPER Certification
- PHI Helicopter Pre-Flight Safety Briefing

6. PERSONAL PROTECTIVE EQUIPMENT

6.1. Each NRDA Field Team Member is expected to utilize Personal Protective Equipment as appropriate for the activity being performed (refer to the Job Hazard Analysis incorporated within this document).

7. LEADERSHIP

7.1. While on an aircraft, boat or airboat, NRDA Team Members will follow pilot/co-pilot/captain/operators safety related instructions at all times. The NRDA Operations Supervisor is responsible for directing team activities and will help decide if safety issues preclude scheduled activities. All team members are responsible for individual and collective safety.

8. JOB HAZARD ANALYSIS (see following pages)

- Shore Operations
- Small Boat / Air Boat Operations
- Helicopter Operations

TASK	NRDA Shore Survey Operations
LOCATION	Various locations of affected areas
DATE PREPARED	5/8/2010 New [X] Revised [ ]

PERFORMED BY	Caleb T. King (Coast Guard - Safety)
REVIEWED BY	Lisa DiPinto (NOAA - NRDA Coordinator)
PPE REQUIREMENTS	Personal Flotation Device (PFD) Safety Glasses or Goggles *(tinted as necessary)* Tyvek Coveralls and Boot Covering Nitrile Gloves

Issue of Concern / Activity	Potential Hazards	Control Measures
Entering / Departing Boat	Wet surfaces, change in stability	Watch where you step; use available handrails; assistance by others.
Walking Shore	Heat Stress	Stay hydrated and take breaks. Monitor each other. Know symptom of heat stress and how do address them.
	Sun Burn	Apply sunscreen to exposed skin. Wear a hat with a brim to shade face.
	Insect Bites / Stings	Use mosquito repellant; and maintain Sting Swabs in First Aid Kit.
	Eye strain (sun light)	Wear tinted eyewear.
	Animals (snakes, alligators, and other non-domestic types)	Careful placement of feet and hands; No open toed shoes.
	Fall Into Water	Wear Personal Flotation Device when 10-feet or closer to water.
	Loss of Communication	Establish and maintain communications with ICP Houma, other vessels, and never separate NRDA workers from vessel where communications cannot be maintained.
	Working alone	Maintain buddy system at all times, personnel should not work alone
Activity where Personal Contamination is Anticipated	Hand contamination and/or other exposed skin as well as clothing	Wear Tyvek (or similar) boot covering and coveralls; Nitrile gloves; Safety Glasses or Goggles depending on liquid splash potential.
Use of Tools	Cuts / Scrapes	Use tools as designed and refrain from over-exerting shovel tips where loss of control could happen.

TASK	Small Boat / Air Boat Operations				PERFORMED BY	Caleb T. King (Coast Guard - Safety)
LOCATION	Various locations of affected areas				REVIEWED BY	Lisa DiPinto (NOAA - NRDA Coordinator)
DATE PREPARED	5/8/2010	New	X	Revised	PPE REQUIREMENTS	Personal Flotation Device (PFD) Safety Glasses or Sun Glasses Hearing Protection

Issue of Concern / Activity	Potential Hazards	Control Measures
Entering / Departing Boat	Wet surfaces, change in stability	Watch where you step; use available handrails; assistance by others.
Vessel in Transit	Fall Overboard	Personal Flotation Device.
	Collision, Allision, or Grounding	Follow Navigational Rules of the Road; Maintain awareness; Know location; Maintain Communications.
	Overloading Vessel	Distribute weight evenly and do not exceed vessel capacity plate.
	Mechanical Issues	Keep spare parts, tools, etc. onboard and always know your fuel levels.
	Airborne Particulates and Insects	Wear safety glasses, sun glasses, or prescription glasses.
	Heat Stress	Stay hydrated and take breaks. Monitor each other. Know symptom of heat stress and how do address them.
	Sun Burn	Apply sunscreen to exposed skin. Wear a hat with a brim to shade face.
	Pinch Points	Maintain control of doors/hatches; Keep fingers and feet clear of lines/ropes
	Noise	Double hearing protection must be worn onboard air boats.

NRDA Field Sampler Data Management Protocol

7-5-2010

MS Canyon 252 (Deepwater Horizon) Oil Spill

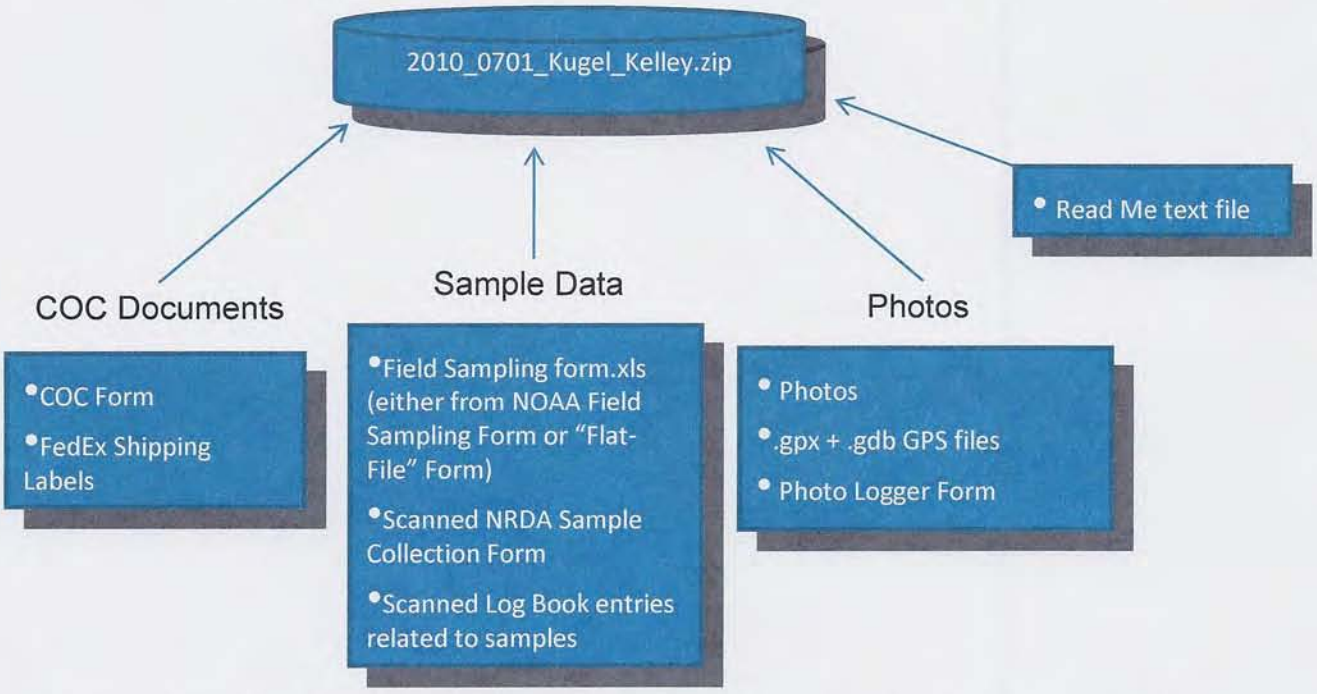
NOTE: THESE INSTRUCTIONS REPLACE ALL PREVIOUS INSTRUCTIONS.

These instructions update the protocol for preparing field sample records and uploading field sampling data into NOAA's NRDA FTP site and match the sampling forms version 16.2.1 updated in July 2010. NRDA samples submitted for chemistry must comply with the documentation requirements set forth in the NOAA field sampling form documentation and outlined below. Samples that do not meet these requirements will not be processed by the laboratory. Individuals who submit samples that do not comply with documentation requirements will be instructed on proper procedures and be given the opportunity to correct any deficiencies; however, this will delay data acquisition. This system was developed with both legal and scientific considerations. Prior to undertaking any sampling, please familiarize yourself with all of the required data elements on the forms relevant to your effort. These documentation requirements are relevant to all work groups, with the exception of the sub-surface multi-depth water sampling conducted on research cruises, which is subject to its own documentation requirements (see Cruise Data Protocol document).

A daily webinar and Q&A session for field samplers (Monday through Friday at 4pm CDT) goes through the contents of this protocol. Please join the webinar if you are new to NRDA Field Sampling or if you have questions about field sampling protocol. The number to call in to the webinar is [redacted] and the webinar is presented at [redacted]

NRDA Sample Data Requirements

This graphic presents an overview of all of the required data that must be within a Field Sampling zip file that is posted on the NRDA FTP website in order to be considered complete:



To gain access to the NRDA FTP site, email [redacted]. All information and forms are located in the Home/Trustees Private Communications/Sample_Data/ directory, hereafter shortened to "//Sample_Data". Each component of this zip file is discussed below.

Field Sample Documentation

The NRDA Field Sample Forms are located in the NRDA FTP site under [redacted]

When a sample is collected for chemical analysis, the following documentation is required and must be provided in order for the samples to be accepted for analysis:

- **Sample collection information**: **All** fields on the applicable NRDA Sample Collection Form (Oil-Tarball-Water, Soil-Sediment, or Tissue-Wrack) must be filled out, with the exception of those fields noted below. There are three options to record this required information:
  a. Use the matrix-specific NRDA Sample Collection Forms;
  b. Record **all** the required information on paper (e.g, other form, log book); or
  c. Record **all** the required information directly into a spreadsheet.
- **NRDA Chain of Custody (CoC) Form**: Complete all fields in the COC form with the exception of the fields noted below. NOTE: Written documentation must be in the NRDA format for this project.
- **Field log books:** If a log book is used, either the log book must be submitted for scanning or appropriate scanned pages must be delivered with the samples. Originals may be demanded in the future; they must be kept by your agency or turned in to the SIC or other NOAA representative.

All data fields on the forms are to be ***completely*** filled out. Exceptions to the data field requirements are very limited:

- NRDA CoC form
  - Analyses Requested (if uncertain, select "As per sample plan" in picklist)
  - Lab Name (if unknown, please write "Lab")
  - Waybill Number (Laboratory will fill in if coolers are sealed prior to obtaining waybill number)
  - Turn Around Time
- NRDA Sample Collection Forms
  - Resource Group Leader (Preferred, but not legally required)
  - Chain of Custody Field CoC information (Only if an intermediary delivers samples from sample site to SIC)
  - Notes sections (The notes sections are not mandatory; however samplers are encouraged to use these sections to provide additional detail.

Pre-Field Sampling Protocol

I. Before going into the field for the first time, the NRDA field sampler should attend at least one daily webinar and read the Field Form User Guide. This explains the official NOAA NRDA field sampling form. [redacted]

II. Before going into the field *each day*, the NRDA field samplers should generally complete two tasks.

1. Print necessary field sampling forms from the NRDA FTP [redacted]

2. Determine your NRDA Sampling Grid Location Code

Near-Shore/Land Sampling:
a. Choose the index map for the state in which you will be sampling. [redacted]

b. Find the sampling grid map corresponding to the specific area in which you will be working. [redacted]

c. Use the sampling grid map to find the grid in which you will be working. The codes are noted in the center of each cell.

Water-Based Sampling:
Given the extent of the Gulf activities, for open water-based sampling please use the following convention:
- GU (for Gulf of Mexico) or EC (for East Coast, east of the Florida Keys)
- Degree Latitude
- Degree Longitude

For example, in the Gulf of Mexico sampling location 27.30 North and -88.30 West code would be GU2788.

Sample Collection Information Options

With every chemistry sampling event, the information on both the matrix-specific NRDA Sample Collection Forms and the NRDA Chain of Custody Form must be collected. For legal defensibility, original copies of all documents must be retained. Individual agencies may choose to retain custody of these documents (field forms, log books) and provide only electronic copies to NOAA; in this case, the individual agency is responsible for providing the material in the event of a discovery request. Alternatively, the original documents may be signed over to NOAA and its contractors, and will be retained in secure document storage.

Some sampling teams may find it convenient or necessary to use formats besides the NRDA Sampling Collection Form to capture this information. There are three options to record this information. If you do multiple days of sampling, you need to fill out one electronic field form per day and submit one zip file per sampling day.

1. ***Use the NRDA Sample Collection Form for the specific matrix you are working with*** (strongly recommended option). The three NRDA Sample Collection Forms are:
   - Oil/Tarball/Water (use separate forms to track water versus oil/tarball)
   - Tissue/Wrack
   - Soil/Sediment

   The completed original NRDA Sample Collection Form is turned in with the samples when using a Sample Intake Center (SIC). If the sampling team is not using a SIC, the data from this form are entered electronically into either the MS Excel-based Field Sample Workbook or Flat File forms and uploaded to the ftp site. Copies of the hand-written form must be scanned and uploaded to the ftp site with the data spreadsheet. Originals may be retained by individual agencies or submitted in hard-copy via a traceable carrier (e.g. U.S. registered mail, FedEx, UPS or similar) to the NRDA document manager:

   NRDA Document Manager

   [redacted]

2. ***Use a form other than the NRDA Sample Collection Form for recording the required information.*** The information can be recorded on another form or in a field log book. It is imperative that **all** required fields from the NRDA Sample Collection Form be recorded (see above requirements). When using a form other than the NRDA Sample Collection Form, the original form or field log book must be turned into the SIC. If the sampling team is not using a SIC, the data from the form or field log book are entered electronically into either the MS Excel-based Field Sample Workbook or Flat File forms and uploaded to the ftp site. Copies of the hand-written form must be scanned and uploaded to the ftp site with the data spreadsheet. Originals may be retained by individual agencies or submitted in hard-copy to the NRDA document manager (see address above).

3. ***Use a computer to input the information directly into a spreadsheet.*** The required information from the NRDA Sample Collection Form can be recorded directly into a computer provided the following steps are followed:
   a. The computer file is recorded on a CD/DVD (non-rewritable) at the end of each field day.
   b. The following is recorded on the CD/DVD label:
      i. Name of person entering data into the computer system
      ii. Date of sample collection/data input
      iii. Make and serial number of the computer
      iv. Software used and version number
   c. A NRDA Chain of Custody is completed for transfer of the CD/DVD
   d. The zip file contained on the CD/DVD is uploaded to the FTP.

   The original file is kept on the computer system until it is verified that the CD/DVD recorded properly. This CD/DVD is turned in with the samples if using a SIC. If the sampling team is not using a SIC, this CD/DVD must be sent to the NRDA document manager under chain of custody (i.e., with a CoC form and using a secure carrier such as FedEx).

If you have questions or need assistance with the workbook please first look for the answer in the User Guide, then try to attend the daily webinar. If you cannot attend the webinar, you may call the field sampling form/COC **helpline number at** [redacted]. If you have any general questions regarding the forms, please send them to the NRDA Gmail address [redacted]

Regardless of which sampling spreadsheet you choose, make a copy, and rename it using the following naming convention. The date is the **date sampled** (if multiple sampling days, use the last day of samples).

<<YYYY>>_<<MMDD>>_<<LAST NAME>>_<<FIRST_NAME>>.xls

For example:
2010_0701_SMITH_JOHN.xls

Scanning Field Form Documents

Scans of all paper forms used in the field and any log book entries must be included in the zip file. All sample intake centers have scanners.

Chain of Custody (COC) Forms and Mailing Labels

Please scan your ***signed*** COC forms and mailing labels. Note that the NOAA Spreadsheet will create a custom COC form based on your inputs. NOAA NRDA samples require the use of the NOAA NRDA COC.

Photos and GPS

Photos are taken in the field for two primary reasons: to validate the field sampling effort and to provide a visual description of field conditions and operations. The GPS is required to geo-locate the photos to a particular time and place for legal reasons. Samples will be accepted without photo documentation, but any submitted photos must follow the NRDA documentation requirements.

Pre-Field Photo/GPS Protocol

I. Read through the field photo validation documents located on the NRDA FTP which include: NRDA Field Photography Guidance, Basic GPS Skills and Garmin MapSource [redacted]

II. Make sure digital camera has charged batteries, is set to a high resolution, and uses JPEG file format (not RAW).

III. Set the camera to local time and date; the time should be in 24h military time.

IV. Have a back up of all past information, and clear camera and GPS before each sampling day.

V. Set the GPS to Datum - WGS 1984, 24h military time with the correct time and date, set the track log to "wrap when full", and make sure the GPS is set in decimal degrees. The batteries for the GPS should also be fully charged.

Field Photo and GPS Protocol

I. Turn on your GPS. Leave it on for the entire sampling day.

II. Take one photo of your GPS screen which displays the time (including seconds) and date clearly. Make sure the GPS screen is clear in the photo. This will be used with the GPS track log to geo-locate the photos.

III. Take photos of the field samples and sampling effort. Remember, for legal reasons, do not delete or rename photos.

Post-Field Photo and GPS Protocol

I. Download your photos from that day's sampling only. Place them in a folder called Photos to be included in the zip file. Do not open, delete or rename any of the photos. If you wish to view your photos, you may download them again to your own personal folder and view them. Sample Intake Centers can also upload your photos.

II. Download the GPS Track Log and way points using Garmin MapSource. Save the points twice from MapSource: once as a Garmin Database file (.gdb) and once as a GPS exchange file (.gpx). If you have other non-Garmin GPS/latitude longitude information, please provide GPS locations in a format (e.g., excel) that links the photo name with its coordinates. If the field locations are staffed with members of the data management team, they can assist you with this process.

III. Fill out the NRDA Photo Logger form (required). Without the form, the data management team will not be able to log your photos.

[redacted]

Uploading the Complete Zip File to the NRDA FTP

Creating the Zip File

All of the files that need to be included in the Zip file before it is uploaded to the FTP are outlined in the diagram on page 1. Include a Read Me text file if you have any comments about your data.

Naming the Zip File

Naming the ZIP correctly will greatly speed up the processing of the sampling information. When bundling and uploading the ZIP file, please use the following naming convention, where the date is the date sampled:
<<YYYY>>_<<MMDD>>_<<LAST NAME>>_<<FIRST_NAME>>

For example:
2010_0505_SMITH_JOHN.zip

Uploading Sample Information and Notifying Data Management

All information should be uploaded in the same zip file only when the data requirements are complete.

To upload the ZIP file, go to the FTP site at: [redacted]

Navigate to the respective sampling day's folder: //Sample_Data/<<YYYY>>_<<MMDD>>

Browse for your ZIP file and click upload. Note that the FTP site currently has a limit of 1 GB *per file.* If you have ZIP files that are larger than 1 GB, please split the file and label appropriately. Please do not scan documents at a resolution higher than 300 DPI. This will help keep file size down.

*******IMPORTANT*******

Once you have uploaded the ZIP file to the FTP site, you must alert the data management staff. Please send an email to the Gmail account [redacted] as notification. Specifically, please use the following subject heading: SAMPLE TO FTP <<YYYY>>_<<MMDD>>_<<LAST NAME>>_<<FIRST_NAME>> For example: SAMPLE TO FTP 2010_0505_SMITH_JOHN

Once again, thank you very much for following these procedures. Assistance from all sampling teams will improve efficiency and reduce our need to call you back for missing information.

ENTRIX	M/V Jack Fitz NRDA Cruise 3	CSA

Water Column Profiling Services to Measure Dissolved-Phase Aromatic Hydrocarbons and Free Oil Droplets as a Function of Depth and Location Relative to the Subsurface Oil Release

GOM BLOCK

MISSISSIPPI CANYON 252

PROJECT HSE PLAN

ENTRIX Corporation

CSA International, Inc. (CSA)

REVISION STATUS			APPROVAL		
Rev	**Date**	**Reason for Issue**	**Originator**	**Reviewed**	**Approved**
A	4-May-2010	Issued for Comment	L. Powell		
B	7-May-2010	Changed vessel	F. Ayer		
C	7-May-2010	Changed HSE Manager	F. Ayer		
D	14-June-2010	Format revision/additions	L. Powell		

Dist:	**Subject**	**HSE Management**
As per page 2	**Activity:**	**Project HSE Plan**
	Location:	**GOM Block MC252**

		Location	Disc	Document Type	Sequence No	Rev
	Doc. No.					**4**

PARTY APPROVAL FOR USE IN OPERATIONS

Bureau Veritas Stephen C. Donham, CIH HSE Manager	CSA Lynwood Powell HSE Manager

3.5.6 Medivac Plan

Should a medical emergency require the immediate evacuation of a person or persons from the survey vessel, the vessel should immediately head toward the nearest shore facility. The Coast Guard should be contacted immediately on VHF channel 16. The Coast Guard air station is located approximately 13 miles south of New Orleans in Belle Chasse, La

Any applicable client transport coordinators or helicopter dispatchers should be contacted by either satellite phone or cellular telephone for assistance with the emergency. They will arrange helicopter evacuation of the injured person(s) from the platform or shore facility to the nearest emergency medical facility. If medical treatment is needed for a non-life threatening situation, the vessel should head to the nearest shore facility from which the injured person(s) can then travel to the nearest medical facility to obtain necessary medical treatment.

The arrangements listed in this document shall apply to the Emergency Response Procedures for the period that the vessel is contracted for the purpose of completing the survey.

Emergency contact numbers for communications during emergency situations are provided below.

Vessel Emergency Contact Numbers

Vessel No 1.	[redacted]
Master	
Satellite Phone	
Vessel Call Sign	
Vessel Manager	

Vessel No 2	
Master	
Bridge	
Vessel Call Sign	
Vessel Manager	

Vessel No. 3	
Master	
Bridge	
Vessel Call Sign	
Vessel Manager	

Vessel No. 4	
Master	
Bridge	
Vessel Call Sign	
Vessel Manager	

Vessel No 5	
Master	
Bridge	
Vessel Call Sign	
Vessel Manager	

Vessel No 6	
Representative	
Bridge	
Vessel Call Sign	
Party Chief/Vessel Manager	

Vessel No 7.	
Master	
Satellite Phone	
Vessel Call Sign	
Vessel Manager	

CSA Emergency Contact Numbers

CSA	
Satellite Phone-OnBoard Vessel	
Fred Ayer, CSA Project Manager	
Gordon Stevens, CSA Operations	
Lynwood Powell, HSE Manager	

ENTRIX Emergency Contact Numbers

ENTRIX	
Ryan Holem, HSE Manager	

4.0 FIRST AID/MEDICAL SURVEILLANCE PROGRAM

CSA and ENTRIX personnel are all properly trained in cardio-pulmonary resuscitation (CPR) and first aid. Training allows CSA / ENTRIX personnel to give immediate and temporary care to a victim of an accident or sudden illness until a physician can be obtained.

In accordance with 29 CFR 1910.120 a medical surveillance plan is in effect for ENTRIX field employees who have the potential for encountering hazardous materials during the course of their duties. The plan is administered, and records maintained, by the HSE Corporate office. In accordance with 29 CFR 1910.120 (f) the employee/contractors involved with this project have been examined by a physician trained in occupational medicine, for the purpose of determining fitness with respect to working with hazardous materials and wearing personal protective equipment including respirator protection. The results of the examination indicate these employees/contractors are physically capable and qualified to work under conditions described herein.

5.0 SUBSTANCE ABUSE PROGRAM

CSA is committed to maintaining a drug-free workplace. In recognition of the dangers to our employees and the company of drug abuse in the workplace, and pursuant to the provisions of the U.S. Drug-Free Workplace Act of 1988 and Federal Acquisition Regulation 23.504, all employees are subject to the following:

- Unlawfully manufacturing, distributing, dispensing, possessing, or using a controlled substance is prohibited in the workplace.
- Any employee who unlawfully manufactures, distributes, dispenses, possesses or uses a controlled substance in the workplace will be subject to discipline up to and including dismissal.
- All employees, as a condition of continued employment, must abide by the statement and are required to notify the company of any criminal drug statute conviction for a violation occurring in the workplace no later than five days after such conviction.
- This Drug-Free Workplace Statement does not amend, limit, restrict, modify or otherwise alter any other company rules, regulations, procedures or policies.

CSA employees tested for substance abuse must meet the U.S. Department of Transportation (DOT) standards for drug and alcohol testing to be able to work as CSA's representatives on designated projects. The medical forms may be made available for the client's inspection with prior approval from the employee.

DOT regulations require screening for the following drugs (known as the NIDA 5 Panel):

- Marijuana;
- Barbiturates;
- Opiates;
- Amphetamines;
- PCP; and
- Cocaine.

6.0 PERSONAL PROTECTIVE EQUIPMENT SAFETY PROGRAM

The following outlines CSA policy pertaining to the issuance and use of certain personal protective equipment (PPE) that will be issued by CSA. Each employee will be responsible for ensuring his PPE is kept clean and in good working condition.

Protective gear for sampling personnel should include the following:

- a personal flotation device (PFD);
- a hard hat;
- steel-toe shoe/boots;
- work vest;
- equipment handling and chemical-resistant gloves (e.g., leather or Nitrile);
- safety glasses/goggles;
- respiratory protection;
- rain gear (if necessary);
- coldwater survival gear (if necessary); and
- hearing protection (if safe noise levels are exceeded).

In addition to the above PPE personnel deploying and retrieving equipment over the side of the vessel will be required to wear a safety harness and utilize a retractable lifeline securely connected to a point on the vessel.

It is important to note that the ship's captain has the ultimate responsibility and authority to immediately override the authority of all other on board personnel, especially where the general welfare of crew and vessel are concerned.

During the dockside mobilization, the Site Safety Coordinator will conduct an inventory of the safety-related equipment and materials and provide a report to the Project Scientist and Operation Manager of their status, location, and availability.

PFD. A Coast Guard approved personal flotation device (PFD) will be worn at all times while onboard any vessel and within 10 feet of the water while onshore.

Hard Hats.
Each employee will be expected to wear a hard hat at all times when working out on deck. These safety hats will meet the specifications contained in American National Standards Institute, Z89.1-1969, Safety Requirements for Industrial Head Protection.

Steel-toed Shoes/Boots.
Steel-toed shoes or boots will be required while outside of office area or on any work site, e.g., work deck.

Gloves – Work and Chemical.
Work gloves will be provided for handling of equipment and supplies to reduce the potential of hand injuries. Nitrile, rubber, gloves will be provided for the handling of all chemicals and solvents.

Safety Glasses/Goggles.
All employees will be issued and must wear approved safety glasses with side shields at all times while in the work area. Those employees who wear prescription glasses will wear safety glasses over their glasses. This also applies to those employees who wear contact lenses.

All employees will be issued and expected to wear 1) approved impact-type goggles with side shields when engaging in any activity that involves hazards to the unprotected eye from chipped or flying particles; and 2) approved splash proof goggles when they are handling hazardous chemical liquids, powders, or vapors as well as when they are in the vicinity of these chemicals.

Employees who wear prescription glasses will wear goggles over their glasses. This also applies to employees who wear contact lenses; these employees must make it apparent that they do wear contact lenses.

Respiratory Protection
Employees handling chemicals or solvents as part of their work duties are required to wear the appropriate respiratory protection in addition to gloves and goggles.

Protective Outerwear
An outerwear capable of protecting the employee from oily products will be worn during all sampling operations. A Tyvek or suitable alternative is required.

Rain gear
Rain gear is not provided for most offshore surveys. It is the responsibility of the employee to provide adequate protection when working outside of the confines of the vessel.

Cold water survival gear
Cold water survival gear will not be necessary for this survey due to the time of year and the location of the survey area.

Hearing protection
Hearing protection is mandatory in all designated high noise areas. Ear plugs and ear muffs will be provided.

During operations which require special equipment and outerwear, the previously mentioned mandatory equipment and requirements pertaining to the equipment may be voided or amended.

7.0 HEARING CONSERVATION PROGRAM

All employees will wear the appropriate hearing protection provided by CSA while in a high noise area (85 decibels [dBA] or above for an 8-hour time period). A sign will be posted in high noise areas.

The Site Safety Coordinator will ensure any employees working in a high noise area are wearing hearing protection.

CSA also urges its employees to use common sense in a "noisy environment." If it is necessary to shout to communicate, an area is considered a high noise area whether or not signs are posted.

8.0 LIFE SAVING EQUIPMENT

All personnel working or riding on the deck of a boat or barge, or when transferring between vessels or onto a platform, must wear a U.S. Coast Guard (USCG)-approved PFD with reflector tape strips. There will be one PFD for each employee. On-board personnel should familiarize themselves with the ship's man overboard procedures and the vessel's life saving equipment location.

9.0 MOB AND FIRE EMERGENCY PROCEDURES

9.1 Man Overboard

- Throw a ring buoy overboard as close to the person as possible.
- Notify the personnel on the bridge immediately; bridge records vessel position.
- Post a lookout to keep the person overboard in sight.
- Maneuver the vessel to pick up the person in the water.
- Crew member wearing a PFD attaches a safety line and stands by to jump into the water to assist the person overboard if necessary.
- If person is not immediately located, notify Coast Guard and other vessels in the area by radio telephone.
- Continue search until released by the Coast Guard.

9.2 Rules for Abandonment

- Review rules posted on vessel prior to vessel leaving dock.
- Take instructions from vessel's captain and proceed to pre-assigned station on the vessel.

9.3 Fire on Board

- Review rules posted on vessel prior to vessel leaving dock.
- When alarm sounds proceed to pre-assigned station on the vessel.
- Vessel's captain will instruct survey team members.

10.0 WATER SURVIVAL PLAN

All employees must become familiar with the use and operation of survival gear and emergency instructions posted on the vessel.

In case of vessel evacuation:

1. Put on a PFD and remove your safety hat.
2. Do not dive into the water but jump in feet first.
3. If swimming in rough water, turn your back to the wind or waves. Keep your head out of water and use a breast stroke.
4. If there is an oil or fuel fire on the water, swim UNDER the water. Before surfacing, use your hands to splash a breathing hole above your head. Close your eyes before surfacing, take a breath, and then resubmerge (feet first).
5. If there is oil and/or debris on the water surface, keep your head up and out of the water. Push the oil/debris away from you as you swim. Protect eyes, nose, and mouth.
6. If swimming in cold water, conserve body heat, and help to prevent hypothermia by minimizing movement.
7. Do not swim to rescuers – let them come to you.

CONSERVE YOUR ENERGY! YOUR SURVIVAL MAY DEPEND ON IT!

11.0 EQUIPMENT INSPECTION PROGRAM

CSA will insure the following equipment is aboard the vessel:

- Fire extinguishers;
- PFDs;
- Safety Harnesses;
- Retractable lifelines;
- Ear protectors;
- Hard hats;
- Safety glasses;
- Safety shoes;
- Organic vapor masks; and
- Protective gloves.

The above equipment shall be inspected daily prior to use for wear and tear and so noted by the designated CSA safety person in his Project Log. During daily inspections, emphasis will be put on equipment security (i.e., safely secured for rough seas), and equipment maintenance.

The safety person will be knowledgeable with U.S. 29 CFR 1926 (Subparts E, F, I, J, K, L, N, and O): Personal Protective and Life Saving Equipment; Fire Protection and Prevention; Tools (Hand/Power); Welding and Cutting; Electrical; Ladders and Scaffolding; Cranes, Derricks, Hoists, Elevators, and Conveyors; Motor Vehicles, Mechanized Equipment, and Marine Operations.

12.0 ELECTRICAL SAFETY PROGRAM

12.1 Installation and Maintenance of Electrical Equipment

All installation and maintenance of electrical equipment must comply with the pertinent provisions of the national electrical code. All electrical work will be performed by competent personnel who are familiar with code requirements and qualified for the class of work to be performed. All applicable electrical wire, apparatus, and equipment will be of a type approved by Underwriters Laboratories, Inc., Factory Mutual Engineering Corp., or any other nationally recognized testing laboratory.

12.2 Electrical Accident Prevention Procedures

The best qualified available employee will be appointed to be the electrical job supervisor. That person will have total responsibility for the electrical work.

Each job should be thoroughly planned, making sure that adequate and proper equipment and sufficient personnel are available to perform the job safely. No job is to be rushed to completion at the expense of safety.

A special safety meeting will be conducted before starting a job to brief all workers involved to make sure all questions are answered and that no confusion exists among the workers.

All possible circuits in the vicinity of the work area should be de-energized and secured in this condition by grounding, locking, and tagging. If it is not possible to de-energize all circuits, use barriers, rubber goods, or any other protective equipment necessary to make the work area safe. Danger signs will be displayed in appropriate locations and on associated equipment as required to afford maximum personnel protection.

Complete attention should be devoted to the job at hand. Preoccupation or day-dreaming cannot be tolerated while working with electrical equipment.

Even low voltage (e.g., 32 volts AC) as well as many battery-powered systems are hazardous and require proper precautions.

All unsafe electrical equipment should be de-energized immediately and tagged "unsafe for use." This action and also notification of inoperable or damaged electrical tools, appliances, etc., should be reported to the immediate supervisor at once. Unqualified persons should not attempt to repair such equipment.

Under no circumstances should the hand or finger be used to test for voltage in a circuit. Only proper and safe test instruments should be used.

In case of an accident or an electrical fire, all power should be cut off immediately. Emergency switches are generally installed at convenient locations to stop electrical machinery. Know where these switches are. Use only fire extinguishers which have been approved for use on an electrical fire. Foamite or other conductive fluids, including water, must not be used on an electrical fire under any circumstances.

Electrical work of any kind will not be performed if an electrical storm is in progress in the immediate vicinity.

Adverse conditions such as darkness, poor weather, isolation, or any abnormal situations may make working alone unduly hazardous. These occasions should be identified by established management guidelines from which the employee can carefully assess the task to be performed and determine whatever assistance might be necessary to perform the job safely. All electrical conductors and equipment will be approved and meet the standards in 29 CFR Subpart K covering the electrical equipment and work practices for this project (copy follows).

13.0 SPILL PREVENTIVE/CLEANUP PLAN

All personnel involved on a project should be aware of all possible polluting situations and take steps to prevent such occurrences.

CSA Operations Managers will insure the MARPOL rules and regulations are posted on the vessel and are followed by all members of the survey team.

Should a spill occur, the following will be available:

- Absorbent pads for use on local spills on vessel and, if necessary, small discharges into the water;
- Absorbent booms for installation around drums and apparatus that could cause a spill on vessel;
- Should portable generators/winches be used that involve fueling, a catchment tray will be provided to prevent gasoline/oil or other fluids from being spilled;
- Shore personnel to locate suitable disposal container close to dock for trash removal from vessel; and
- Trash bags and ties for general trash storage will be provided on vessel.

In case of large spills, the vessel is to cease operations, stay in the area and call in to the local client base, local Coast Guard, or other appropriate regulatory agency.

PICK UP ANY TRASH YOU SEE -- NOT JUST YOUR OWN.
AND REMEMBER NO TRASH/DEBRIS/WASTE/POLLUTANT IS TO BE DEPOSITED ANYWHERE BUT IN THE CORRECT RECEPTACLE.

14.0 SHORT-TERM EMPLOYEE PROGRAM

Any CSA employees that have been with the company less than six months will be identified as "Short-Term Employees" to all personnel including the client or its agent prior to start-up and mobilization of project.

Short-term employees will be given a job-specific orientation prior to the general job safety meeting dealing with the client's site safety expectations and procedures and hands-on training by CSA for upcoming job assignments.

Short-term employees will expect to be given special supervision during their 90-day probationary period with the orientation reinforced at the end of their first week's employment with CSA and at the end of their first month's employment. The employee will then be evaluated by their supervisor monthly for the next three months. It is implied here and to be understood by the short-term employee that he will be teamed with an experienced employee whenever possible. Under no circumstances will two short-term employees be teamed on a job without approval.

APPENDICES

APPENDIX A

HOSPITAL ROUTE MAP

APPENDIX B

HAZARDS ANALYSIS/RISK ASSESSMENT

HAZARDS ANALYSIS/RISK ASSESSMENT

Hazard	Consequences/Risk	Severity	Safeguard(s)/Control Measure(s)	Risk Matrix		Recommendations	Responsibility	Status
				Likelihood	Risk Rank			
Lifting accidents, dropped equipment	Injuries, damage to or loss of equipment/material	Major	Lifting procedures, lift plan, worker awareness, qualified/experienced personnel	Remote	B	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
Boarding/loading boats	Trips, falls, injuries, damage to or loss of equipment	Minor	Designated boarding/ loading areas and procedures, first aid, clear work procedures	Infrequent	A	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
Navigation and positioning control	Wrong locations, work delays, impact to work productivity	Moderate	Obtain latest nautical charts, set up and check CSA vessel GPS navigation during mobilization, prepare pre-plots, provide accurate locations, provide coordinates in a digital exchange file	Remote	B	Confirm accuracy of coordinates through backup GPS	Project Scientist	Open
Deployment/handling of sample collection equipment	Pinching injury, impact/crushing injury, entanglement, MOB	Moderate	Worker training, established procedures, work gloves, HSE briefing	Infrequent	B	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
Man overboard (MOB)	Loss of personnel	Major	PFDs, work deck rules, safety chain, MOB procedures	Infrequent	C	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
General health and safety (offshore/on water)	Heat exhaustion and overheating, exposure, dehydration, minor injuries	Moderate	Adequate drinking water available, sunscreen, light clothing, clear decks, designated work areas and clear work procedures, first aid	Infrequent	B	Review during HSE induction	Operations Supervisor	Open
Spillage of fuels, oils, and lubricants	Environmental degradation, regulatory fines, damage to reputation	Major	Refueling on land or in port only, adequate capacity for full-day operations	Infrequent	C	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
General health and safety (onshore)	Exposure, dehydration, minor injury	Moderate	Adequate shade, adequate drinking water available, sunscreen, light clothing, clear/designated work areas, clear work procedures, work breaks	Infrequent	B	Review during HSE induction	Operations Supervisor	Open
Road/driving accidents	Collisions, damage to vehicles or equipment, injury	Major	Use of licensed and experienced drivers, safe driving at posted speeds, seatbelts	Remote	B	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
Food-/water-/blood-borne pathogens	Debilitating illness, impacts to productivity	Moderate	Worker training, HSE briefing, emergency response plan	Infrequent	B	Review during HSE induction	Operations Supervisor	Open

Hazard	Consequences/Risk	Severity	Safeguard(s)/Control Measure(s)	Risk Matrix		Recommendations	Responsibility	Status
				Likelihood	Risk Rank			
Unsafe weather/sea state conditions	Damage to vessels	Major	Weather forecast reviews, continuous monitoring of local weather, ongoing communications, delay/cancel/abort weather thresholds	Remote	B	Conduct continuous monitoring of weather while on site, morning forecast reviews and postpone mobilization if predicted to exceed limitations	Operations Supervisor	Open
Rough sea conditions	Injuries, MOB, damage to or loss of equipment/materials	Moderate	Check for secure deck and equipment/materials before getting underway, use of PFDs	Infrequent	B	Cross check for clear deck prior to getting underway	Operations Supervisor	Open
Vessel mechanical failure or damage	Loss of vessel, vessel adrift, stranded divers	Major	Rigorous vessel maintenance and inspection, standby vessel, float plan, established communications	Remote	B	Ensure valid vessel inspections, pre-day vessel checklists	Vessel Master	Open
Unsafe deck conditions (e.g., wet, cluttered)	Slips, trips, falls, MOB, damage to equipment	Major	Clear decks, designated work areas, clear work procedures, emergency response plan	Frequent	D	Review procedures and PPE requirements in toolbox meeting prior to activity; install safety line across stern	Vessel Master	Open
Underwater obstructions, contact with bottom, grounding	Damage to seabed features/organisms, damage to boats/ equipment, injuries	Major	Review of nautical charts, mapping of navigation hazards, experienced boat operators	Remote	B	Review transit route for obstructions, shallow water	Vessel Master	Open
Other vessel/traffic shipping	Collisions	Major	Deck watch	Remote	B	Review of shipping patterns, contact any vessels in vicinity	Vessel Master	Open
Medical emergencies (injured/unconscious worker), limited timely medical access/support	Lack of/late medical attention leading to medical complications, possibly disablement/ fatality	Major	Emergency procedures for worker extraction, established communications to shore, standby vessel, local emergency support, emergency response plan, emergency oxygen on-board, comprehensive first aid equipment	Remote	B	Prior arrangements with Port/ambulance, advice to Navy and/or Coast Guard; post-emergency contact infomation readily available on all vessels/boats	Operations Supervisor	Open
Emergency preparedness	Inadequate response to emergencies	Minor	Conduct weekly drills, HSE inspection to review emergency systems	Infrequent	A	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
Confined Space Entry	Loss of consciousness, fatality, impact to work productivity	Major	Real-time air monitoring, forced air ventilation, full body harness, rescue tri-pod	Remote	B	Review procedures in toolbox meeting prior to activity	Site Safety Officer	Open

APPENDIX C

MSDS FOR PROJECT CHEMICALS

Liquinox

Alconox

Methylene Chloride

Acetone

Hexane

Isopropyl Alcohol

Phenol

COREXIT EC9500A (Oil Dispersant)

COREXIT EC9527A (Oil Dispersant)

COREXIT EC9580A (Shoreline Cleaner)

APPENDIX D

FORMS

Pre-Mobilization Safety Briefing

HSE Indoctrination Record

Job Safety Hazard Analysis

Hazard Analysis/Risk Assessment Acknowledgement

Daily Safety Meeting

Incident/Accident Notification

Next of Kin Information

Daily Survey Report

Management of Change Order

CSA INTERNATIONAL, INC.
PRE-MOBILIZATION SAFETY BRIEFING (PMSB)

A PMSB will be conducted by the CSA Site Safety Coordinator

The following is a summary of items to be discussed:

1) Description of project and goals
   - Sediment & Water collection, hydrographic profiler casts, ADCP, ROV Ops
2) Communications – key to acquiring goals
   - Accident prevention - safe and healthy environment
3) Team members, assignments, and shifts
   - CSA, ENTRIX, and vessel crew
4) Coordination with boat driver/vessel's crew
   - Efficient procedures
   - Emergencies - medical, fire, man overboard (MOB), abandon ship
5) Designation of person in charge on deck
   - Shift leader
6) Complexity of the operations
   - Mobilization, Field, Demobilization
   - Collection Processes
7) Pre-operation checks
   - Vessel preparation
   - Location of vessel safety equipment
8) Safety equipment
   - Vessel
   - Sampling
   - First-aid
9) Hazards
   - Vessel operations
   - Sampling operations
   - Vessel and equipment: slips, trips, falls, bumps, pinching;
10) Limitations of personnel and equipment
    - Lifting, rigging, and safe working loads
    - Personal protective equipment
11) Environmental conditions
    - Wind, sea state, etc.

The PMSB/HSE induction for all personnel involved with the field activities will be conducted prior to vessel mobilization. Daily briefings will be conducted for survey personnel. All vessel crew members will be briefed on the operation of all primary and support equipment and primary sampling equipment (especially the winch, blocks, cable, and A-frame) prior to mobilization. It is the responsibility of the survey team members to ensure that proper rigging and lifting procedures are used. The vessels' Masters will be responsible for conducting the following drills: MOB, fire, abandon ship, and medical emergency. These drills will be conducted once before the survey begins and weekly thereafter.

CSA INTERNATIONAL, INC.

HEALTH, SAFETY, AND ENVIRONMENTAL INDOCTRINATION RECORD

Name:

Date:

Employer:

I have received indoctrination and training for following:

1. Company safety policies of CSA, ENTRIX, and vessel safety requirements and the names of persons assigned to safety supervision duties.
2. Requirements and my individual responsibilities for accident prevention, maintaining a safe and healthy work environment, preventing damage to property, and protecting safety of others.
3. Provisions for medical facilities and procedures for reporting or correcting unsafe conditions and practices, and reporting accidents.
4. Job hazards and means used to control or eliminate those hazards, including applicable "Job Safety Analyses (JSA)" (major activity, locations, hazards, controls).
5. Accident Reporting - Both my individual and my Supervisor's responsibilities for reporting all accidents, even minor.
6. Sanitation - Water, toilet facilities.
7. Medical Facilities - Location of nearest medical emergency facilities, emergency phone numbers, first-aid kits and material data safety sheets.
8. Emergency Plans – man overboard, fire, medical, severe weather, spill response, and other emergency procedures.
9. Personal protective equipment.
10. Daily housekeeping requirements.
11. Fire prevention.
12. Policy on use of ropes, slings, and chains.

13. Hazards of floor and wall openings.
14. Hearing protection.
15. Requirements when working around hot substances.
16. Precautions with welding, cutting, and grounding of machinery.
17. Temporary electrical requirements.
18. Proper use of hand tools and power tools.
19. Proper precautions with compressed gas cylinders.
20. Requirements for ramps, runways, platforms, and scaffolds.
21. Clear access and ladder safety.
22. Material handling, storage, and disposal.
23. Hazardous materials.
24. If I am injured I (do) (do not) want the following person notified:

Name:

Phone:

Signature: _____ Date _____

Safety Officer Signature: _____ Date _____

CSA INTERNATIONAL, INC.

JOB SAFETY HAZARD ANALYSIS FORM

JOB TITLE:	JSHA No.____	Page___of___	DATE: New___ Revised___
Employer: Facility: Location:	Classification(s) Doing Job: Supervisor:	Required /Recommended Personal Protective Equipment:	Analysis by: Reviewed by: Approved by:

Sequence of Basic Job Steps	Potential Hazards	Recommended Action or Procedure

CSA INTERNATIONAL, INC.

HAZARDS ANALYSIS/RISK ASSESSMENT ACKNOWLEDGEMENT

My supervisor has reviewed this hazard analysis with me, and I understand the hazards and required precautionary actions. I will follow the requirements of this hazard analysis or notify my supervisor if I am unable to do so. I understand that there are Environmental, Safety, and Health professionals on staff if I need further assistance or clarification.

Name (please print)	Signature	Date

CSA INTERNATIONAL, INC.

DAILY SAFETY MEETING FORM

DATE:_____

PROJECT TITLE:_____

CONDUCTED BY:_____

IN ATTENDANCE: **Print Name** **Sign Name**

_____

_____

_____

_____

_____

_____

SUBJECT(S) DISCUSSED: **Potential Safety Hazards and Resolutions**

_____

_____

_____

_____

_____

_____

INCIDENT/ACCIDENT NOTIFICATION FORM Directions for filling out form

Email within 24 hrs to – Lynwood Powell, CSA Stuart Office – [redacted]

Originators Reference No: *Number assigned by project/asset as in its incident summary*		
Date of Incident:	**Time:**	**Exact Location:** **Location of the incident/Project Group**
Name of Person(s) involved: *Injured party, any other people involved*		
Employing Company: *Injured party and all people involved*		
Type of Incident: *LTI, Near Miss, RWC, Medical Treatment, etc.*		
Initial Potential Consequence: *Assign initial potential consequence as per The Risk Assessment Matrix*		
Description of Incident:	Where, when, what, how, who, operation in progress at the time (only factual)	
Provide details of the incident including: - *timing,* - *order of events,* - *Personnel involved their position, company, etc.* - *their role in the incident,* - *any relevant information available at the time of reporting* - *medical/emergency response details* - *any other important information*		

Immediate Action:	Immediate remedial action and actions to prevent reoccurrence or escalation
In this section provide only immediate remedial actions (corrective) and actions TO PREVENT REOCCURRENCE. Do not include medical response into this section	
Remedial Actions: *Provide long term remedial actions (if identified at the stage of reporting). For the incidents requiring further investigation do not include remedial actions. Those will have to be reported as a part of a final investigation report*	

Name: **Title:** **Date:**

Signature:

CSA International, Inc.

INCIDENT NOTIFICATION FORM

E-mail/Fax within 24 hrs to – Lynwood Powell, CSA Stuart Office – [redacted]

Originators Reference No:		**Project/Asset Group:**
Date of Incident:	**Time:**	**Exact Location**:
Client/Employing Company:		
Type of Incident:		
Initial Potential Consequence:		
Description of Incident: Where, when, what, how, who, and the operation in progress at the time (only factual).		
Immediate Action: Immediate remedial action and actions to prevent reoccurrence or escalation.		
Remedial Actions:		

Name: **Title:** **Date:**

Signature:

CSA International, Inc.

NEXT-OF-KIN INFORMATION

Person	Name	Relationship	Phone

CSA INTERNATIONAL, INC.
DAILY SURVEY REPORT

Client: ENTRIX
Project: Water Column Profiling Survey
Location: GOM; MC Block 252
Job Number: CSA-2290
Date:

Vessel:
Client Rep:
Current location:
Satellite Phone #:
Onboard Email:

Weather Report
Wind speed/dir:
Wave height:
General:

PERSONNEL ON BOARD

CSA	*Client*	*Vessel*

CSA INTERNATIONAL, INC.
Daily Survey Report (*Cont'd*)

SAMPLE SUMMARY

Total Stations:		Total Stations:	
# Complete:	0	# Complete:	0
% Complete:	0.00%	% Complete:	0.00%

DAILY ACTIVITIES LOG

Time	*Description*

SUMMARY OF PROJECT TIME

Operation	*today*	*previous total*	*Total*
Mob/Demob			0
Operations			0
Standby Weather			0
Standby Other			0
Standby in Port			0
Standby Client			0
Technical Downtime			0
Vessel Downtime			0
Maintenance Time			0
TOTAL	0	0	**0**

CSA INTERNATIONAL, INC.
Daily Survey Report (*Cont'd*)

PLANNED ACTIVITY FOR NEXT 24 HOURS

ACCIDENTS/INCIDENTS

HAZARDS REPORTS

AUDITS COMPLETED

SIGHTINGS OF/INTERACTIONS WITH FISHERMEN

EMERGENCY DRILLS
COMPLETED

HSE ISSUES/CONCERNS

MARINE MAMMAL/SEA TURTLE SIGHTINGS

CURRENT ESTIMATE OF COMPLETION DATE

CSA INTERNATIONAL, INC.
Daily Survey Report (*Cont'd*)

MONTHLY EVENTS

Event	*Quantity*
Number of Fatalities	
Number of Lost Time Injuries	
Number of Restricted Work Injuries	
Number of Medial Treatment Injuries	
Number of First Aid Injuries	
Number of Fires and Explosions	
Number Incidents involving Equipment Damage	
Number of Near Misses	
Number of Spills (to sea or land)	
Number of Security Incidents	
Number of hazard reports /STOP cards or safety observations	
Number of incidents involving stakeholder complaints	
Amount of waste generated, categorized by type. (monthly only)	
Amount of fuel oil / diesel used	

At the completion of the survey a report on injury absences and details of ongoing HSE Programs/Initiatives will be completed.

CSA INTERNATIONAL, INC.

Management of Change Order

Date:

To:

Subject:

Comments:

Project Change	Reason for Change

Approved by:

CSA Project Manager

_____

Client Representative

_____

APPENDIX E

OFFSHORE HEAT STRESS MANAGEMENT PLAN

[place document for Appendix E here]

APPENDIX F

Recommended Decontamination and Air Monitoring Plan for Research Vessels

07.14.10 M/V Bunny Bordelon

700 HSE w/ Woody Powell + ops

715 MOBE to 300-009 to obtain NE/SW fence array to suspected bot trigger malfunction

730 @ station 300-009
coll. D-1 TOP

802 col D-2
v. spotty lt. sheen

825 cast 1 drop to 60'

835 (D3) 100m trip 2/liner (D4) (D5) (D6) langyard

840 Trip 1x20L Bot @ 75m (246')

857 bot 3 3rd langyard for bot

913 trip 1x 20L + 1x10L bot @ 24m (80' bot 4+5 2 top langyards -D6

948 ROV on deck All bottles opened mobe to 030-009

955 300-018 989 m Z

1045 (D1) @ sta 300-18 take surf
1052 (D2) water spls (clean last sta)
1115 Depth 989 m from NOAA DB.
1135 cls to station tough w/o bow thrusters

07.14.10 M/V BB

1242 cast 2 300-018
miner flour pack 100m to 70m

1253 stop ROV 297m 1 dr (974')

1300 stop ROV 592 m (1944')
DO min ~400m

1315 stop @ bot 980m (3216')

1318 (D3) trip 2x5L bot @ 977m (3208')

1350 (D4) stop @ 100m (328') Trip 2x20L

1357 (D5) stop @ 36m trip 1x10L

1400 ROV on deck
call Jodi Horney + mobe to new location 030-009.

1630 030-009
28° 48' 37.847" = 28.810513 08630
-88° 19' 26.973" = -88.324 159 18110

1645 (D1) at station collect surf water

1658 (D2) cast 1 15m dd not open
cls D2 bring a deck trip again

1719 Fluor max 75m-80m
DO min ~450m seen before
Fl max small 1113m does not appear to be sig.

GulfofMexicoSPU

bp

MC-252 Incident
SIMOPS Plan

2	5/15/2010	Final – Issued for Use	Geir Karlsen	Houston IC
2	5/10/2010	Issued for Comments	Geir Karlsen	Houston IC
2	5/7/2010	Issued for Comments	Geir Karlsen	Houston IC
1	4/29/2010	Final – Issued for Use	Geir Karlsen	Houston Incident Commander
0	4/28/2010	Final – Issued for Comments	Geir Karlsen	Houston Incident Commander
Rev	**Date**	**Document Status**	**Custodian/Owner**	**Authority**

Document	Organization ID	Sector ID	Discipline ID	Document Class	Sequence Number	Document Revision
Control Number	2200	T2	DO	PN	4001	2

AMENDMENT RECORD

Revision Number	Amender Initials	Date	Amendment
A	G. Karlsen	April 24, 2010	Initial draft.
B	K. Mouton	April 25,2010	Edits
C	G. Karlsen	April 27, 2010	Comments incorporated.
0	G. Karlsen	April 28, 2010	Comments incorporated, issued for use. Clarified and added comment to Section 1.3: Clarified section and added comment "Source Control SIMOPS Director covers an area of appr. 1,000-m from site". Added Sections 6.9 on Aviation and Section 6.10 on Helicopter Refueling. Added section 1.8 (HazID of operating in contaminated waters and added HazID documents. Updated contact details and general cleanup of doc. Added doc. number from Doc. Control.
1	G. Karlsen	April 29, 2010	Removed 1000-m radius circle from map Fig. 9 and updated with debris field.
2	G. Karlsen	May 15, 2010	Revised doc. to take into account the Discoverer Enterprise over the cofferdam with Thunder Horse light intervention riser and Massachusetts barge aft end and the Q4000 top kill operations to the ESE of the well. Updated maps, riser location and debris map, field arrival procedures, issued standby areas, safe zone for Discoverer Enterprise riser deployment, updated org. chart, coms. plan, frequency management plan, SIMOPS HazID action items list and contact details. Added section 1.5 on VOC and LEL levels. Added section 6.6 on fire fighting vessels. Added coms. chart fig. 4. Added Fig. 9 Discoverer Enterprise and Q4000 escape routes. General corrections and clarifications. Updated Figure 1 with contact details. Added Section 1.4 VOC and LEL Environment. Updated Table 3 Acoustic Allocations. Updated Table 4 Fan Beam Heights. Expanded and clarified Section 4.1.1 Planned SIMOPS Activities. Added contact details to Figure 3. Updated Figure 9. SIMOPS Coordinator chairs the daily SIMOPS call ref. 2.5. Added Well Specific Operating Guidelines to take into consideration VOC and LEL levels. Removed section on Management of Change. The process is not in use (ref. Neil Cramond). May 10: Removed Well Specific Operating Criteria for Air Quality. Document was a DRAFT only document that had not been approved for use by TOI or BP drilling groups. May 15: Updated maps. Added Figure 12 through **Figure 16** WSOC for operating in elevated LEL and VOC environment. Updated HazID action items. Added coms. guideline Figure 4. Added Section 4.2.1 Fire and Emergency Drill.

REVIEWER SIGN-OFF			
	Name	**Signature (PLEASE PRINT)**	**Date**
Custodian/Owner	Geir Karlsen		
Reviewer (s)	BP Marine Assurance Rep		
	BP Houston IMT Operations		
	BP Wells Rep		
	BP (IMT) Safety Officer		
	BP (IMT) Source Control Operations		
	USCG Houston		
Authorizer (s)	BP Discoverer Enterprise Lead		
	BP DD II Team Leader		
	BP DD III Team Leader		
	BP Q4000 Team Leader		
	BP GoM Marine Authority		
	Transocean Incident Commander		
	BP Incident Commander		
	BP On-Scene Commander		

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FIGURES

TABLES

1 Introduction

1.1 SIMOPS Plan Objectives

The goal of the MC-252 Incident Simultaneous Operations (SIMOPS) Plan is safe and efficient execution of the SIMOPS between all marine assets deployed in support of the spill and source control operations. It excludes shrimping, fishing and vessels of opportunity. Air support is run as a separate entity, is shown in the SIMOPS organization chart (ref. Figure 1, page 9) and is managed through the Houma Air Command.

The following assets are being utilized:

- Transocean Offshore Inc.
  - Development Driller II (DDII) semisubmersible drilling rig.
  - Development Driller III (DDIII) semisubmersible drilling rig.
  - Discoverer Enterprise (DEN) drillship and riser leak recovery vessel.
- Helix Q4000 semisubmersible for top kill operation.
- HOS Strong Line and HOS Centerline shuttle tankers for top kill operation.
- BOA Sub-C construction support vessel.
- Ocean Intervention 3 and Ocean Intervention 1 (OI3 and OI1) ROV and construction support vessel.
- Skandi Neptune ROV and construction support vessel.
- Viking Poseidon ROV and construction support vessel.
- C-Express ROV support vessel.
- Iron Horse ROV support vessel.
- Wild Well Control fire fighting, water cannon and dispersant vessel(s).
- ROV construction and work boats of opportunity.
- Harvey Gulf Thunder tug for Discoverer Enterprise support.
- Tankers, barges, AHVs and tug boats of opportunity.
- BP Logistics and Aviation (PHI, Chouest, Tidewater, VIH, Cougar, Graham Gulf)
- Marine Spill Response Corp (MSRC).
- National Response Corp (NRC).
- Airborne Services Inc (ASI).
- USCG.
- US Navy.

The plan seeks to:

- Inform all members of the SIMOPS principles required for conducting safe and efficient simultaneous operations.
- Identify the SIMOPS hierarchy and priorities for the major scopes of work between Spill Recovery, Well Control Operations, Source Vessel Operations, Relief Well Drilling, Flow Back and Top Kill operations.
- Outline high-level procedural steps complimented by the detailed processes, procedures and plans (3P) issued by the respective groups. The 3P's are issued and reviewed in conjunction with Hazard Identification (HazID) assessments or planning meetings just prior to the SIMOPS event.

Concurrent operations onboard the assets described above are NOT covered or included in the SIMOPS Plan unless these activities affect other activities at site.

1.2 What Does Success Look Like?

Success is defined as zero SIMOPS clashes, zero SIMOPS impact to schedules and zero SIMOPS incidents.

Getting to zero is only possible by keeping strict discipline by all stakeholders, adhering to all elements of the plan and keeping open communications between groups and vessels.

Vessels and groups MUST NOT assume that other players or adjacent vessels are informed of upcoming operations and vessel movements.

Remember: "Good SIMOPS is all in the communications."

1.3 The SIMOPS Team

SIMOPS Director – Overall responsibility for coordinating the execution of SIMOPS events. The SIMOPS Director resides in Houston (see Section 1.3.1, page 9).

Offshore Spill Operations SIMOPS Branch Director – Overall responsibility for coordinating the execution of Spill SIMOPS events. Position resides onboard Louisiana Responder.

Offshore Source Vessel Control SIMOPS Branch Director – Overall responsibility for coordinating the execution of Source Vessel Control SIMOPS events. Position resides offshore onboard the DD III or the Discoverer Enterprise. The Branch Director generally controls the areas inside the rigs 500-m zones and an area of appr. 1,000-m from the MC-252 well site. See **Figure 7**, page 37.

BP Logistics – Overall responsibility for providing vessel and air support to the project. Group resides in Houston.

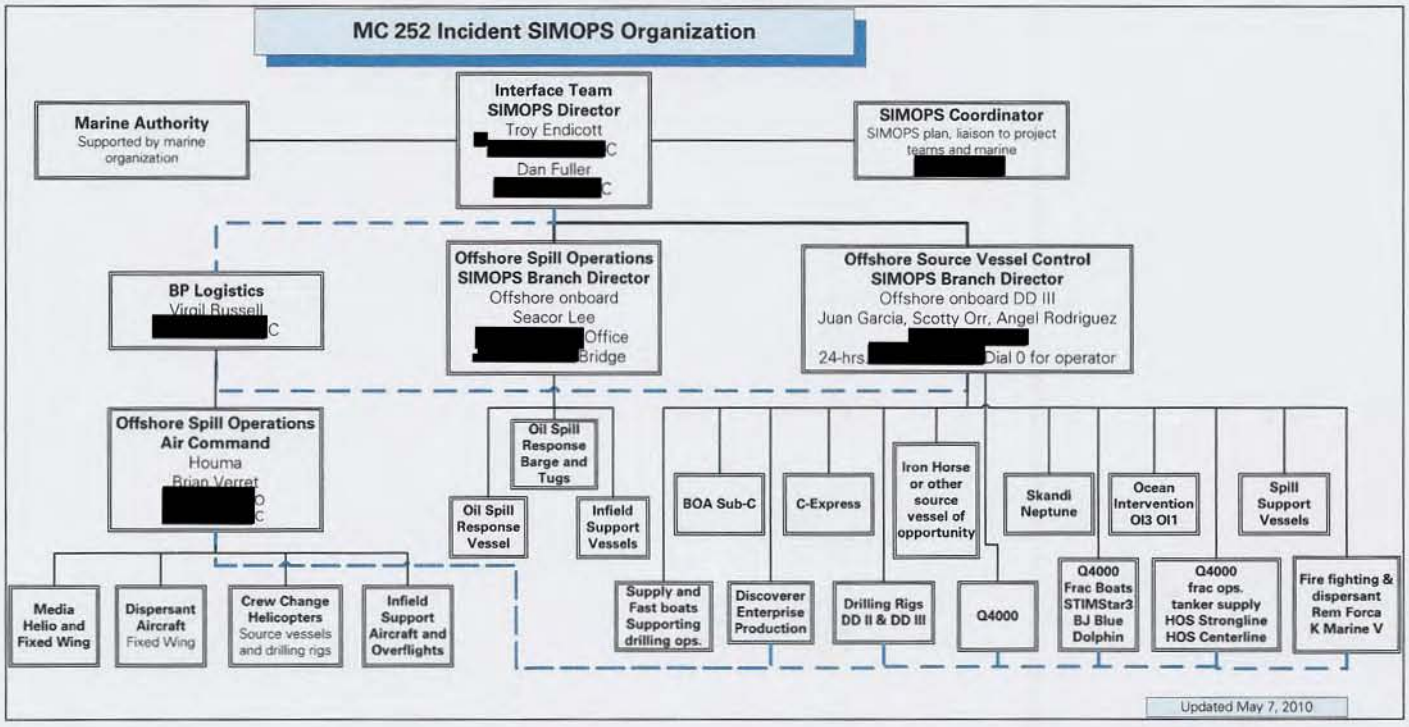
Offshore Spill Operations Air command – Overall responsibility for coordinating and scheduling all aircrafts including fixed wing, crew change helicopters, dispersant deployments, over flights, recons and spotter planes. Position resides in Houma.

Vessel Person in Charge (VPIC) – Is the BP Vessel Rep. onboard. Can also be the OIM or the Well Site Leader. The VPIC is responsible for all Health, Safety, Security and Spill (HSSE) incidents. All incidents will be reported using the Notification scheme contained within the plan.

SIMOPS Coordinator – Is the Houston liaison between the offshore operations and the SIMOPS team. The position chairs the daily SIMOPS calls.

Note: Any person involved in a SIMOPS event has the authority and obligation to discontinue and shut down the SIMOPS event in the case of safety or operational concerns.

Figure 1: SIMOPS Organization



SIMOPS events will be coordinated through daily SIMOPS call as per Section 2.5, page 14 and through the Offshore Source Vessel Control SIMOPS Branch Director.

1.3.1 Onshore SIMOPS Director Responsibility

- Be the overall coordinator of SIMOPS activities at MC-252 Incident.
- Ensure SIMOPS events comply with HSSE guidelines.
- Identify need of SIMOPS HazIDs and SIMOPS reviews prior to a SIMOPS event.
- Assess potential schedule impact and associated risks from upcoming SIMOPS events.
- Liaison and resolve SIMOPS issues, scheduling and technical conflicts with Houston leadership.
- Identify critical path and determine which operation has priority.
- Assess risks of single and multiple operations and SIMOPS events.

- Facilitate and resolves any SIMOPS conflicts with the teams.
- Coordinates and resolves SIMOPS issues between the DD II, DD III, Discoverer Enterprise. Q4000, Marine Activities and Aviation.

1.3.2 Offshore Vessel Source Control SIMOPS Branch Director Responsibility

- Be the overall coordinator of the execution of SIMOPS activities in the fleet of source vessels.
- Area of responsibility is in the Macondo well area and the debris field out to appr. 1,000-m from site.
- Direct vessels as per the daily operating plan.
- Identify resource needs.
- Liaison with the source vessels.
- Ensure vessel activities comply with HSSE guidelines.
- Assess potential schedule impact and associated risks and convey to the SIMOPS Director.

1.3.3 Offshore Spill Operations SIMOPS Branch Director Responsibility

- Be the overall coordinator of the execution of SIMOPS activities in the spill clean up operation.
- Direct vessels as per the daily operating plan.
- Identify resource needs.
- Liaison with the vessels in the cleanup fleet.
- Ensure spill cleanup SIMOPS events comply with HSSE guidelines.
- Assess potential schedule impact and associated risks and convey to the SIMOPS Director.
- Work with vessel Captain on all SIMOPS and HSSE.

1.3.4 Vessel Representative (Vessel Person In Charge – VPIC)

Source control vessels and possibly some of the spill cleanup vessels will have a BP vessel representative onboard. The DDII, the DD III and the Discoverer Enterprise will have an additional Well Site Leader dedicated to SIMOPS coordination. The vessel representative's responsibility is to:

- Implement specific programs concerning ROV, salvage, search and clean-up.
- Ensure HSSE and safety guidelines are followed onboard the vessel and in vessel ops.
- Provide guidance for the specific operation.
- Comply with operating procedures and applicable MC-252 Incident SIMOPS requirements.
- Work with vessel OIM or Captain on SIMOPS issues.
- Call-in on the daily SIMOPS call.

1.3.5 SIMOPS Coordinator

The SIMOPS Coordinator is assigned to the SIMOPS and the Marine Team to support the organization on all field SIMOPS matters. The position is a liaison between the SIMOPS team and the groups working projects and well control solutions. The position resides onshore.

The SIMOPS coordinator's responsibilities are:

- Leads the daily SIMOPS call.
- Assists in conflict resolutions.
- Work with the project teams to ensure SIMOPS issues are understood and can be integrated into the plan.
- Assist the Incident SIMOPS Director in implementing the SIMOPS Plan.

1.4 VOC and LEL Environment

The HSSE group has issued recommendations for maximum exposure and recommended actions should vessels and rigs be exposed to hydrocarbon fumes. The VOC and LEL levels are summarized in Table 1, page 12 and give guidance on maximum exposure levels and recommended actions. Further information is found in "Mississippi Canyon 252 Offshore Air Monitoring Plan for Source Control and Skimming Operations."

The document "Mississippi Canyon 252 Offshore Air Monitoring Plan for Source Control and Skimming Operations" must be available to all crew members and be fully understood.

The firefighting vessels Rem Forza, K Marine V are dedicated to firefighting and fume suppression. The Adriatic and HOS Super H are dedicated to fume suppression only. The vessels must be used to the fullest extent. Having them on standby while ships and rigs are exposed to sheen and fumes is not an option. The vessel priorities will be worked through the Offshore Source Control SIMOPS Director onboard the DD III.

WSOC (Well Specific Operating Criteria) for air quality for the DD II, DD III, Discoverer Enterprise, Q4000, construction and support vessels are shown in Figure 12, page 47 through **Figure 16**, page 53. The figures address what actions the vessels have to take at elevated VOC and LEL levels.

Table 1: Action Levels For Elevated VOC and LEL Levels

OIM Air Monitoring Plan Summary/Posting

Chemical	Action Level	Monitoring Condition	Recommended Action
Volatile Organic Compounds (VOC)	50 ppm	Continuous levels for > 15 minutes	• Deploy Fire Watch Vessels to control VOCs
	100 ppm	Continuous levels for > 15 minutes	• Increase airflow with portable industrial fans • Non-essential personnel should relocate to an area of lower concentration (i.e., move to different location on the vessel or move to the living quarters or galley) • Don respirators as necessary to continue working in the area • Re-orient vessel into wind • Deploy fire watch vessels
Benzene	0.5 ppm	At least 3 samples over a period of 15 minutes	
Hydrogen Sulfide (H_2S)	5 ppm	Continuous levels for > 15 minutes	
Carbon monoxide	25 ppm	Continuous levels for > 15 minutes	
Flammable, %LEL	10%	Continuous levels confirmed by 2 or more monitors for 15 minutes	• Initiate action appropriate to the activity set in accordance with Well Specific Operating Guidelines in MC252 Source Control Simops Procedures
Flammable, %LEL	40%	Instantaneous reading confirmed by 2 or more monitors	• Move off location

Contact IMT Industrial Hygiene at [redacted] if you have questions 5/10/2010

1.5 HazID Assessing Operations in a Contaminated Environment

Each major operation will have an appropriate HazID conducted prior to execution of the operation. Moving ROV and construction support vessels in the field does not require a HazID. Vessel movements are coordinated by the Offshore SIMOPS Source Vessel Coordinator. The updated HazID action items are found in Figure 9, page 41 through Figure 11, page 45. Action items are closed out prior to executing the associated operation.

2 Field Communications and Emergencies

2.1 Crisis Management

The Gulf of Mexico Deepwater Development (GoM DWD) Emergency Response Plan Guidelines are initiated should any emergency occur during a SIMOPS event. The SIMOPS event will be terminated or postponed until the emergency is cleared.

Any emergency onboard the Discoverer Enterprise, the DD II, the DDIII, the Q4000 and associated ROV and construction vessels will be reported immediately to the other vessels and the Offshore SIMOPS Branch Director to ensure necessary precautions can be taken.

2.2 Severe Weather Contingency Plan

See GoM IMS Vol. III – Severe Weather Contingency Plan (see References in Section 7, page 55).

The Crisis Center at WL-4 handles the management of severe weather planning and gives field evacuation guidance.

2.3 Emergency Evacuation Plan

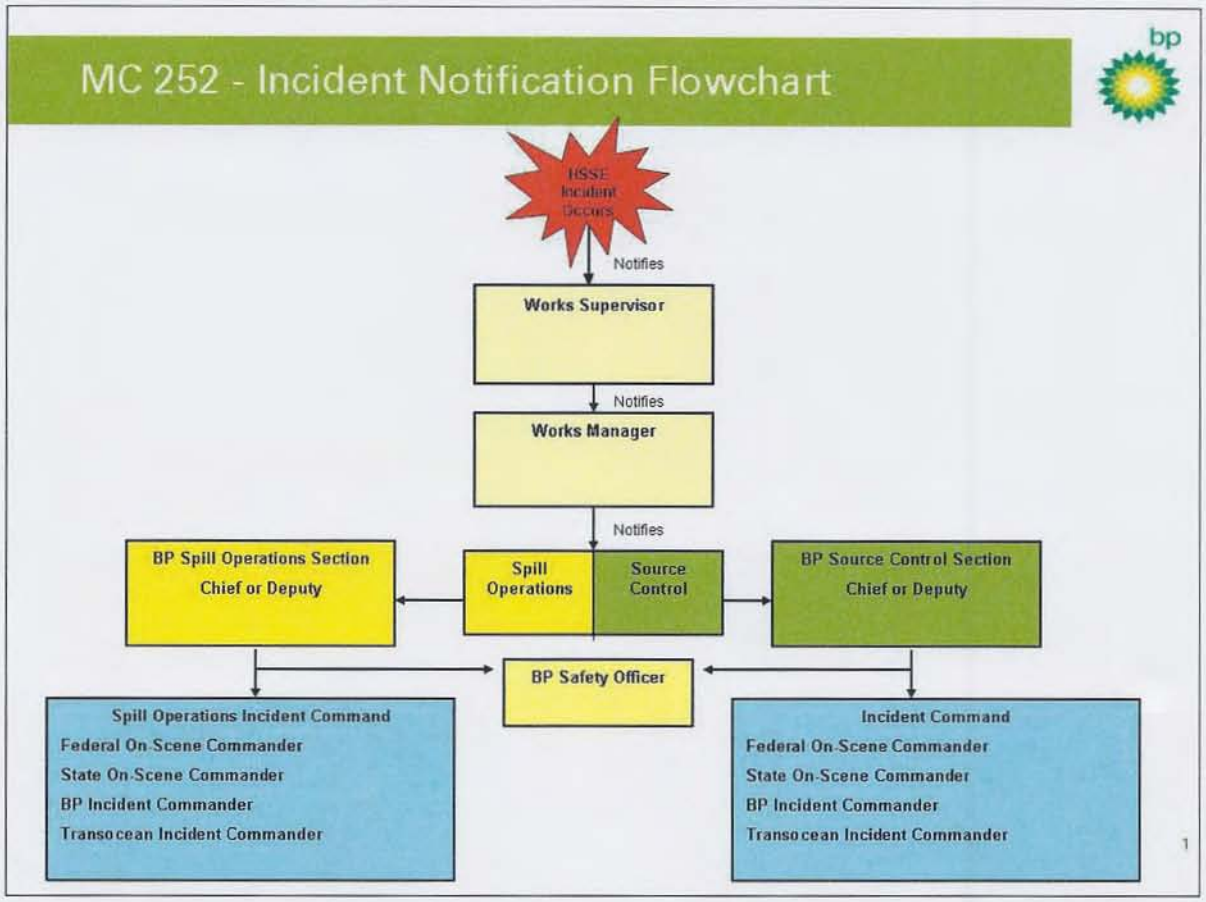
See GoM DWD Emergency Evacuation Plan (see References in Section 7, page 55).

2.4 Incident Notification

The Incident Notification Chart shown in Figure 3, page 14 is the main routing of incident notifications on the project.

It is recognized, however, that the MC-252 Incident operation is complex and that there is a possibility of incidents being reported through different channels.

Figure 2: Incident Notification Chart



2.5 Daily SIMOPS Conference Call

The Houston based SIMOPS Coordinator chairs the SIMOPS conference call. The call is held twice daily at **0830-hrs**. and at **2030-hrs**.

The following groups and personnel call in to the SIMOPS call:

1. SIMOPS Source Vessel Director onboard DD III.
2. SIMOPS Cleanup Vessel Director onboard lead cleanup vessel.
3. Each source control vessel (ROV and construction support vessels).
4. Houma IC.
5. Houston IC.
6. Houston Source Control Section lead.
7. Houston Ops. Section Lead.

8. Discoverer Enterprise, DD II, DD III, Q4000 (OIM or Captain).
9. DDII and DD III Well Site Leader (SIMOPS rep.).
10. BP vessel rep. and Captain on source control vessel(s) performing SIMOPS at site.
11. Impact Weather and Horizon Marine (only if met-ocean conditions dictate).
12. Shore-based personnel as required
13. USCG as required.

Work boats, fast boats and cleanup vessels are not required to participate.

The purpose of the daily SIMOPS conference call is to:

- Provide daily SIMOPS support to all incident groups.
- Get the latest met-ocean and environmental updates.
- Ensure all project groups and activity centers are fully aware of ongoing and upcoming field activities and SIMOPS events.
- Review SIMOPS schedule issues.
- Review VHF and acoustics communication needs and clashing issues.
- Ensure the SIMOPS events are planned and executed according to the program with no impact to HSSE and minimum impact to other operations.
- Give a 24-hr. look-ahead.

Table 2 below shows the details of the conference call center.

Participants call the Toll-free or the Toll numbers and then the Pass-code to get into the conference call.

Table 2: Conference Call Center

Dial-In Numbers and Pass Codes	Toll-Free number from inside USA:	[redacted]
	Participant pass code:	

Each operation issues a daily SIMOPS report to the SIMOPS Director that is reviewed prior to the SIMOPS call. The report is a short synopsis of last 24-hours and the coming 24-hours utilizing Incident Action Plan (IAP).

The SIMOPS call agenda is:

- Met-ocean update (wind, waves and currents).
- Sheen, plume, VOC (volatile organic compound), LEL (lower explosive limit) and marine debris update.
- Vessel Summary
  - Lead spill clean-up vessel – Area of operation, sheen and plume update.
  - Discoverer Enterprise – Current operations, SIMOPS events, next activity, special issues.
  - DD III – Current operations, SIMOPS events, next activity, special issues.
  - DD II – Current operations, SIMOPS events, next activity, special issues.
  - ROV, Construction and Intervention vessels – Current operations, SIMOPS events, next activity, special issues.
  - Fire fighting vessels – Current operations, SIMOPS events, next activity, special issues.
  - Barge and tugs – Update on current operations and plans for next 24-hrs.

- SIMOPS issues, communications and VHF use.
- Scheduling, conflicts and concerns.
- Upcoming fire and emergency drills.

2.6 SIMOPS Communication Guideline

Well-planned and established communications are keys to the successful execution of the MC-252 Incident SIMOPS. The SIMOPS Branch Directors must communicate with the respective Vessel representatives / OIMs / Captains prior to the start of any SIMOPS activity and during the SIMOPS event as conditions require. Core field vessels are: DD II, DD III, Discoverer Enterprise and Q4000.

Remember: "Good SIMOPS is all in the communications."

2.7 Field Communications

2.7.1 Hailing Channel

Vessels approaching the field will hail according to the communications plan shown in Figure 4, page 31. Channel selection, following the initial hailing is agreed upon with the respective installation. The table is a guideline and lists the agreed VHF and UHF channels. It is anticipated that radio noise and high usage may require selection of other channels at times.

Radio use and frequency selection will be part of the daily SIMOPS call.

2.7.2 Radio

Vessels and aircraft, under contract to BP, are equipped with BP radios in addition to the contractor's communication equipment.

Operators of vessels involved in SIMOPS activities must agree upon *primary* and *secondary* radio communication frequencies prior to the start of any SIMOPS activity.

Note: Conduct radio check and confirm operability prior to start of any SIMOPS event.

2.7.3 Emergency Communications

For emergency response communication procedures and contact information, reference the "GoM DWD Emergency Response Plan" (see Section 7, page 55).

3 Acoustic Frequency Management and Position Referencing

The Acoustic Frequency Management Plan is summarized, page 18. The plan is continuously being updated based on vessel arrivals, departures and requirements.

Please note the following:

1. It is essential that all vessels with dual head HiPAP systems configure the system to track all transponders from a single head (all transponders tracked from the same head).
2. There is absolutely no selection of HiPAP or wide band channels not shown in Table 3, page 18.

3.1 Enabling and Disabling of Transponders and Responders

The Dynamic Positioning Operator (DPO) onboard the DD II, the DD III, the Discoverer Enterprise and the Q4000 are responsible for the management and safe use of the acoustic frequencies in the field.

No acoustics will be turned on or off without the concurrence of the DPOs onboard the DDII, the DD III, Discoverer Enterprise and the Q4000.

Warning:	**Do not change allocated acoustic channels without the concurrence of the DD II, the DD III, Discoverer Enterprise and the Q4000 DPOs. The main requirement of the Acoustic Management Plan is to prevent frequency clashing and risk interference or loss of acoustic position referencing for the core fleet of vessels.**

Note that any noise issues degrading the acoustic position reference system *MUST* be reported to the OIM and the Well Site Leader. Under no circumstances should the acoustic system be disabled because of degraded signal to noise ratio. The acoustic system may be taken out of solution if degraded while fixing the problem. Disabling the acoustic system will bring the vessel from DP Class II to a DP Class I.

Table 3: MC-252 Acoustic Allocation Summary

DP		ROV System		DO NOT USE
DD II DP	b41 DP b42 DP b43 DP b45 DP b46 DP b67 DP LIC	DD II	b24 Tracking b64 Tracking b84 Tracking	b12 b13 b15 b17 b21 b23 b25 b26
DD III DP	b31 DP b32 DP b35 DP b37 DP b73 DP b76 DP LIC	DD III	b28 Tracking b48 Tracking b68 Tracking	b51 b52 b53 b57 b61 b62 b63 b65 b71 b72 b75 b81 b82 b83 b85 b86
Discoverer Enterprise DP array: Sonardyne wideband Family 14, CIS. 00 Ch. 1409, 1410, 1411, 1412, 1413				
BOA SUB C	b18 Tracking b38 Tracking b58 Tracking b78 Tracking	IRON HORSE	b27 Tracking b47 Tracking b87 Tracking	
VIKING POSEIDON	b16 Tracking b36 Tracking b56 Tracking	SKANDI NEPTUNE	b14 Tracking b34 Tracking b54 Tracking b74 Tracking	
OI-3	**Wideband Family 12 (see below)** Address 1201, CIS 1 ROV 1 Address 1202, CIS 2 ROV 1 Cage Address 1203, CIS 3 ROV 2 Address 1204, CIS 7 ROV 2 Cage	**Acoustic frequency management plan summary**		
C-Express	**Wideband Family 15 (see below)** Address 1512, CIS 4 ROV Address 1513, CIS 5 ROV Backup Address 1514, CIS 6 ROV TMS			
CIS = Common Interrogation Signal				
Q4000 DP array: Sonardyne wideband Family 4, CIS 08. Ch. 405, 406, 407, 408 Q4000 Wideband Sub Minis 4113, 3706, 3308. Interrogate on tone CIF, reply on IRS 913, 506, and 108 Coffer Dam Inclinometer Compatts set to address 313 and 401, CIS 09 via ROVNAV Pressure monitoring Compatts set to address 301, 302 and 303, CIS 09 via ROVNAV Riser Monitoring Compatt set to address 307, CIS 09 via ROVNAV				
Field Wide LBL Array: Sonardyne Wideband Family 13				

The acoustic allocations for all construction vessels are found in Figure 10, page 34, Figure 11, page 35 and Figure 12, page 35.

It is imperative that the plan is adhered to and that there are no changes without preapproval.

The DD II and DD III ROV channels may be utilized by others if not required by the DD II or DD III operation.

3.2 Safe Distance

The Frequency Management Plan assumes there is no safe distance where acoustics will not interfere, especially with the short distance between vessels. The plan produced a set of compatible channel allocations and guidelines that will allow each vessel to operate freely without concern as to the effect on other vessels nearby.

3.3 Echo Sounder Turnoff

Any vessels entering the MC-252 Incident area must turn off the echo sounders within 5-nm of arriving in the MC-252 Incident field. This is to ensure echo sounders do not create noise in the water column and interfere acoustically with any of the vessels using acoustic communications. Do not turn on echo sounders until the vessel is outside this 5-nm limit.

Caution:	**Compliance with the echo sounder turnoff while in the MC-252 Incident field is mandatory.**

It is the responsibility of each MC-252 Incident group contracting vessels, the Logistics Group and the Fourchon Base to notify and inform the MC-252 Incident vessels of the Echo Sounder turnoff requirements.

3.4 Acoustic Frequency Coordination

3.4.1 Coordination of Acoustic Activities

All information, regarding the coordination of the MC-252 Incident Acoustic Frequency Management Plan, is directed to the respective rig's Team Leader, Jonathan Davis, Ian Dootson and Geir Karlsen (see phone list for contact details).

3.5 Acoustic Equipment Use Notifications

Source vessels will work in close proximity to the Discoverer Enterprise and the DD III. These vessels must follow the Frequency Management Plan and the acoustic guidelines before enabling acoustic equipment.

3.5.1 Acoustic Field Operations

For acoustic operations at MC-252 Incident, vessels will inform the DDII, the DD III, Discoverer Enterprise and the Q4000 Bridge of arrival in the field. The following must take place prior to commencement of acoustic operations:

- Confirm field arrival and departure.
- Confirm all frequencies in use by the vessels in the field (see Table 3, page 18) showing frequency allocations.

- Confirm pre-approved acoustic channel allocations for the upcoming operation.
- Advise core vessels of minimum proximity requirements.
- Advise core vessel DPOs when channels are enabled and disabled.
- Advise core vessel DPOs of source vessel channel selections.
- Be prepared to immediately disable acoustic channels in case of degradation of the core vessels acoustic position reference systems.
- Core vessels to advise of degradation from added acoustics in the water column.

Caution:	**No vessel shall deploy transponders without first contacting the DD II, DD III, Discoverer Enterprise and Q4000 DPO and receiving confirmation as to channels in use. Any vessels using acoustics will be in continuous communications concerning acoustic noise and frequency clashing.**

3.6 Fan Beam

Fan Beam is a position reference system used while vessels are in proximity. Workboats and supply boats, as well as vessels carrying out subsea construction, utilize Fan Beam. The system's maximum range is 2,000-m with an accuracy of ±10 cm during optimum conditions. The system uses a laser beam and is, therefore, weather sensitive. The practical range for Fan Beam is in the range of 200-m to 400-m.

The key to a successful operation of the Fan Beam position reference system is to ensure the system is maintained, fully operational and in Green status and that the Fan Beam is set up according to the manufacturer's specifications.

Particular attention is required to the system setup. The gating parameters must be set correctly to ensure the intended target is followed. This may have been a problem in the past. There are known instances where the laser beam has locked onto a moving object onboard the adjacent vessel. The moving object may have been someone in coveralls with reflective tape.

Note: Any vessel working the MC-252 Incident area and using Fan Beam as a relative position reference system, must confirm that the system is operational according to manufacturer's specifications before the system is allowed to be used to station keep off the DD II, DD III, Discoverer Enterprise, the Q4000 and the source vessels.

The Fan Beam User Guide v. 4.1 is listed as a reference in this document. *The user, however, shall always check with the manufacturer to ensure the correct and latest version of the user guide is utilized for setting up the Fan Beam systems on the particular vessel.*

Vessels have Fan Beam laser units installed at different heights. Adjustments may be required in the height of the prisms or reflector tubes installed on the adjacent vessel.

The vessel having prism or reflector tube installed should determine correct prism height and location based on communications with the respective user of Fan Beam systems. Table 4, page 21 lists the Fan Beam height for some vessels which may be used at MC-252 Incident. Fan Beam heights generally range from 45-ft. to above 100-ft. depending on the size and configuration of the vessel.

Table 4: Fan Beam Height

MC-252 Incident Vessels	Fan Beam Height Above Sea Level	MC-252 Incident Vessels	Fan Beam Height Above Sea Level	Ideal Reflector Height above Sea Level
Amy Chouest	40-ft.	C-Freedom (CyScan)	47-ft.	The reflector height is determined by the application and distance between vessels and is generally set at Fan Beam height -0 +17-ft.
BOA Deep-C	95-ft.	C-Hero	45-ft.	
BOA Sub-C (RADius)	105-ft.	C-Pacer	47-ft.	
C-Captain	45-ft.	Dante (CyScan)	65-ft.	
C-Carrier	45-ft.	Kobe Chouest	50-ft.	
Celena Chouest (CyScan)	54-ft.	L-Legacy	50-ft.	
C-Commander	45-ft.	OI1	56-ft.	
C-Courageous	42-ft.	OI3	72-ft.	
C-Enforcer	72-ft.	Pat Tilman	45-ft.	
C-Express	44-ft.	Skandi Neptune	75-ft.	
C-Fighter	52-ft.	Schlumberger DeepSTIM II	44-ft.	
		Viking Poseidon	82-ft.	

Table 5 below lists the MC-252 Incident vessels using Position Reference systems.

Table 5: Vessels using Position Reference Systems

MC-252 Incident Vessels	Available Position Reference System	Notes
Discoverer Enterprise	DGPS, Acoustics (Sonardyne wideband digital)	DP Class II+
DD III	DGPS, Acoustics (HiPAP)	DP Class II+
DD II	DGPS, Acoustics (HiPAP)	DP Class II+
Q4000	DGPS, Sonardyne wideband digital	DP Class II+
Source control vessels	DGPS, Fan Beam and RADius. Acoustics for tracking and surveying	DP Class I and II Some vessels may not have been assessed for DP class
Spill clean-up vessels		Not assessed for DP class

3.7 RADius Position Reference System

The RADius position reference system measures relative distance between two adjacent vessels using the Doppler principle. The adjacent vessel is equipped with RADius transponder(s). The system has a range of approximately 1,100-m and is not affected by activities onboard the adjacent vessel. A transponder system consisting of a small box is installed onboard the host vessel (i.e., DD II, DD III, Discoverer Enterprise. Q4000). The system requires a 120-volt power source. Range accuracy is 0.25-m.

Note: Any vessel, working the MC-252 Incident area and using RADius as a relative position reference system, must confirm that the system is operational according to manufacturer's specifications before the system is utilized.

4 SIMOPS Events

4.1 SIMOPS Events

The SIMOPS plan contains multiple events and interfaces between the DDII at relief well location RxD and DD III at relief well location RxC.

4.1.1 Planned SIMOPS Activities

Planned SIMOPS events covered by this plan are all operations within 5-nm of MC 252. **The major SIMOPS events are**:

1. DDII at relief well location RxD (see **Figure 6**, page 35).
2. DD III at relief well location RxC (see **Figure 6**, page 35).
3. Discoverer Enterprise at riser leak location gathering hydrocarbons from cofferdam, insertion tool, top hat, hot tap or other means (see **Figure 7**, page 37).
    a. Run riser in "safe zone" and move in to riser leak location.
    b. Massachusetts barge or tanker operation lightering off the Discoverer Enterprise.
    c. Skandi Neptune coiled tubing injection during flow back to Discoverer Enterprise and Q4000 top kill operation.
4. Q4000 semisubmersible top kill (see **Figure 7**, page 37).
    a. Two frac boats and supply tankers pumping at high rate.
    b. Source control vessel(s) with ROV monitoring during flow-back and top kill operation.
5. Riser hot tap operation.
6. Riser cutting operation.
7. LMRP removal operation.
8. LMRP and riser running operation.
9. Source control vessel activity inside the Discoverer Enterprise, DDII, DDIII and Q4000 500-m exclusion zones.
10. Spill cleanup vessel activity inside the Discoverer Enterprise, DDII, DDIII, Q4000 and source vessels 500-m exclusion zones.
11. Salvage operations and seabed recovery using source control vessels.

Notes:

1. **The Discoverer Enterprise may be over the riser leak location or over a hot tap location further away along the riser. This does not change the overall scope of work or the SIMOPS plan.**
2. **There is no requirement to develop a separate SIMOPS procedure for any of the MC-252 SIMOPS events.**
3. **This revision of the SIMOPS plan covers the planned SIMOPS events. The SIMOPS Plan may be revised should new project require major marine change to operations or vessel configurations.**
4. **Detailed project operating procedures specifically developed in conjunction with and referring to the MC-252 SIMOPS plan are required.**
5. **Operations are supported by associated HazIDs.**

Table 6: SIMOPS Preplanning General Checklist

Activity	Well Site Leader/PIC	OIM/Captain	DPO	SIMOPS Source Vessel Branch Director
Vessel within 500-m of DD II, DD III, Discoverer Enterprise and Q4000.	To be informed.	Approve.	Prepare most favorable heading. Ensure communications to vessel are as planned.	To be informed.
In close proximity to, alongside or equipment hooked up to DD II, DD III, Discoverer Enterprise and Q4000	To be informed.	Approve through Permit to Work (PTW) process.	Ensure communications to vessel are as planned.	To be informed.
Station-keeping alongside.	To be informed of changes in met-ocean conditions and any required heading change of DD II, DD III, Discoverer Enterprise and Q4000	To be informed of met-ocean conditions and any heading change of DD II, DD III, Discoverer Enterprise and Q4000	Works according to WSOC. Communicate with vessel in SIMOPS on all DP matters.	To be informed.
Fan Beam prism or reflective tube installation.	To be informed of station-keeping readiness.	To determine correct height based on vessel alongside.	Ensure fully operational	No action
Degradation in station-keeping ability of vessel(s).	To decide on further action together with OIM.	DPO to assess and decide on action according to WSOC.		To be informed.
SIMOPS with other ops.	To be informed.	To approve.	Requirements as above.	To approve

4.2 Emergencies during SIMOPS Events

Emergencies onboard one of the vessels involved in SIMOPS impact the ability to proceed with SIMOPS. The SIMOPS planning should specifically address emergencies during SIMOPS events, mitigations and restrictions associated with such emergencies.

Use the following guidelines to shut down or postpone the SIMOPS event, which may reduce the ability of personnel to respond effectively to an emergency:

- Sheen, plume or surface debris that could impact the SIMOPS event or result in elevated VOC and LEL levels above recommended limits (see Section 1.4, page 11).
- Any condition the OIM, Captain or the BP Well Site Leader determines to exist or develop and which would compromise safety of crews, equipment or vessels during the SIMOPS execution.
- Any event where acoustics communications are interfering with station-keeping of any vessel.
- Any fire requires vessels to suspend activities except those required to handle the event.
- Any hull emergency requires vessels to suspend activities except those that are required to handle the event.
- Any loss of firewater pumps requires vessel to suspend all activities at a secure point.
- Any loss of communication requires vessels to suspend all activities at a secure point.
- Any met-ocean event that could jeopardize station-keeping or operations during the SIMOPS event.
- Any event that takes a vessel out of readiness condition such as power, cooling and fuel systems, power management system, position reference systems and DP system.

4.2.1 Fire and Emergency Drills

Any fire and emergency drill must be communicated to the fleet should these be required during multiple vessel operations. Any upcoming drills should be discussed during the daily SIMOPS call to ensure adjacent vessels are fully aware of the upcoming drill.

4.3 SIMOPS Approval

The complexity of the SIMOPS activity determines the level of approval required for the work plan. Use the following procedure as a guideline:

- The SIMOPS Director has the overall responsibility for determining SIMOPS priorities and give necessary approvals following review with Branch Directors and Air Command.
- The SIMOPS Branch Directors approve SIMOPS events within their fleet after review with the SIMOPS Director and the respective vessels.
- The vessel OIM/Captain approves SIMOPS events associated with the respective vessel.
- The BP Well Site Leader or vessel rep. with input from the respective OIMs and Branch Directors determine the level of authority required to approve a safe work plan for a more complex activity inside the DD II, DD III, Discoverer Enterprise and Q4000 500-m zones.
- A SIMOPS event requires an associated marine HazID and close out of action items.

5 Dropped Objects Prevention

5.1 Drilling Vessels

Any dropped object is to be reported through regular channels. There are no infrastructure concerns at the respective well sites. There are a number of pipelines and wellheads in the area, so dropped object prevention must have the same focus as when working in any of BP's assets.

5.2 Source Vessels and Marine Clean-up Vessels

Any dropped object must be reported as per the Incident Notification Chart. The DD II, DD III, Discoverer Enterprise and Q4000 Bridge should be notified as well of any dropped object incident.

Caution:	**Vessels inside the MC-252 Incident field MUST promptly report a dropped object incident to the DD II, DD III, Discoverer Enterprise and Q4000 Bridge and the source control vessels.**

6 Area Vessel Control and Aviation

The key to vessel control is through good communications. The daily SIMOPS calls are the main venues to inform of upcoming vessel activities, requirements and conflicts.

6.1 Surface Conditions

Marine debris and hydrocarbons will to a large extent determine activities at the MC-252 incident site. A continuous assessment is being made as to DD II, DD III, Discoverer Enterprise and Q4000 operability while being exposed to a surface sheen or the plume. Daily updates on sheen and plume developments together with marine debris updates are provided to ensure appropriate marine decisions can be made. Section 1.4, page 11 discuses recommendations should elevated VOC and LEL levels be experienced.

6.1.1 Sheen and Plume

It is likely that the DD II, DD III, Discoverer Enterprise and Q4000 will be exposed to a sheen or the plume. This depends on met-ocean conditions and the volume of hydrocarbon (HC) being released. The Bridge of the DD II, DD III, Discoverer Enterprise and Q4000 will stay in communications with the spill clean-up vessels and be notified of any changes in weather patterns that may result in HC reaching the sites.

6.1.2 Marine Debris

Discovery of marine debris will be broadcasted to the fleet by the first observer. Recovery will be handled by the appropriate team as required.

6.2 Vessel Arrival at MC-252 Incident Site

Surface and marine debris conditions determine how vessels arrive at the MC-252 Incident site.

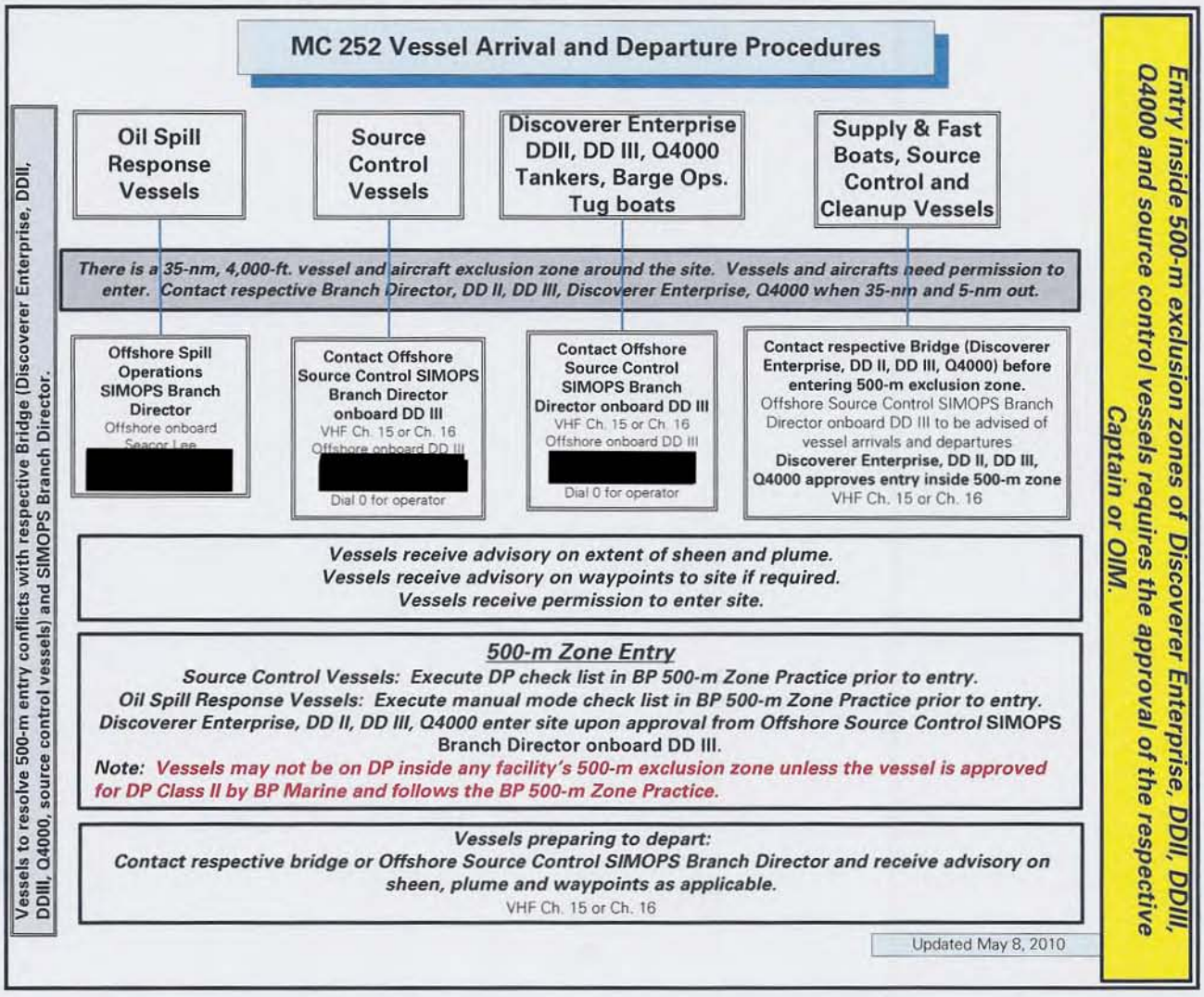
6.2.1 Arrival and Departure Procedures at MC-252 Incident

Vessel arrival and departure will follow the procedures set up in Figure 3, page 28. The number of vessels on DP and connected to the seabed either trough drilling risers or ROVs requires careful planning of vessel movements.

6.3 Heading Change and Notice to Fleet

Any heading change during the top kill and flow-back operation must be communicated to any vessel that could be affected by the change. The top kill and flow-back operation could have up to ten (10) vessels inside the 500-m zone of the site. Maintaining good communications are, therefore, essential.

Figure 3: Vessel Arrival and Departure Procedures



6.4 Core Fleet

The DD II, DD III, Discoverer Enterprise and Q4000 are considered the core fleet.

The Discoverer Enterprise and the DD II will arrive from the SW or as determined by sheen, VOC and LEL levels. Vessels will move on to location once receiving approval through the respective Team Leader. Figure 5, page 33 shows regional map and dedicated standby areas. **Figure 8**, page 39 shows recommended escape directions should vessels have to depart in an emergency. Vessels with riser systems will depart towards deeper water.

6.4.1 Staging Area

There is a dedicated Staging area in MC-339 as shown in Figure 5, page 33. Preparations to start operations may be carried out at this location until approval is received for moving to the well location or to one of the dedicated standby areas.

6.4.2 Standby Area

Two standby areas are dedicated as seen in Figure 5, page 33. The use of the standby areas is managed by the SIMOPS Source Vessel Director located onboard the DD III.

6.5 Source Control Vessels

The DD II, DD III, Discoverer Enterprise and Q4000 500-m exclusion zones will be adhered to. Entry into any of these zones requires the respective vessel's OIM approval.

Please note that the DDII and the DD III 500-m exclusion zones overlap. Any passage between the two rigs will, therefore, require DD II and DD III OIM approvals.

6.6 Oil Spill Response Vessels

Oil spill response vessels will be directed through the Incident Management Command via the SIMOPS Branch Director and are expected to interact with the DD II, DD III, Discoverer Enterprise and Q4000.

It is essential that the DD II, DD III, Discoverer Enterprise and the Q4000 are notified of any clean-up vessel activity in the vicinity of the well operations and especially inside the rigs 500-m exclusion zones.

Note: The DD II, DD III, Discoverer Enterprise and Q4000 500-m exclusion zones will be adhered to. Entry into any of these zones requires the respective vessel's approval. Please note that the DD II and the DD III 500-m exclusion zones overlap. Any passage between the two rigs will, therefore, require the DD II and the DD III OIM approval.

6.7 Firefighting Vessels

The Rem Forca and the K Marine V are dedicated firefighting vessels to be used for dispersant applications and firefighting. The Rem Forca is dedicated to the Discoverer Enterprise support. The K Marine V will be working water cannons and dispersants in the DD III and the DD II areas. The vessels will be directed through the Source Vessel SIMOPS Branch Director onboard the DD III.

6.8 VHF Hailing Channels

All vessels approaching the DD II, DD III, Discoverer Enterprise and Q4000 will use VHF channels as shown in Figure 4, page 31 to call up the DD II, DD III, Discoverer Enterprise and Q4000 Bridge.

6.9 Working Channels

Once the targeted rig or vessel is hailed, the channel is switched to an agreed frequency.

6.10 GoM 500-Meter Zone Practice

Any vessel entering the 500-m exclusion zone of any MC-252 Incident vessel shall comply with the requirements in the 500-m Zone Practice. The document is issued by the BP Marine Vessel Operations group.

The nature of the MC-252 Incident operation, however, requires flexibility in how vessels interact. It is anticipated that the Captains on the Source Control vessels and the Spill clean-up vessels review proximity requirements between vessels and have an agreement in place concerning procedures and safeties.

Entry into the DD II, DD III, Discoverer Enterprise and Q4000 500-m exclusion zones, however, takes place according to the 500-m Zone Practice.

Caution:	**Critical vessel repairs and maintenance shall be performed either before or after the SIMOPS event. No critical vessel repairs will be performed during the SIMOPS event or inside the DD II, DD III, Discoverer Enterprise and Q4000 500-m zone (see details in the 500-m Zone Practice). A critical repair is defined as repair that could lead to single point failure and loss of station or vessel integrity.**

6.11 Aviation

The air command in Houma is an integrated part of the MC 252 operation. The operation is run as a separate entity from the Houma Air Command. The following types of air activities are expected:

1. Helicopter crew flights to drilling rigs and source control vessels.
2. Spotter planes and fixed wing surveillance
3. Areal spray of dispersants (four aircrafts in one dispersant sortie, four to five sorties per day).
4. Over-flights of fixed wing and helicopters.
5. Drone surveillance.
6. Press and media.

The MC-252 area has a restricted airspace (TFR – Temporary flight restriction) of 35-nm from site up to a 4,000-ft. elevation. Flights inside this zone are controlled by the USCG cutter Harriet Lane or other USCG vessel on site. The air command in Houma plans all flights to the site and reports through the SIMOPS Director as shown in Figure 1, page 9.

6.11.1 Helicopter Fueling

Helicopter fueling operations will mainly take place onshore. The aviation group will arrange emergency fueling onboard offshore facilities if needed. It is emphasized, however, that using the core fleet as fueling stations other than for dedicated flights reduces the efficiency of the operations because of shut-down of cranes and deck activities.

Figure 4: MC-252 Communications Plan VHF and UHF

MC 252 VHF and UHF Communications Plan

Drilling Rigs and Construction Vessels																							
Location	DEN	DEN ROV	DDII	DDII ROV	DDII	DD III ROV	Q4000	Q4000 ROV	Skandi Neptune	BOA Sub-C	BOA Deep-C	Oil	Oil	Viking Poseidon	HOS Iron Horse	K Marine V	Rem Forza	C-Express	BJ Blue Dolphin	Halliburton STIMStar III	HOS Centerline	HOS Strongline	Other field support vessels
Email	OIM.DEN@deepwater.com	NA	OIM-PIC.DevelopmentDriller2@deepwater.com	NA	OIM.DD3@deepwater.com	NA	g4k_captain@helixesg.com	NA	captain@neptune.dof.no	captain@boasubc.no	offshore:supervisorbdc@boa.no	oilmaster@oceaneering.com	captain@interventionislandoffshore.com	master.viking-poseidon@eidesvik.no	ironhorsecapt@hornbeckoffshore.com	chaunceym@williamsfire.com No Bridge e-mail	captain.forza@rem-maritime.no	my.c-express@cchouest.com	mv.bj.blue.dolphin@chouest.com		centerline@hornbeckoffshore.com	stronglinecapt@hornbeckoffshore.com	
Hailing general	16		16		15, 16	15	13, 16		16	16	16	16	16	6, 13, 16	16	16	16	16	16	16	16	16	16
Bridge to Bridge	13 , 12		15		13		13		6, 13	13	13	13	13	6	6, 13	6, 13	6, 13	13	13	13,6	13, 16	16, 13	13
Bridge to boat	8, 10, 12		69, 72 05, 09		13		6, 10, 15		6, 77	6,17	6,17	17,63,74	74	6, 72			6		81	6,13	13, 16	13,16	
Port crane	10		69		67		360 UHF		77		17,72	63	NA	72 Ch. 2 467.550	17		72		N/A				
Starboard crane	11,12		05		68		160 UHF		NA		17,72		74	72 Ch. 2 467.550	17		n/a		N/A				
Crane to boat	11, 12		72, 05		Port: 67 Stb.: 68		10		77	17	17	63	74	72	17		72		SB	17			
Bulk and liq. transfer	8, 11		09, 69		72, 88		10		77	6	2,16		74		72, 88		72		UHF 6	72,88			
ROV		8	09	8		72, 88	UHF	UHF	6	6	UHF	63	NA	Ch. 1 467.525	VHF 6 UHF 3		n/a		N/A				
Spare VHF channels	6, 69, 71, 73		NA		6, 69, 71, 73		69, 71, 73		68, 67, 73, 74	8, 69	4, 5, 6	05,17,74	NA		6, 69, 71,73		17, 77		69, 72, 74, 78	82, 72, 68, 69			
UHF	[redacted]																		[redacted]				
Helicopter	123.050		123.500		122.700		123.050		123.500	123.500	123.500		123.500	123.050	123.050								
Knuckle boom			11				UHF																
Medic							UHF		72		163	63											
Harvey Thunder tug	13, 16																						

Notes:

1. Perform radio check prior to startup of all operations.
2. Communications plan is a guideline and needs to be adjusted in the field as conditions dictate.
3. Remember to keep radio traffic to the essentials since there is a high demand for VHF.
4. Cleanup vessels work on channel 6, 13, 15, 16, 68, 71 and other channels as requested. Some vessels may have limitations in channel availability above minimum requirements.
5. Harvey Thunder or AHV to support the Discoverer Enterprise and the PQ as a backup and works on ch. 13 and ch. 15.
6. Q4000 top kill project is working UHF: 464.600 469.600 464.625 469.625 to be used during management of the Top Kill pumping operation. It is essential that these channels are dedicated to the pumping operation and that no other activity is allowed on these frequencies. VHF will be used for the marine portion.
7. Future tanker and barge operations for Discoverer Enterprise support to use VHF ch. 13 and 15 to call up and then agree with respective vessel on channel selection.

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Figure 5: MC-252 Incident Regional Map With 20-nm Zone and Vessel Standby Areas

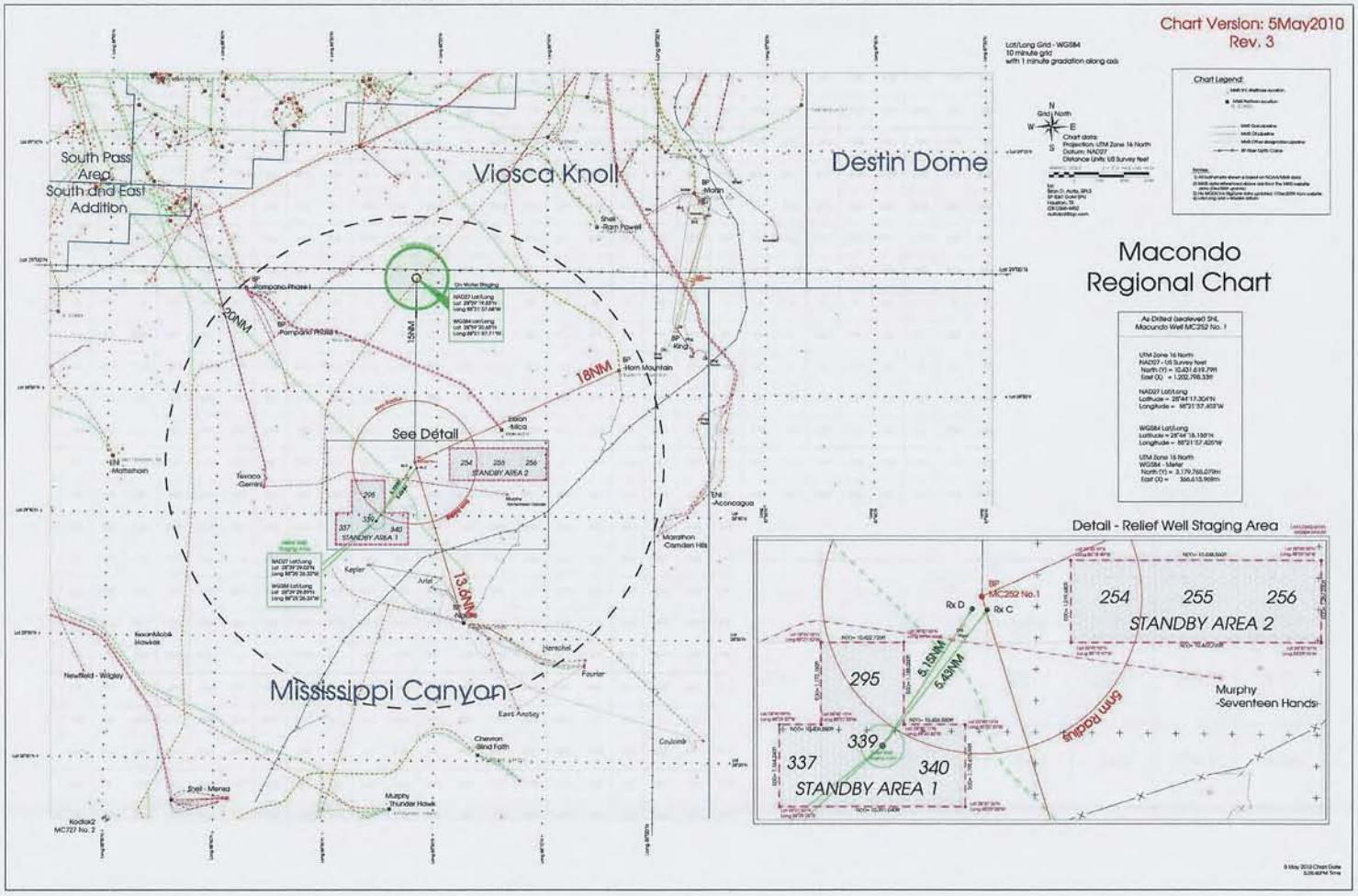

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Figure 6: Relief Well and Top Kill Operation

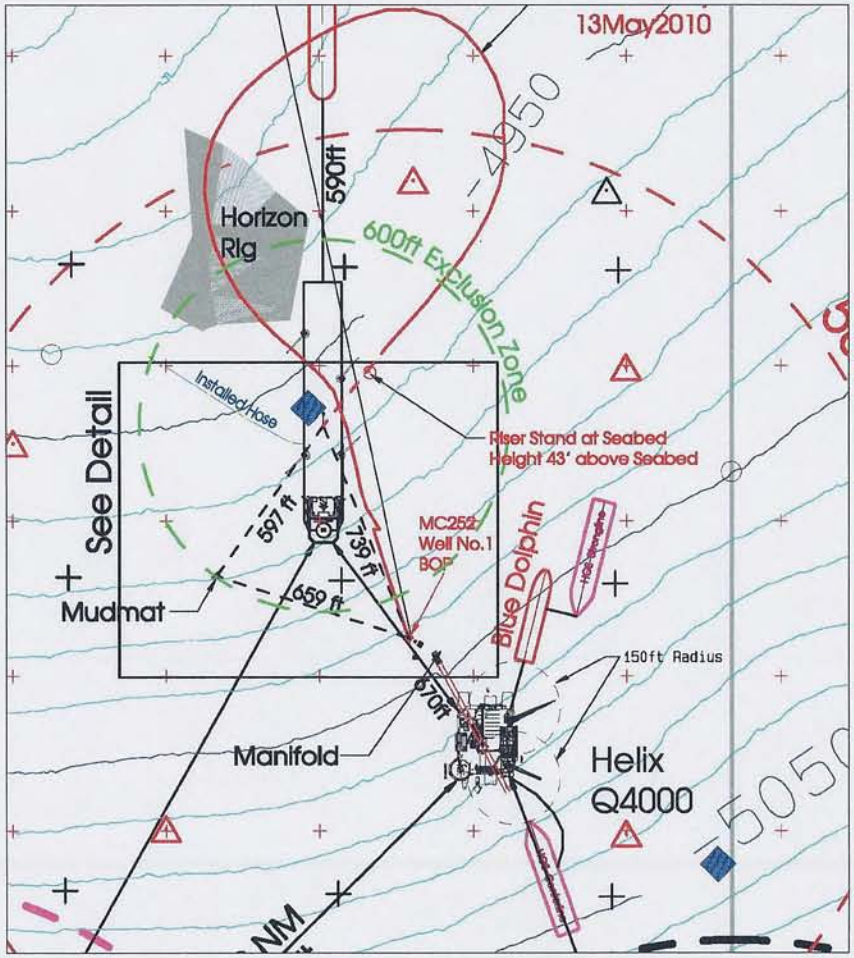

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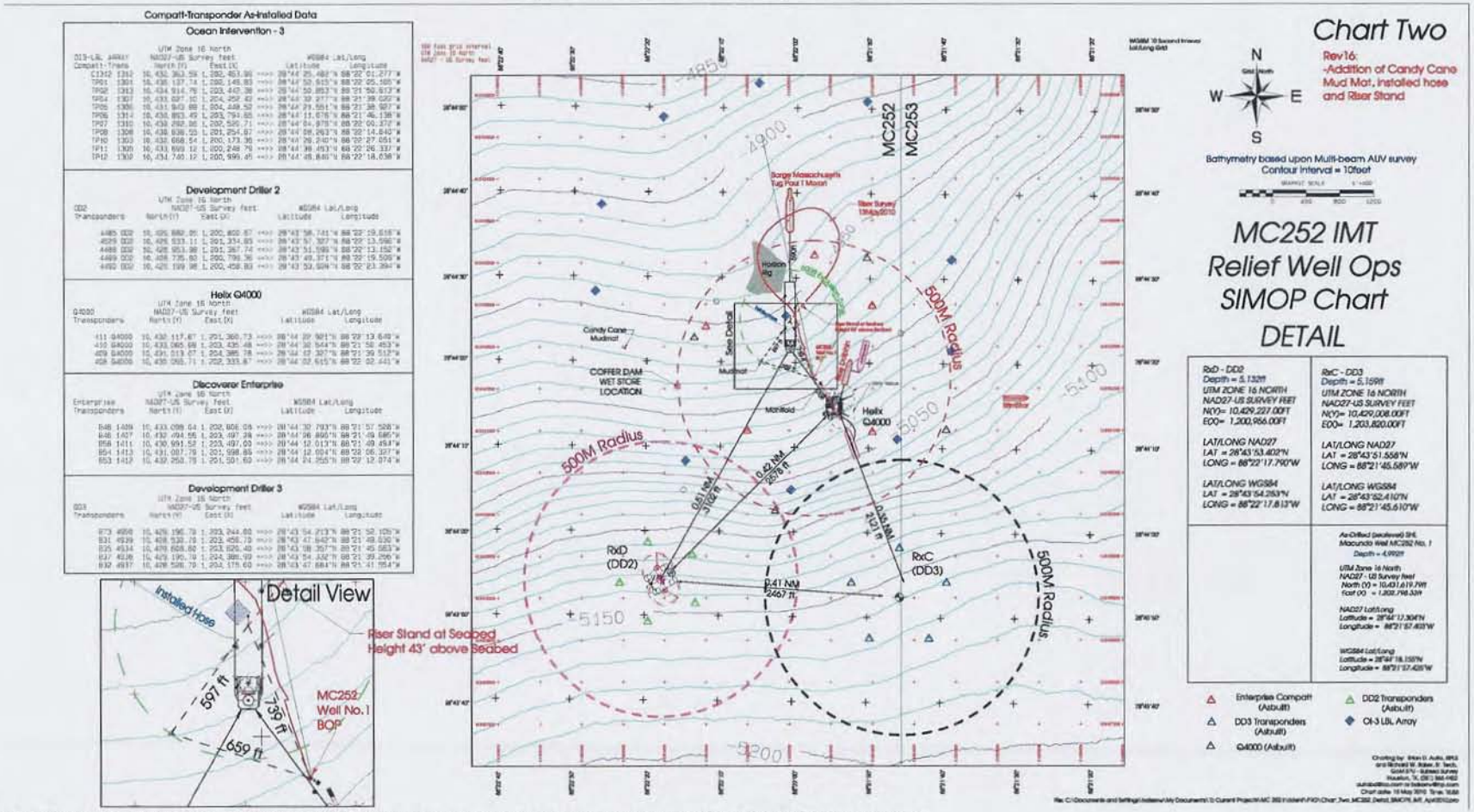
Figure 7: Riser Leak Collection and Top Kill Vessel Locations



Note: *The Offshore Vessel Source Control SIMOPS Coordinator controls the debris field and an area within appr. 1,000-m of the MC 252 no. 1 well site.*

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Figure 8: Escape Zones Discoverer Enterprise and Q4000 Fleet

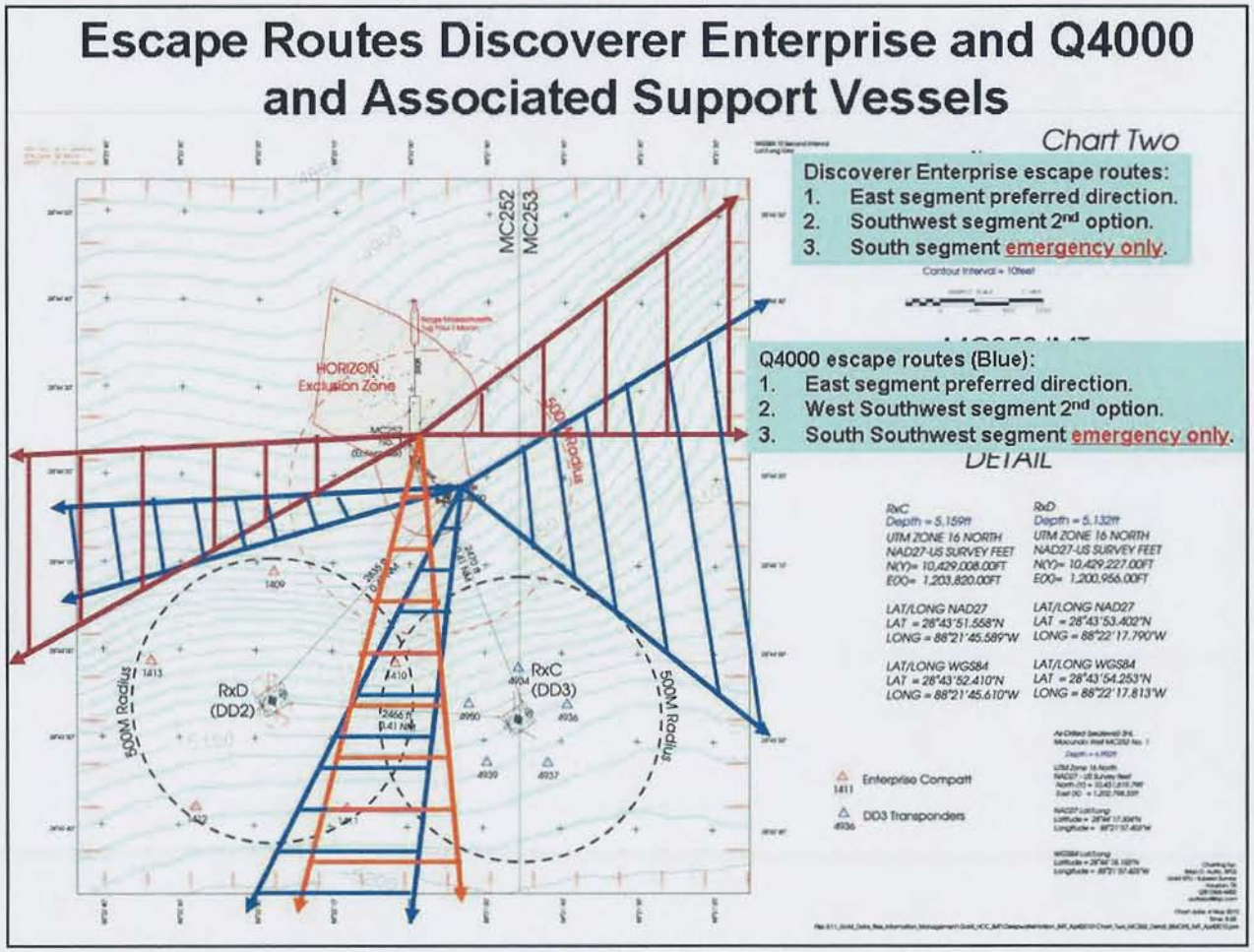

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Figure 9: Marine SIMOPS HazID Action Items Page 1

	HAZID Action Items	Responsible Person	Due Date	Status
	From the Enterprise - Q 4000 Close Proximity HAZID on May 4, 2010			
1	Ensure DPO's are well schooled to react correctly and quickly on a drive off. *Note: this operation will be the closest proximity for Enterprise and Q 4000.*	Lambros		TOI has issued lessons learned from Clear Leader DP incident. Lessons issued to all DP vessels in fleet.
2	Define DPO staffing for each vessel during specific operations	Lambros		A 3rd DPO on the bridge confirmed for Q4000, HOS Strongline, HOS Centerline, Stim Star III, Blue Dolphin,
3	Distribute lessons learned on Clear Leader incident.	John MacDonald		
4	Evaluate at skills and competencies of DPO's on both the Q and enterprise.	Vessel Masters / Lambros		
5	Consider having a vessel capable of halting any drift off of the DEN or Q4000. Note: Depending on the criticality of the operations and wind/current direction, the Captains should make the decisions on where to place the assist vessel and whether or not it should actually be connected or just standing by	Steve Walker		Completed. An additional positioning vessel has been requested and included in the SIMOPS plan.
6	Test emergency connect and running of generators under load. Enterprise, Q4000 and frac boats	Vessel Capt. / Lambros		
7	Define where Frac boats will be staged and moved in as needed. Three boats in the field with two connected when pumping.	Geir Karlsen	Closed	Included in the SIMOPS Plan Rev. 2
8	Get SIMOPS out to all the vessels including the emergency diagram.	Geir Karlsen		SIMOPS Plan Rev. 2 to be issued to all vessels.
9	Get ROV Sonar data to evaluate edge of plume. Consider using the Enterprise.	Paul Zutz		
10	Determine if the plume from the riser end has potential to impact the Enterprise. NOTE: do a dry run with the Enterprise.	Dan Stoltz		
11	Provide data from monitoring already done.	IMT Safety Officer / Dan Stoltz		The Safety Section updated the air monitioring plan. The operational table was provided to all vessels early on 7 May 2010. The overall plan will be distributed by 8 May 2010.
12	Review existing HAZOP (1998) to determine cold venting was addressed. If not, model dispersion of venting for full range of potential vent rates and wind speeds. Update existing procedures if necessary.	Steve Walker		
13	Consider stopping inlet flow instead of pulling off site.	Steve Walker		
14	Identify safe zone for riser deployment	Dan Stoltz		Completed
15	Develop contingency plans for clashing of recovery riser and downed riser in the event of lost station keeping.	Paul King		
16	Define roles of source vessels in the field.	Charlie Holt		
17	Include frac boat locations in SIMOPS plan once pumping plan is finalized.	Geir Karlsen		Included in the SIMOPS Plan Rev. 2
18	Follow up with US Navy to determine if satellite maintenance can be minimized to avoid impact on DGPS.	Lambros		Closed via email forwarded by Lambros. "Last week AFNORTH submitted a request to the GPS Op's Center to limit any GPS maintenance over the Gulf for the foreseeable future. Higher than normal solar activity."
19	Place transponder on downed riser to monitor riser movement.	Jonathon Davis		Closed, transponder placed prior to installation of coffer dam

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Figure 10: Marine SIMOPS HazID Action Items Page 2

From the Top Kill with Q 4000 HAZID on May 2, 2010			
1	Confirm the preferred target for the frac vessel fan beam; prism of reflective tape. Note; consider the impact of pitch and roll.	Angel Rodriguez	
2	Develop project specific communications plan for the frac pumping crews.	Angel Rodriquez Hank Porter Jason Steckler	
3	Update drawing and turn enterprise 180 degrees from rev 5 drawing. Q 4000 must be port side. Frac boats will be located port bow and port stern of the Q 4000	Geir Karlsen	Included in the SIMOPS Plan Rev. 2
4	Define emergency disconnect between the LDIS riser and frac lines.	Geir Karlsen	Ongoing
5	Define max distance between LDIS and BOP.	Geir Karlsen	Included in the SIMOPS Plan Rev. 2
6	Define best place for manifold based on prevailing weather conditions. Note: north side of the well is not an option because of debris field. Wind must be on port bow of Enterprise if venting from SB flare boom.	Geir Karlsen	Closed. Included in the SIMOPS Plan Rev. 2
7	Define weather criteria including for Q4000 working in close proximity of Enterprise. Include weather vaning limits of Enterprise and impact on the Q 4000.	Geir Karlsen	Ongoing. Included in the SIMOPS Plan Rev. 2
8	Conduct a HAZID of Top Kill procedures when developed. Note; this initial review focused on the vessels working in close proximity.	Geir Karlsen	Closed. Included in the SIMOPS Plan Rev. 2
From the Two Drill Rig Operation HAZID on April 28, 2010			
1	Develop a decision matrix for various scenarios of increased oil flow that could impact the drill rig.	George Gray	
2	Include in IAP that source control immediately communicates any flow changes to the SIMOPS Director	Troy Endicott	
3	Develop a model to predict plume location based on subsea currents. Consider the impact of rapidly increasing flow rate.	Troy Endicott	Ongoing and being coordinated by Richard Simpson.
4	Determine the location and density of oil/water emulsion / mousse floating below the surface.	Troy Endicott	
5	Convey IMT air monitoring and safety plan to the vessels.	Joe Neumeyer	The Safety Section updated the air monitioring plan. The operational table was provided to all vessels early on 7 May 2010. The overall plan will be distributed by 8 May 2010.
6	Send 500 meter zone to branch directors.	Troy Endicott	Done
7	Communicate to the IMT the drill rigs request to maintain a minimum of one mile distance for dispersant application or in situ burning.	Troy Endicott	Done

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Figure 11: Marine SIMOPS HazID Action Items Page 3

Marine SIMOPS HazID Top Kill Operations and Discoverer Enterprise on Riser Leak Location, Cluster of Vessels in Close Proximity May 13, 2010

1	Define the number of firefighting boats needed in the field during flowback to apply water fog and/or deploy dispersant. Two dedicated to Enterprise during flowback. Procure other vessels as necessary.	Geir Karlsen	Two additional fire fighting vessels have been added to the existing two vessels.
2	Review the safety protocol for VOC and LEL with all affected vessels. Ensure that each vessel has a well defined and understood plan to monitor and respond to elevated levels of VOC's. NOTE: If one vessel goes to yellow, all vessels involved in the operation go to yellow alert.	Dan Polk	
3	Define location of Dispersant injection vessel and ROV during flowback.	Geir Karlsen	Ongoing. To be worked with Discoverer Enterprise. Normal SIMOPS issue.
4	Need to have plan for emergency disconnect of frac hose and affect on Q4000 position keeping.	George Gray Jeff Lott	
5	Define emergency escape routes for other vessels. NOTE: Per drawing the Q4000 and Enterprise are good to go.	Lambros with Geir	Closed. Included in the SIMOPS Plan Rev. 2
6	Confirmed clearly defined break command	Lambros	
7	Determine response criteria for neighboring vessels if a vessel goes to red. NOTE: If a vessel goes to yellow all go to yellow.	Geir Karlsen	Ongoing.
8	Include in SIMOPS Plan that regularly scheduled vessel fire and emergency drills will be postponed during flowback operations. In addition any routine maintenance that could affect operations or vessel stationkeeping will be postponed.	Geir Karlsen	Closed. Included in the SIMOPS Plan Rev. 2
9	Make sure all appropriate vessels are on distribution list for overflight surveys.	Richard Simpson	
10	Confirm fuel levels, potable water and supplies for all vessels so each as enough for the duration of critical operations.	Jeff McCormick	
11	Need confirmation of scheduled offloading from Enterprise during the Q4000 operations.	Geir Karlsen	Ongoing.
12	Define watch circles for the two largest vessels, WSOC	Dan Polk	
13	Communicate with BP Aviation that heading change capability is limited during pumping operations. Need to take that into account for any helicopter flights.	Dan Polk	
14	Need to have timely weather data during critical operations. Coordinate with David Driver. "NOW casting"	Geir Karlsen	Ongoing.
15	Q4000 will determine options for emergency towing/stationkeeping.	Darren Hilton	
16	Follow up with HSE on contaminated potable water issue for all vessels.	Jeff McCormick	

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Figure 12: DD II and DD III LEL and VOC Operating Limits

	DDII/DDIII Only - Well Specific Operational Criteria - Air Quality						
	Casing Size	**Condition**	**Preventive Measures**	**Action Level 10% LEL - YELLOW**	**Mitigations to reduce LEL**	**Contains 5% LEL - RED**	**Consequences from Decision**
	36" 28" 22"	Tripping Drilling Run Csg / Jetting	Weather forecast / current profiling / Mitigations prior	Stop operations/Advise source control branch Director Spot pad mud Pull above ML or Release from CADA Pull hot work permit Pull people out of areas	Skimmers WWC Boat-Dispersant and water cannon Bow into wind	Advise other vessels of move Move out on escape route	Delay Equipment Damage Loss of Well if unable to pull above Mud Line
		Cementing	Weather forecast Current profiling Mitigation before hand	Stop cement/ Displace to shoe / Regroup Release R/T Pull above ML Pull hot work permit Pull people out of areas	Skimmers WWC Boat-Dispersant and water cannon Bow into wind	Advise other vessels of move Move out on escape route	Compromised Cement Job SWF
	18" and 16"	Tripping Drilling	Weather forecast Current profiling Mitigations - boats, skimmers, etc...	If above stack close BSR and displace If in open hole pull to shoe, hang-off & displace riser	Skimmers WWC Boat-Dispersant and water cannon Bow into wind	If below stack DP EDS Move out on escape route	Environmental Event Delay Fishing Operations
		Well Control / Lost Circulation		Well Control - Hang off and continue kill ops LC - pull to shoe, hang off and displace riser	Skimmers WWC Boat-Dispersant and water cannon Bow into wind	DP EPS & move out on escape route	Environmental Event Delay Fishing Operations Well Control
Evaluate with Spill Response group		Run Csg	Weather forecast Current profiling Mitigation - boats, skimmers	Above stack stop Below stack - RIH and Land Out	Evaluate conditions for non shearables Csg shear mode	Casing EDS & move out on escape route	Environmental Event Delay Fishing Operations Stuck Pipe Remedial Cementing
		Cementing		Stop cement/Displace to shoe Release R/T, Set Packoff	Same as above Evaluate risk/reward plugs vs inner string	DP EDS & move out on escape route	Compromised Cement Job Well Control Event
	13-5/8	Tripping Drilling	Weather forecast Current profiling Mitigations - boats, skimmers, etc.	If above stack close BSR and displace riser If in open hole pull to shoe, hang-off & displace riser	Same as for 18" / 16"	If Below stack, Hang off and DP EDS, then move over	Environmental Event Delay Fishing Operations
		Well Control/LC		Well Control - Hang off and continue Kill Ops LC - pull to shoe, hang off and displace riser	Same as for 18" / 16"	DP EDS and move out on escape route	Environmental Event Delay Fishing Operations Well Control
		Run Csg	Implement incremental measures to keep oil away Estimate time break over point for decision to keep running or pull above stack	Above stack stop Use decision tree to make decision Stuck - work pipe	Evaluate conditions Csg shear Rams	Casing EDS & move out on escape route	Environmental Event Delay Fishing Ops Well Control Loss of Well
		Cementing		Stop cement / displace to shoe Release RT & set packoff	Same as preventative	DP EDS and move out on escape route	Compromised Cement Job Well Control Event Delay Fishing Operations
	11-7/8" & 9-7/8"	Tripping Drilling	Weather forecast Current profiling Mitigations - boats, skimmers	If above stack close BSR and displace If in open hole pull to shoe, hang-off & displace riser	Same as for 18" 16"	If below stack hang off and DP EDS Move out on escape route	Environmental Event Delay Fishing Operations
		Well Control/LC		Well Control - Hang off and continue Kill Ops LC - pull to shoe, hang off and displace riser	Same as for 18" 16"	DP EDS and move out on escape route	Environmental Event Delay Fishing Operations Well Control
	1800' 2300' csg	Run Csg	Implement incremental measures	Above stack - STOP Across Stack - pull above stack	Same as preventative	EDS Casing Mode, move out on escape route	Environmental Event Delay Fishing Operations
		Cementing		Stop Cement / Displace to shoe	Same as preventative	DP EDS Mode, move out on escape route	Compromised cement job Delay Well Control Event
	Final Plan Pending	Dynamic Kill	Implement incremental measures to keep oil away	Discontinue Move boats away Final Plan Pending	Same as preventative	DP EDS move out on escape route	Delay Well Control Event Continual Flow

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Figure 13: Discoverer Enterprise LEL and VOC Operating Limits

Enterprise - Well Specific Operational Criteria - Air Quality						
	Operation	**Preventive Measures**	**Action Level - YELLOW** **> 10% LEL** **> 0.5 ppm Benzene** **> 100 ppm VOC** **Continuous levels confirmed by 2 or more monitors for 15 minutes.**	**Mitigations to reduce LEL**	Action Level - ORANGE 20% LEL Continuous Levels confirmed by 2 or more monitors for 15 minutes.	Action Level - RED 40% LEL Instantaneous reading confirmed by 2 or more monitors
	Move in	Weather forecast Review plume model and use current profiling to predict changes in plume azimuth Compare model and current profile to actual plume surface location for confirmation Utilize WWC Boat (or equivalent) to scout for plume and monitor air quality in front of planned transit route	Stop operations/Advise source control branch Director Pull hot work permit Pull confined space permits Remove people from contaminated areas If necessary utilize Masks for work in contaminated areas	Skimmers WWC Boat-Dispersant and water cannon Dispersant application to moonpool	Suspend Operations Evaluate preparation needed to move vessel to safe location Have personnel don air masks	Advise other vessels of move Move out on escape route
	Position Funnel or Insertion Tube over Leak	Weather forecast Current profiling Mitigation before hand	Prepare to abort move-in if readings continue to increase Pull hot work permits Pull people out of areas with readings	Skimmers WWC Boat-Dispersant and water cannon Bow into wind Dispersant application to moonpool	Suspend Operations Evaluate preparation needed to move vessel to safe location Have personnel don air masks	Advise other vessels of move Move out on escape route
	Start Oil containment	Weather forecast Continuous monitoring of the current profile Mitigations - Fireboat	Prepare to abort Containment start up if readings continue to increase Prepare to displace recovery string to nitrogen	Skimmers WWC Boat-Dispersant and water cannon Bow into wind Dispersant application to moonpool	Suspend Operations Displace drill pipe with nitrogen Evaluate preparation needed to move vessel to safe location Have personnel don air masks	As LEL increases above 40% Remove insertion tube. Advise other vessels of move Move out on escape route
	Process Oil through Oil Facilities	Weather forecast Current profiling Mitigations - Fireboat	As containment continues, readings should steadily improve If readings reach above levels and increase, prepare to displace Drill Pipe to Nitrogen	Skimmers WWC Boat-Dispersant and water cannon Bow into wind Dispersant application to moonpool	Suspend Operations Displace drill pipe with nitrogen Evaluate preparation needed to move vessel to safe location Have personnel don air masks	As LEL increases above 40% Remove insertion tube. Advise other vessels of move Move out on escape route
	Condition	**Preventive Measures**	**Action Level - YELLOW** **> 10% LEL** **> 0.5 ppm Benzene** **> 100 ppm VOC** **Continuous levels confirmed by 2 or more monitors for 15 minutes.**	**Mitigations to reduce LEL**	Action Level - ORANGE 20% LEL Continuous Levels confirmed by 2 or more monitors for 15 minutes.	Action Level - RED 40% LEL Instantaneous reading confirmed by 2 or more monitors.
	Standing By in Field	Weather forecast Current profiling Mitigation before hand	Stop operations/Advise source control branch Director Pull hot work permit Pull confined space permits Remove people from contaminated areas If necessary utilize Masks for work in contaminated areas	Reposition Vessel Skimmers WWC Boat-Dispersant and water cannon Bow into wind Dispersant application to moonpool	Advise other vessels of intent to move and clear with field SIMOPS Director. Define escape route.	Advise other vessels of move. Move out on escape route. Advise SIMOPS Field Director
	Working with another vessel (cargo transfer operations)	Weather forecast Current profiling Mitigation before hand	Stop operations/Advise source control branch Director Pull hot work permit Pull confined space permits Remove people from contaminated areas If necessary utilize Masks for work in contaminated areas	Reposition Vessel Skimmers WWC Boat-Dispersant and water cannon Bow into wind Dispersant application to moonpool	Stop Cargo Transfer If possible move from close proximity situation. Advise other vessels of intent to move and clear with field SIMOPS Director. Define escape route.	Advise other vessels of move. Move out on escape route. Advise SIMOPS Field Director

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Figure 14: Q4000 LEL and VOC Operating Limits

Q4000 - Well Specific Operational Criteria - Air Quality

Condition	Preventive Measures	Action Level 10% LEL - YELLOW Continuous levels confirmed by 2 or more monitors for 15 minutes	Mitigations to reduce LEL	Action Level 25% LEL - ORANGE Continuous levels confirmed by 2 or more monitors for 15 minutes	Action Level 40% LEL - RED Continuous levels confirmed by 2 or more monitors for 15 minutes	Consequences from Decision
Hoses and flexibles test yellow psid	Weather forecast /constant monitoring/ MC252 Air Monitoring Plan	Evaluate operations/Advise source control branch Director recover pod if possible Energize hoses staged at intakes to knock down gas Pull hot work permit Muster all non essential personnel to galley area close dampers and recirculate air through accomodations (S4 group LE)(group 1 VMS)	Skimmers WWC Boat Dispersant and water cannon Bow into wind Water spray at intakes on vessel	Suspend Operations Evaluate preparation needed to move vessel to safe location	Advise other vessels of move Move out on escape route EMERGENCY DISCONECT FROM POD	Delay Equipment Damage Loss of POD
Run LDES w/45# collet hose	Weather forecast /constant monitoring/MC252 Air Monitoring Plan	Evaluate operations/Advise source control branch Director Energize hoses staged at intakes to knock down gas Pull hot work permit Muster all non essential personnel to galley area close dampers and recirculate air through accomodations (S4 group LE)(group 1 VMS)	Skimmers WWC Boat Dispersant and water cannon Bow into wind Water spray at intakes on vessel	Suspend Operations Evaluate preparation needed to move vessel to safe location	Advise other vessels of move Move out on escape route EMERGENCY DISCONECT FROM POD	Delay Equipment Damage Loss of POD Damage to LDES
Hookup flying lead from accumulator and test manifold	Weather forecast /constant monitoring/ MC252 Air Monitoring Plan	Evaluate operations/Advise source control branch Director Energize hoses staged at intakes to knock down gas Pull hot work permit Muster all non essential personnel to galley area close dampers and recirculate air through accomodations (S4 group LE)(group 1 VMS)	Skimmers WWC Boat Dispersant and water cannon Bow into wind Water spray at intakes on vessel	Suspend Operations Evaluate preparation needed to move vessel to safe location	Advise other vessels of move Move out on escape route EMERGENCY DISCONECT FROM POD	Environmental Event Delay Fishing Operations
connect LDES to manifold including flexible jumpers	Weather forecast /constant monitoring/ action plan	Evaluate operations/Advise source control branch Director Energize hoses staged at intakes to knock down gas Pull hot work permit Muster all non essential personnel to galley area close dampers and recirculate air through accomodations (S4 group LE)(group 1 VMS)	Skimmers WWC Boat Dispersant and water cannon Bow into wind Water spray at intakes on vessel	Suspend Operations Evaluate preparation needed to move vessel to safe location	Advise other vessels of move Move out on escape route EMERGENCY DISCONECT FROM POD AND LDES	Delay Equipment Damage Loss of POD Damage to LDES
Move frac boats on location and begin hook up	Weather forecast continuous monitoring MC252 Air Monitoring Plan Mitigation - boats, skimmers	Evaluate operations/Advise source control branch Director Suspend operations and recover hoses and move frac boats to a safe standby location Energize hoses staged at intakes to knock down gas Pull hot work permit Muster all non essential personnel to galley area close dampers and recirculate air through accomodations (S4 group LE)(group 1 VMS)	Skimmers WWC Boat Dispersant and water cannon Bow into wind Water spray at intakes on vessel	Suspend Operations Evaluate preparation needed to move vessel to safe location	Advise other vessels of move Move out on escape route EMERGENCY DISCONECT FROM POD AND LDES	Delay Equipment Damage Loss of POD Damage to LDES
BOP valve testing pressure integrity testing, Functionality	Weather forecast continuous monitoring/ action plan Mitigation - boats, skimmers	Evaluate operations/Advise source control branch Director Suspend operations and recover hoses and move frac boats to a safe standby location Energize hoses staged at intakes to knock down gas Pull hot work permit Muster all non essential personnel to galley area close dampers and recirculate air through accomodations (S4 group LE)(group 1 VMS)	Skimmers WWC Boat Dispersant and water cannon Bow into wind Water spray at intakes on vessel	Suspend Operations Evaluate preparation needed to move vessel to safe location	Advise other vessels of move Move out on escape route EMERGENCY DISCONECT FROM POD AND LDES	Delay Equipment Damage Loss of POD Damage to LDES
Kill Pumping Operations	Weather forecast continuous monitoring/ action plan Mitigation - boats, skimmers	Evaluate operations/Advise source control branch Director Possibly recover hoses and move frac boats to a safe standby location Energize hoses staged at intakes to knock down gas Pull hot work permit Muster all non essential personnel to galley area close dampers and recirculate air through accomodations (S4 group LE)(group 1 VMS)	Skimmers WWC Boat Dispersant and water cannon Bow into wind Water spray at intakes on vessel	Suspend Operations Evaluate preparation needed to move vessel to safe location	Advise other vessels of move Move out on escape route EMERGENCY DISCONECT FROM POD AND LDES	Delay Equipment Damage Loss of POD Damage to LDES Environmental event Loss of well control at source
Cement pumping Operations	Weather forecast continuous monitoring MC252 Air Monitoring Plan Mitigation - boats, skimmers	Evaluate operations/Advise source control branch Director Possibly recover hoses and move frac boats to a safe standby location Energize hoses staged at intakes to knock down gas Pull hot work permit Muster all non essential personnel to galley area close dampers and recirculate air through accomodations (S4 group LE)(group 1 VMS)	Skimmers WWC Boat Dispersant and water cannon Bow into wind Water spray at intakes on vessel	Suspend Operations Evaluate preparation needed to move vessel to safe location	Advise other vessels of move Move out on escape route EMERGENCY DISCONECT FROM POD AND LDES	Delay Equipment Damage Loss of POD Damage to LDES Environmental event Loss of well control at source

Condition	Preventive Measures	Action Level 10% LEL - YELLOW Continuous levels confirmed by 2 or more monitors for 15 minutes	Mitigations to reduce LEL	Action Level 25% LEL - Orange Continuous levels confirmed by 2 or more monitors for 15 minutes	Action Level 40% LEL - RED Continuous levels confirmed by 2 or more monitors for 15 minutes
Standing By in Field	Weather forecast / current profiling / Mitigations prior	++ Advise SIMOPS Field Director ++ Pull hot work permit ++ Pull people out of area	++ Reposition vessel, if possible. ++ Utilize fans / blowers ++ Ready standby boats with water cannons to knock up sheen in immediate area ++ Apply surface dispersant or vapor suppressing foam from standby vessels "if approved"	++ Advise other vessels of intent to move and clear safe field SIMOPS Director ++ Define escape route.	++ Advise other vessels of move. ++ Move out on escape route. ++ Advise SIMOPS Field Director
Working with another vessel (cargo transfer operations)	Weather forecast / current profiling / Mitigations prior	++ Advise SIMOPS Field Director ++ Pull hot work permit ++ Pull people out of area	++ Reposition vessel, if possible. ++ Utilize fans / blowers ++ Ready standby boats with water cannons to knock up sheen in immediate area ++ Apply surface dispersant or vapor suppressing foam from standby vessels "if approved"	++ Stop Cargo Transfer. ++ Disconnect Hoses and / or Lifting gear from load ++ If possible move from close proximity situation	++ Advise other vessels of move. ++ Move out on escape route. ++ Advise SIMOPS Field Director

Condition	Preventive Measures	Action Level 10% LEL - YELLOW Continuous levels confirmed by 2 or more monitors for 15 minutes	Mitigations to reduce LEL	Action Level 25% LEL - Orange Continuous levels confirmed by 2 or more monitors for 15 minutes	Action Level 40% LEL - RED Continuous levels confirmed by 2 or more monitors for 15 minutes
Standing By in Field	Weather forecast / current profiling / Mitigations prior	++ Advise SIMOPS Field Director ++ Pull hot work permit ++ Pull people out of area	++ Reposition vessel, if possible. ++ Utilize fans / blowers ++ Ready standby boats with water cannons to knock up sheen in immediate area ++ Apply surface dispersant or vapor suppressing foam from standby vessels "if approved"	++ Advise other vessels of intent to move and clear safe field SIMOPS Director ++ Define escape route.	++ Advise other vessels of move. ++ Move out on escape route. ++ Advise SIMOPS Field Director
ROV's or iconic operations	Weather forecast / current profiling / Mitigations prior	++ Advise SIMOPS Field Director ++ Pull hot work permit ++ Pull people out of area	++ Reposition vessel, if possible. ++ Utilize fans / blowers ++ Ready standby boats with water cannons to knock up sheen in immediate area ++ Apply surface dispersant or vapor suppressing foam from standby vessels "if approved"	++ Stop Crane Operations ++ Stop Cargo Transfer Operations ++ Retrieve ROV's to Cages. Disconnect lines any Fixed infrastructure ++ If possible move from close proximity situation	++ Advise other vessels of move. ++ Move out on escape route. ++ Advise SIMOPS Field Director

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Figure 15: Construction Vessel LEL and VOC Operating Limits

Construction Vessel - Site Specific Operational Criteria - Air Quality						
	Condition	**Preventive Measures**	**Action Level 10% LEL - YELLOW Continuous levels confirmed by 2 or more monitors for 15 minutes.**	**Mitigations to reduce LEL**	**Action Level 30% LEL - Orange Continuous Levels confirmed by 2 or more monitors for 15 minutes.**	**Action Level 40% LEL - RED Instantaneous reading confirmed by 2 or more monitors.**
	Standing By in Field	Weather forecast / current profiling / Mitigations prior	++ Advise SIMOPS Field Director ++ Pull hot work permit ++ Pull people out of areas	++ Reposition vessel, if possible. ++ Utilize fans / blowers ++ Notify standby boats with water cannons to break up sheen in immediate area. ++ Apply surface dispersant or vapor suppressing foam from standby vessels*(if approved)	++ Advise other vessels of intent to move and clear with field SIMOPS Director. ++ Define escape route.	++ Advise other vessels of move. ++ Move out on escape route. ++ Advise SIMOPS Field Director
	ROVs or crane operations	Weather forecast / current profiling / Mitigations prior	++ Advise SIMOPS Field Director ++ Pull hot work permit ++ Pull people out of areas	++ Reposition vessel, if possible. ++ Utilize fans / blowers ++ Notify standby boats with water cannons to break up sheen in immediate area. ++ Apply surface dispersant or vapor suppressing foam from standby vessels*(if approved)	++ Stop Crane Operations ++ Stop Cargo Transfer Operations ++ Retrieve ROVs to Cages Disconnect from any Fixed infrastructure ++ If possible move from close proximity situation.	++ Advise other vessels of move. ++ Move out on escape route. ++ Advise SIMOPS Field Director

Figure 16: Support Vessel LEL and VOC Operating Limits

Support Vessel - Site Specific Operational Criteria - Air Quality						
	Condition	**Preventive Measures**	**Action Level 10% LEL - YELLOW Continuous levels confirmed by 2 or more monitors for 15 minutes.**	**Mitigations to reduce LEL**	**Action Level 30% LEL - Orange Continuous Levels confirmed by 2 or more monitors for 15 minutes.**	**Action Level 40% LEL - RED Instantaneous reading confirmed by 2 or more monitors.**
	Standing By in Field	Weather forecast / current profiling / Mitigations prior	++ Advise SIMOPS Field Director ++ Pull hot work permit ++ Pull people out of areas	++ Reposition vessel, if possible. ++ Utilize fans / blowers ++ Notify standby boats with water cannons to break up sheen in immediate area. ++ Apply surface dispersant or vapor suppressing foam from standby vessels*(if approved)	++ Advise other vessels of intent to move and clear with field SIMOPS Director. ++ Define escape route.	++ Advise other vessels of move. ++ Move out on escape route. ++ Advise SIMOPS Field Director
	Working with another vessel (cargo transfer operations)	Weather forecast / current profiling / Mitigations prior	++ Advise SIMOPS Field Director ++ Pull hot work permit ++ Pull people out of areas	++ Reposition vessel, if possible. ++ Utilize fans / blowers ++ Notify standby boats with water cannons to break up sheen in immediate area. ++ Apply surface dispersant or vapor suppressing foam from standby vessels*(if approved)	++ Stop Cargo Transfer. ++ Disconnect Hoses and / or Lifting gear from load ++ If possible move from close proximity situation.	++ Advise other vessels of move. ++ Move out on escape route. ++ Advise SIMOPS Field Director

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7 References

7.1.1 BP

- MC-252 Incident Offshore Coordination SIMOPS Guidelines.
- GoM MC-252 Incident Management of Change Plan.
- Mississippi Canyon 252 Offshore Air Monitoring Plan.
- BP GoM TOI HSE Management System Bridging Document.
- Emergency Response Plan (ERP) Document Number: 1440-85-OP-PR-0005.
- GoM Safe Practices Manual (SPM) – GoM Incident Notification, Reporting and Investigation Procedure. Document Number: CD # UPS-US-SW-GOM-HSE-DOC-00115-2.
- GoM IMS Vol II – Regional Oil Spill Plan.
- GoM IMS Vol III – Severe Weather Contingency Plan.
- GoM Contract Aircraft Guidelines.
- GoM Diving Procedures.
- GoM Operational Guidelines for Offshore Support Vessels.
- GoM DEN Operations Manual.
- 500-m Zone Practice – BP Marine.
- VOI – Vessel Operating Instructions – BP Marine.
- Fan Beam User Manual v. 4.1
- Mississippi Canyon 252 Offshore Air Monitoring Plan for Source control and Skimming Operations Doc. no. 2200-T2-DO-PN-4002.

7.1.2 Transocean (TOI)

- See TOI DEN and DD III HSE Plans
- TOI WSOC for DEN and DD III
- TOI Operations Manual
- TOI Floating Operations Manual HQS-OPS-004, Section 4, Subsection 11: DP Operations Guidelines – Close Proximity Operations.
- DEN DP Capability Plots.
- Development Driller III DP Capability Plots.

Appendix A: Contact Details – MC-252 Incident

Name	Telephone	E-Mail	Title
		Emergencies and Regulatory	
Terrebonne General Medical Center 8166 Main Str. Houma	[redacted]		
US Coast Guard	[redacted]		
Houston Crisis Center BP ICP – 24 Hour Number			
MMS Houma District MMS Pipeline Section			
Douglas, Scherie		[redacted]	**Sr. Regulatory & Advocacy Advisor**
		SIMOPS Director	
Endicott, Troy		[redacted]	Deputy Marine Authority
		Oil Spill Response Command	
Smith, Stephen Onboard Seacor Lee		[redacted]	Oil Spill Response On-Scene SIMOPS Coordinator (onboard Seacor Lee
		Source Control Vessel Branch Director	
SIMOPS Branch Director onboard DD III Juan Garcia, Scotty Orr, Angel Rodriguez		[redacted]	Source Vessel Control
		TOI Discoverer Enterprise	
Captain OIM Bridge / DPO Radio room BP WSL BP Clerk / dispatch	[redacted]	[redacted]	

Name	Telephone	E-Mail	Title
BP Subsea Port and Stb. ROV	[redacted]		
DD III Well Site Leader Radio Rm. DD III Inmar Sat DPO Captain BP Dispatcher ROV1 ROV2			
DDII Well Site Leader Radio Rm. Bridge / DPO OIM / Master El. Supervisor BP Dispatcher BP Performance Eng. BP Subsea office SROV PROV			
Helix Q4000			
Master/OIM Q4000 Darin Hilton Helix Well Ops support Bret Dawson	[redacted]		Technical Manager
Rig Operations Discoverer Enterprise, DD II, DD III and Q4000			
Fleece, Trent	[redacted]		Discoverer Enterprise Engineer
Gray, George			Q4000 Team Leader
Halvorson Dory, Kathleen			Drilling Engineer DD II
Jacobsen Plutt,			Drilling Engineer DD III

Name	Telephone	E-Mail	Title
Louise			
Kidd, Gavin			DD II Team Leader
Sanders, Robert			DD III Team Leader
Stoltz, Dan			DEN Team Leader
TOI Rig Support			
Brekke, Jim			Manager Marine Technology
Blue, Mike			Rig Manager Performance DD II
Hess, Adam			Rig Manager Performance DD III
King, Paul			Rig Manager, Performance Discoverer Enterprise
MacDonald, John			Operations Marine Manager
Richards, Ramsey			Rig Manager DD III
Sims, Chuck			Manager DP and Instrumentation
Walker, Stephen			Marine and DP Superintendent NAM
Logistics Boats and Helicopters Houston			
Hollier, Jamie			GoM Shelf Marine Coordinator
John Rougeau			Deepwater Marine Coordinator Subsea Ops & Intervention Leader
Reeves, Harold J.			Aviation Coordinator
Verret, Brian			Aviation Team Lead
Russell, Virgil			GoM Logistics and Materials Management Manager
Huston, John			
Murdoch, Alistair			Shore base & Marine Operations Team Leader
Fourchon Base			
Base Supervisor Deepwater			Mailing address Fourchon Base:

Name	Telephone	E-Mail	Title
Dispatcher Dartez, Bradley Deepwater Receiving Shipping Shore base manager Marine Dispatcher Production	[redacted]	[redacted] Fourchon Base Address:	BP America C-Port 1 [redacted] Logistics Coordinator
Air Logistics			
PHI (Houma)			Mailing Address: PHI Heliport [redacted]
BP Marine			
Fuller, Dan	[redacted]		Marine Operations Lead
Nichols, Scott			Marine Operations Superintendent
Polk, Daniel			Marine Operations Lead
Klaoudatos, Lambros			Project Manager BP Marine
Vessels			
Source Control Vessels			
Boa Deep C	[redacted]		
BOA Sub C			
C-Express Bridge Client office			
Gary Chouest Bridge			
Iron Horse Bridge Client			
Miss Ginger			

Name	Telephone	E-Mail	Title
	[redacted]		
Ocean Intervention 3 Bridge Client Oceaneering ROV			
Skandi Neptune Client			
Viking Poseidon Bridge Bridge Client Clerk ROV	[redacted]		
Frac Vessels			
STIMStar 3 Bridge Tracy Carter Vessel MBU Leader Stim Star III	[redacted]		
Blue Dolphin Bridge 1 Bridge 2 Backup Captain BJ Supv. - Mike Gautreaux BJ Supv. - James Quibodeaux BJ Houston: Rick Pearcy: Jack Tucker			

TABLE 1.1d
C5-C13 Volatile Compounds for PIANO Forensic Assessment

Abbrev.	Analyte
IP	Isopentane
1P	1-Pentene
2M1B	2-Methyl-1-butene
C5	Pentane
T2P	2-Pentene (trans)
C2P	2-Pentene (cis)
TBA	Tertiary butanol
CYP	Cyclopentane
23DMB	2,3-Dimethylbutane
2MP	2-Methylpentane
MTBE	MTBE
3MP	3-Methylpentane
1HEX	1-Hexene
C6	Hexane
DIPE	Diisopropyl Ether (DIPE)
ETBE	Ethyl Tertiary Butyl Ether (ETBE)
22DMP	2,2-Dimethylpentane
MCYP	Methylcyclopentane
24DMP	2,4-Dimethylpentane
12DCA	1,2-Dichloroethane
CH	Cyclohexane
2MH	2-Methylhexane
B	Benzene
23DMP	2,3-Dimethylpentane
THIO	Thiophene
3MH	3-Methylhexane
TAME	TAME
1H	1-Heptene/1,2-DMCP (trans)
ISO	Isooctane
C7	Heptane

Abbrev.	Analyte
MCYH	Methylcyclohexane
25DMH	2,5-Dimethylhexane
24DMH	2,4-Dimethylhexane
223TMP	2,2,3-Trimethylpentane
234TMP	2,3,4-Trimethylpentane
233TMP	2,3,3-Trimethylpentane
23DMH	2,3-Dimethylhexane
3EH	3-Ethylhexane
2MHEP	2-Methylheptane
3MHEP	3-Methylheptane
T	Toluene
2MTHIO	2-Methylthiophene
3MTHIO	3-Methylthiophene
1O	1-Octene
C8	Octane
12DBE	1,2-Dibromoethane
EB	Ethylbenzene
2ETHIO	2-Ethylthiophene
MPX	p/m-Xylene
1N	1-Nonene
C9	Nonane[7]
STY	Styrene
OX	o-Xylene
IPB	Isopropylbenzene
PROPB	n-Propylbenzene
1M3EB	1-Methyl-3-ethylbenzene
1M4EB	1-Methyl-4-ethylbenzene
135TMB	1,3,5-Trimethylbenzene
1D	1-Decane
1M2EB	1-Methyl-3-isopropylbenzene

Abbrev.	Analyte
C10	Decane[7]
124TMB	1,2,4-Trimethylbenzene
SECBUT	sec-Butylbenzene
1M3IPB	1-Methyl-3-isopropylbenzene
1M4IPB	1-Methyl-4-isopropylbenzene
1M2IPB	1-Methyl-2-isopropylbenzene
IN	Indan
1M3PB	1-Methyl-3-propylbenzene
1M4PB	1-Methyl-4-propylbenzene
BUTB	n-Butylbenzene
12DM4EB	1,2-Dimethyl-4-ethylbenzene
12DEB	1,2-Diethylbenzene
1M2PB	1-Methyl-2-propylbenzene
14DM2EB	1,4-Dimethyl-2-ethylbenzene
C11	Undecane[7]
13DM4EB	1,3-Dimethyl-4-ethylbenzene
13DM5EB	1,3-Dimethyl-5-ethylbenzene
13DM2EB	1,3-Dimethyl-2-ethylbenzene
12DM3EB	1,2-Dimethyl-3-ethylbenzene
1245TMP	1,2,4,5-Tetramethylbenzene
PENTB	Pentylbenzene
C12	Dodecane[7]
N0	Naphthalene [8]
BT0	Benzothiophene[8]
MMT	MMT
C13	Tridecane[7]
2MN	2-Methylnaphthalene[8]
1MN	1-Methylnaphthalene[8]

Target Detection Limit

Sediment/Soil = 0.1 – 10 ng/g

Water = 0.2 - 2.0 µg/L

Target Reporting Limit

Oil = 2 mg/kg

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[7] These compounds are also included on the Table 1.1b target analyte list of saturate hydrocarbons. Because of the extraction technique, the GC-FID method for hydrocarbons is the preferred method, rather than this volatile method. Thus, if a sample location is analyzed for both saturate hydrocarbons by GC-FID and VOC the result from the GC-FID analysis will be noted in the database as the preferred result.

[8] These compounds are also included on the Table 1.1a target analyte list of PAH compounds. Because of the extraction technique, the PAH analysis is the preferred method, rather than this volatile method. Thus, if a sample location is analyzed for both PAH and VOC the result from the PAH analysis will be noted in the database as the preferred result.

TABLE 1.1e
Petroleum Biomarkers for Quantitative Analysis

Compound [1]	Quant Ion m/z
C23 Tricyclic Terpane (T4)	191
C24 Tricyclic Terpane (T5)	191
C25 Tricyclic Terpane (T6)	191
C24 Tetracyclic Terpane (T6a)	191
C26 Tricyclic Terpane-22S (T6b)	191
C26 Tricyclic Terpane-22R (T6c)	191
C28 Tricyclic Terpane-22S (T7)	191
C28 Tricyclic Terpane-22R (T8)	191
C29 Tricyclic Terpane-22S (T9)	191
C29 Tricyclic Terpane-22R (T10)	191
18a-22,29,30-Trisnorneohopane-Ts (T11)	191
C30 Tricyclic Terpane-22S (T11a)	191
C30 Tricyclic Terpane-22R (T11b)	191
17a(H)-22,29,30-Trisnorhopane-Tm (T12)	191
17a/b,21b/a 28,30-Bisnorhopane (T14a)	191
17a(H),21b(H)-25-Norhopane (T14b)	191
30-Norhopane (T15)	191
18a(H)-30-Norneohopane-C29Ts (T16)	191
17a(H)-Diahopane (X)	191
30-Normoretane (T17)	191
18a(H)&18b(H)-Oleananes (T18)	191
Hopane (T19)	191
Moretane (T20)	191
30-Homohopane-22S (T21)	191
30-Homohopane-22R (T22)	191
30,31-Bishomohopane-22S (T26)	191
30,31-Bishomohopane-22R (T27)	191
30,31-Trishomohopane-22S (T30)	191
30,31-Trishomohopane-22R (T31)	191

Compound	Quant ion m/z
Tetrakishomohopane-22S (T32)	191
Tetrakishomohopane-22R (T33)	191
Pentakishomohopane-22S (T34)	191
Pentakishomohopane-22R (T35)	191
13b(H),17a(H)-20S-Diacholestane (S4)	217
13b(H),17a(H)-20R-Diacholestane (S5)	217
13b,17a-20S-Methyldiacholestane (S8)	217
14a(H),17a(H)-20S-Cholestane (S12)	217
14a(H),17a(H)-20R-Cholestane (S17)	217
13b,17a-20R-Ethyldiacholestane (S18)	217
13a,17b-20S-Ethyldiacholestane (S19)	217
14a,17a-20S-Methylcholestane (S20)	217
14a,17a-20R-Methylcholestane (S24)	217
14a(H),17a(H)-20S-Ethylcholestane (S25)	217
14a(H),17a(H)-20R-Ethylcholestane (S28)	217
14b(H),17b(H)-20R-Cholestane (S14)	217
14b(H),17b(H)-20S-Cholestane (S15)	217
14b,17b-20R-Methylcholestane (S22)	217
14b,17b-20S-Methylcholestane (S23)	217
14b(H),17b(H)-20R-Ethylcholestane (S26)	217
14b(H),17b(H)-20S-Ethylcholestane (S27)	217
C26,20R- +C27,20S- triaromatic steroid	231
C28,20S-triaromatic steroid	231
C27,20R-triaromatic steroid	231
C28,20R-triaromatic steroid	231

[1] Peak identification provided in parentheses.

Target Detection Limit

Sediments/Soil = 2 ug/Kg dry weight
Waters = 10 ng/L[A2]

Target Reporting Limit

Oil = 2 mg/Kg

TABLE 1.1f
Suggested Hydrocarbon Groups and Petroleum Biomarkers for Qualitative Analysis (monitoring mass/charge ion)

n-Alkycyclohexanes (m/z 83)
n-Alkanes (m/z 85)
Diamondoids (m/z 135, 187)
Sesquiterpanes (m/z 109, 123)
Isoprenoids (m/z 183)
Triterpanes (m/z 191)
Regular Steranes (m/z 217)
Rearranged β,β-steranes (m/z 218)
Methyl steranes (m/z 232, 245)
Methyl and triaromatic steranes (m/z 231)
Monoaromatic steranes (m/z 253)
Diasteranes (m/z 259)

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 Assessment Manager

Greg Baker
Office of Response and Restoration
NOAA
[redacted]

The Assessment Manager is the designated natural resource trustee representative who is responsible for the review and acceptance of specific work plans and associated QA plans.

2.2 Project Coordinator

Mark Curry
Industrial Economics, Inc. (IEc)
[redacted]

The Project Coordinator is responsible for administration of the contracts with the laboratory(ies). The Project Coordinator will oversee the proper scheduling and transmittal of the data from the time of sampling to data reporting.

2.3 Quality Assurance

Ann Bailey is the QA Coordinator reporting directly to the Assessment Manager. Ms. Bailey is responsible for the implementation of this Analytical QA Plan. She will receive assistance in the coordination and performance of laboratory technical audits and independent data validation from the QA Contractor (EcoChem). The QA Coordinator has the authority and responsibility to cease or temporarily halt activities not in keeping with this QA Plan. The QA Coordinator will work closely with laboratory representatives and the project team to assure that project and data quality objectives are met. The QA Coordinator may be reached at:

Ann Bailey
EcoChem, Inc.
[redacted]

Cheryl Randle is a QA Reviewer conducting data validation on behalf of BP America. Ms. Randle is responsible for working closely with the Assessment Manager's QA Coordinator to assure the validity

of the final data in accordance with this Analytical QA Plan. The QA Reviewer will conduct spot validation of up to 25 percent of the reported data, unless substantial problems are discovered in which case up to 100 percent validation may be performed. The QA Reviewer may be reached at:

Cheryl Randle
ENTRIX, Inc.
[redacted]

2.4 Analytical Laboratories

The laboratories planned to be contracted at this time for analytical work in support of the NRDA are TDI-Brooks B&B Laboratories (B&B), Newfields/Alpha Analytical (Alpha), and Columbia Analytical Services (CAS). The laboratory project managers are responsible for assuring that all analyses performed meet project and measurement quality objectives. The Laboratory Project Managers are:

Juan Ramirez
TDI-Brooks B&B Laboratories
[redacted]

Liz Porta
Alpha Analytical
[redacted]

Greg Salata, PhD.
Columbia Analytical Services (CAS)
[redacted]

As additional analytical laboratories are brought under contract this QAP will be updated to include their names and project managers.

3.0 SAMPLE HANDLING AND CHAIN OF CUSTODY PROCEDURES

Chain of custody procedures will be used for all samples throughout the analytical process and for all data and data documentation, whether in hard copy or electronic format. Sampling procedures, including sample collection and documentation, are part of the work plans of the individual projects and as such, are not considered here.

3.1 Sample Preservation and Holding Times

Sample preservation and field treatment of samples for analyses should be described in relevant field work plans. Based on EPA guidance, "advisory" sample holding times prior to analysis and holding times for the extracts are presented below. These holding times may be extended or preservation guidance changed, as options are assessed.

Matrix	Storage for Samples	Holding Time to Extraction	Holding Time for Extracts/Analysis
Water for PAH, SHC/TEH, Biomarkers	Refrigeration 4°± 2C; Optional: Preserved with 1:1 HCl to pH<2	7 days if not acid preserved; 14 days if acid preserved	40 days from extraction[9]; except biomarkers no holding time
Water for VOC	Refrigeration 4°± 2C with no headspace; Optional: Preserved with HCl in the field in VOA vial.	Not Applicable	7 days if not acid preserved; 14 days if acid preserved
Filters for PAH, SHC/TEH, Biomarkers	Frozen	1 Year	40 days from extraction[9]; except biomarkers no holding time
Sediment/Soil for PAH, SHC/TEH, Biomarkers[A3]	Frozen, except grain size at 4°C (not frozen)	1 Year	40 days from extraction[9]; except biomarkers no holding time
Tissue for PAH, SHC/TEH, Biomarkers	Frozen	1 Year	40 days from extraction[9]; except biomarkers no holding time
Vegetation for PAH, SHC/TEH, Biomarkers	Frozen	1 Year	40 days from extraction[9]; except biomarkers no holding time
Inert Sorbent Material for PAH, SHC/TEH, Biomarkers	Frozen	1 Year	40 days from extraction[9]; except biomarkers no holding time
Oil/Oily Debris for PAH, SHC/TEH, Biomarkers	Refrigeration <6°C	No holding time	40 days from extraction[9]; except biomarkers no holding time

[9] 40 days is an advisory extraction holding time. Extracts should be held at -20C in the dark, and may be analyzed past 40 days and results not qualified if surrogates are within criteria.

3.2 Chain of Custody

Chain of custody records will be completed in ink.

A sample is considered in "custody" if:

- it is in the custodian's actual possession or view, or
- it is retained in a secured place (under lock) with restricted access, or
- it is placed in a container and secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s).

Samples are kept in the custody of designated sampling and/or field personnel until shipment.

3.4 Sample Shipping

Any transfer or movement of samples will use chain of custody procedures. The original signed and dated chain of custody record accompanies the sample(s); a copy is retained by the sample shipper. All shipments will comply with DOT regulations (*49CFR, Parts 172 and 173*).

3.5 Sample Receipt

Immediately upon receipt of samples, the recipient will review the shipment for consistency with the accompanying chain of custody record and sample condition, before signing and dating the chain of custody record. Sample condition(s) will be noted on the laboratory's sample receipt form and maintained with the chain of custody records. If there are any discrepancies between the chain of custody record and the sample shipment, the recipient will contact the sample shipper immediately in an attempt to reconcile these differences. Reconciliation of sample receipt differences will be maintained with the chain of custody records and discussed in the laboratory narrative which accompanies the data report.

3.6 Intra-Laboratory Sample Transfer

The laboratory sample custodian or designee will maintain a laboratory sample-tracking record, similar to the chain of custody record that will follow each sample through all stages of laboratory processing. The sample-tracking record will show the name or initials of responsible individuals, date of sample extraction or preparation, and sample analysis.

3.7 Inter-Laboratory Sample Transfer

Transfer of samples from one analytical laboratory to another, e.g. for grain size or TOC analysis, will follow chain of custody, sample shipping and receipt procedures described above. Transfer of samples between laboratories will be noted in the laboratory case narrative which accompanies the data report.

3.8 Sample Archival

All unanalyzed samples and unutilized sample aliquots or extracts will be held by the laboratory in a manner to preserve sample integrity at a secure location with chain of custody procedures for one (1) year after the QA Contractor has validated the data package for that particular set of samples. All archived materials will be accessible for review upon request. At the end of the archival period, the laboratory shall contact the QA Coordinator to obtain directions for handling remaining samples. The samples will not be disposed of by the laboratory unless provided with written approval from the Assessment Manager.

3.9 Data and Data Documentation

The laboratories will provide the QA Contractor with hardcopy data tables, QC documentation, and instrument printouts suitable for QA assessment/data validation. Required laboratory deliverables are listed in **Table 7.1**. Data packages will include all related instrument print-outs ("raw data") and bench sheets. A copy of the data and data documentation developed by the laboratory for a given data package will be kept by the laboratory in a secure location using chain of custody procedures for five (5) years after the QA Contractor has validated that data package. All archived data and documentation will be accessible for review upon request. These materials will become the responsibility of the Assessment Manager upon termination of the archival period.

The original data will be transferred from the laboratory to the QA Contractor by means such that a signature is required at the time of document delivery. The QA Contractor will document receipt of packages and maintain a record of the method and date of data submittal with the complete data package. The QA Contractor will maintain the copy of the data packages and related validation documentation in a secure location for a period of one (1) year from the date of validation. These materials will become the responsibility of the Assessment Manager upon termination of the archival period.

4.0 LABORATORY OPERATIONS

All laboratories providing analytical support for the MC252 Damage Assessment must have the appropriate facilities to store and prepare samples, and appropriate instrumentation and staff to provide data of the required quality within the time period dictated. Laboratories are expected to conduct operations using good laboratory practices, including:

- Training and appropriate certification of personnel.
- A program of scheduled maintenance of analytical balances, laboratory equipment and instrumentation.
- Routine checking of analytical balances using a set of standard reference weights (ASTM class, NIST Class S-1, or equivalents).
- Recording all analytical data in secure electronic system with date and associated analyst identification, and/or logbooks with each entry signed and dated by the analyst.

- Monitoring and documenting the temperatures of cold storage areas and freezer units.

Laboratory operations may be evaluated by the QA Coordinator through technical systems audits, performance evaluation studies, and performance in a NIST-managed intercomparison program. Personnel in any laboratory performing analyses for this damage assessment should be well versed in good laboratory practices, including standard safety procedures. It is the responsibility of the laboratory manager and /or supervisor to ensure that safety training is mandatory for all laboratory personnel. The laboratory is responsible for maintaining a current safety manual in compliance with the Occupational Safety and Health Administration (OSHA) or equivalent state or local regulations. Proper procedures for safe storage, handling and disposal of chemicals should be followed at all times; each chemical should be treated as a potential health hazard and good laboratory practices should be implemented accordingly.

4.1 Quality Assurance Documentation

All laboratories must have the latest revision of the MC 252 NRDA Analytical QA Plan. In addition, the following documents and information must be current and available to all laboratory personnel participating in the processing of MC 252 samples:

- Laboratory Quality Assurance Management Plan
- Laboratory Standard Operating Procedures (SOPs) – Detailed instructions for performing routine laboratory procedures.
- Control charts or data tables – These must be developed and maintained throughout the project for appropriate analyses and measurements, including:
  - Alkyl PAH pattern book for MC252 reference oil.

4.2 Laboratory Systems Audits

Prior to or during sample analysis, QA systems audits will be performed. The laboratory audits will be conducted by the QA Coordinator or designee. The checklists used for the laboratory audits are based on requirements outlined in "Good Laboratory Practice Standards" (*40 CFR Part 792*) and audit procedures of the EPA National Enforcement Investigations Center, "NEIC Procedures Manual for the Contract Evidence Audit and Litigation Support for EPA Enforcement Case Development" (*EPA 330/9-89-002*). The Laboratory Project Managers will be informed of the findings and recommendations of the audit before the auditors leave the facility. A written report discussing the audits will be submitted to the Assessment Manager.

Additional laboratory audits may be performed at any time throughout the duration of the NRDA.

4.3 Participation in Intercomparison Exercises

Each analytical laboratory performing analysis will be required to participate in potential intercomparison exercises that may be organized by NS&T and/ or NIST during the duration of the laboratory's participation in this NRDA analytical program. A variety of samples including sample

extracts and representative matrices (e.g., sediment or tissue samples) may be utilized in these exercises. Laboratories are required to analyze only those matrices or analytes that they are providing in like manner for the NRDA analytical program. When participating in the intercomparison exercise, the laboratory should analyze the sample(s) in the same manner as routinely performed for this NRDA and as specified in this Analytical QA Plan. Laboratories which fail to achieve acceptable performance will be required to provide an explanation to the QA Coordinator and/or undertake appropriate corrective actions.

5.0 ASSESSMENT OF DATA QUALITY

The purpose of this Analytical QA Plan is to develop and document analytical data of known, acceptable, and defensible quality. The quality of the data is presented as a set of statements that describe in precise quantitative terms the level of uncertainty that can be associated with the data without compromising their intended use. These statements are referred to as Data Quality Objectives (DQOs) and are usually expressed in terms of precision, bias, sensitivity, completeness, and comparability.

5.1 Precision

Precision is the degree of mutual agreement among individual measurements of the same property under prescribed similar conditions, such as replicate measurements of the same sample. Precision is concerned with the "closeness" of the results. Where suitable reference materials (RMs) are available, precision will be expressed as the relative standard deviation (RSD) for the repeated measurements. This use of RMs allows for the long-term measurement of precision but does not include sample heterogeneity as a source of analytical variability.

In addition to the tracking precision of replicate RM analyses, precision will be expressed as the relative percent difference (RPD) between a pair of replicate data from environmental samples prepared and analyzed in duplicate.

5.2 Bias

Bias is the degree of agreement of a measurement with an accepted reference value and may be expressed as the difference between the two measured values or as a percentage of the reference value.

The primary evaluation of bias will be through the use of RMs. RMs with certified values (from NIST or a similar source) will be used if they are available. The laboratory will maintain control charts to track the RM performance. Spiked matrix samples will also be analyzed to assess bias for those analytes that are not available in suitable reference materials.

5.3 Comparability

Comparability expresses the confidence with which one data set can be evaluated in relationship to another data set. Comparability of the chemical analytical data is established through the use of:

- Program-defined general analytical methodology (e.g., low resolution MS), detection limits, bias and precision requirements and reporting formats;
- NIST-traceable calibration materials;
- Reference material with each sample batch;
- Analysis of a common "reference oil".

5.4 Completeness

Completeness is a measure of the proportion of data specified in the sampling plan which is determined to be valid. Completeness will be assessed by comparing the number of valid sample results to the total number of potential results planned to be generated. The DQO for completeness is 95%, i.e. no more than 5% of the analytical data missing or qualified as unreliable (rejected).

6.0 QUALITY CONTROL PROCEDURES

No particular analytical methods are specified for this project, but the QA/QC requirements will provide a common foundation for each laboratory's protocols. This "common foundation" includes: (1) the specification of the analytes to be identified and quantified and the minimum sensitivity of the analytical methods and (2) the use of NIST reference materials, and (3) the use of a common MC252 Reference Oil.

Prior to the analysis of samples, each laboratory must provide written protocols for the analytical methods to be used; calculate detection limits for each analyte in each matrix of interest and establish an initial calibration curve in the appropriate concentration range for each analyte. The laboratory must demonstrate its continued proficiency by participation in refereed intercomparison exercises (as available) and repeated analyses of reference materials, calibration checks, and laboratory method blanks. Laboratories will be expected to take corrective actions promptly if measurement quality objectives described in this plan are not met.

A laboratory may be audited at any time to determine and document that they have the capability to analyze the samples and can perform the analyses in compliance with the QA plan. Independent data validation will be undertaken promptly after analyses of each sample batch to verify that measurement quality objectives are met. The data validator will discuss any unacceptable findings with the laboratory as soon as possible, and assist the laboratory in developing a satisfactory solution to the problem.

6.1 Standard Operating Procedures for Analytical Methods

Prior to the analysis of field samples, each laboratory is required to submit to the QA Coordinator for review and approval, written Standard Operating Procedures (SOPs) detailing the procedures used in sample receipt and handling, sample preparation and analysis, data reduction and reporting. Once approved, the SOPs for each analytical method and from each analytical laboratory will be archived with this plan as part of the QA documentation[A4].

6.2 Determination of Method Detection Limit, Quantitation Range, and Reporting Limits

The analytical laboratory will establish and report a method detection limit (MDL) for each analyte of interest in each matrix, with the exception of oil for which MDLs cannot be accurately determined. The target detection ranges or limits are specified in **Tables 1.1a – 1.1e**. The actual MDLs will be established by following the method in *40CFR part 136*. Results less than 10X the MDL or less than the lowest calibration standard (whichever is lower) will not be required to meet the measurement quality objectives (MQOs) for precision and bias, because these results may be outside the "quantitation range". Thus, these results will be flagged by the laboratory with a "J", to indicate the results are possibly estimates and are not required to meet the MQOs. If the analyte is not detected in a sample, the result will be reported as non-detected at the MDL, adjusted for sample-specific preparation and analysis factors, and flagged with a "U".

Reporting limits for the supporting analyses (percent moisture, percent total extractable organics [TEO], total organic carbon, and grain size) will be 0.01%. The reporting limit will be demonstrated by the laboratory to be greater than 5X the detection limit.

Target detection limits, as shown in the bottom of Tables 1.1a through 1.1e, may not be met due to required dilutions, interferences, and/or limited sample size. If a laboratory method detection limit does not meet the target detection limit, the reason for the elevated detection limits should be discussed in the laboratory case narrative.

6.3 Quality Control Criteria

MQOs and required minimum frequency of analysis for each QC element or sample type are summarized in **Tables 6.1a – 6.1g**. The analytical laboratory will determine when MQOs have not been met, and perform appropriate corrective actions before continuing the analyses or reporting of the data. If the "Corrective Action" in the Method Performance Criteria table states "Resolve before proceeding", the laboratory must perform an adjustment to the analytical process and subsequently demonstrate the criteria will be met before proceeding with analysis for project samples. In addition, if results associated with a non-compliant QC element have been obtained, the laboratory must repeat those analyses until acceptable QC results are obtained. If the laboratory determines the non-compliance does not affect the quality of the data, the laboratory will discuss the non-compliance and the rationale, used to conclude the data are not affected, in the case narrative which accompanies the data report. If the laboratory determines the non-compliance is due to interferences or circumstances

outside the laboratory's control, the laboratory will discuss the reason for the non-compliance in the case narrative and the results reported.

At this time, no criteria for evaluating the target analyte concentrations in the MC252 Reference Oil have been established. Chromatographic resolution criteria for specific compound (peaks) are specified in tables 6.1a through 6.1e and Table 6.1g below. When additional criteria are developed they will be added to this Analytical QAP.

TABLE 6.1a
Method Performance Criteria for Extended PAH (Parent and Alkyl Homologs) and Related Compounds

Element or Sample Type	Minimum Frequency	Measurement Quality Objective/ Acceptance Criteria	Corrective Action
Tuning	Prior to every sequence	Tune as specified in laboratory SOP	Resolve before proceeding.
Initial Calibration (All parent PAH and selected alkyl homologue PAH)	Prior to every sequence, or as needed based on continuing calibration/verification check.	5-point calibration curve over two orders of magnitude %RSD ≤ 20	Resolve before proceeding.
Continuing Calibration (CCAL)	Every 12 hours or every 12 field samples	%D ≤ 25 for 90% of analytes %D ≤ 35 for 10% of analytes	Perform instrument maintenance. Re-analyze affected samples.
Initial Calibration Verification (Second Source or can be met if CCAL is second source)	Per initial calibration	%R target analytes 80-120%	Resolve before proceeding.
Matrix SRM 1941b for sediment; SRM 1974b for tissue	One per batch/every 20 field samples	Within ±20% of NIST 95% uncertainty range for analytes within the quantitation range. 2 analytes may be greater than 20% outside, however average %D must be <35%	Resolve before proceeding.
Oil SRM 1582 (Oil and Water only)	One per batch of oil/every 20 field samples	Within ±20% of NIST 95% uncertainty range for analytes within the quantitation range. 2 analytes may be greater than 20% outside, however average %D must be <35%	Resolve before proceeding.
MC 252 Reference Oil	One per batch/every 20 field samples	Peak resolution >80% of 9-methylphenanthrene from 1-methylphenanthrene (m/z 192). Plus additional criteria to be developed.	Resolve before proceeding.
Matrix Spike/Matrix Spike Duplicate (Sediments, Soils, Tissues only)	One per batch/every 20 field samples	%R 50% - 125% for target analytes detected at >5X the spiked amount; RPD ≤30%, except biphenyl (40%-140%) and decalin (25%-125%)	Evaluate impact to data, discuss with manager, determine if corrective action is needed.
Blank Spike/Blank Spike Duplicate (Aqueous Samples)	One per batch/every 20 field samples	%R 50% - 125% for target analytes, RPD ≤30%, except biphenyl (40%-140%) and decalin (25%-125%)	Resolve before proceeding.
Method Blank	One per batch/every 20 field samples	No more than 2 analytes to exceed 5x target MDL unless analyte not detected in associated samples(s) or analyte concentration >10x blank value	Resolve before proceeding. QA coordinator may be contacted to resolve issues surrounding 'minor exceedance'.
Sample Duplicate (not required for water matrix)	One per batch/every 20 field samples	RPD ≤ 30% if analyte concentration is greater than QL	Evaluate impact to data, discuss with manager, and determine if corrective action is needed.
Mass Discrimination	Initial calibration and CCVs (mid-level)	Ratio for the raw areas of Benzo[g,h,i]perylene to phenanthrene ≥0.70	Resolve before proceeding.
Internal Standard (IS)	Every sample	50% - 200% of the area of the IS in the associated calibration standard	Resolve before proceeding.
Surrogates	Every sample	%R 40-120% except d12-perylene which is 10-120%	Re-extract affected samples. Evaluate impact to data, discuss with manager, if corrective action is needed.

TABLE 6.1b
Method Performance Criteria for Alkanes/Isoprenoids Compounds and Total Extractable Hydrocarbons

Element or Sample Type	Minimum Frequency	Measurement Quality Objective/ Acceptance Criteria	Corrective Action
Initial Calibration (Standard solution - all target analytes, except phytane, and C_{31}, C_{33}, C_{35}, and C_{39} n-alkanes)	Prior to every sequence, or as needed based on continuing calibration/verification check.	5-point calibration curve %RSD ≤ 20	Resolve before proceeding.
Continuing Calibration (CCAL)	Every 12 hours or every 12 field samples	%D ≤ 15 for 90% of analytes %D ≤ 20 for 10% of analytes	Perform Instrument Maintenance. Re-analyze affected samples.
Initial Calibration Verification (Second Source or can be met if CCAL is second source)	Per initial calibration	%R target analytes 80-120%	Resolve before proceeding.
SRMs - no SRMs for SHC or TPH are available at this time			
MC 252 Reference Oil	One per batch/every 20 field samples	Peak resolution >80% of n-C17 from pristine; Add'l criteria to be developed.	Resolve before proceeding.
Matrix Spike/Matrix Spike Duplicate (Sediments, Soils, Tissues only)	One per batch/every 20 field samples	%R 50% - 125% for target analytes detected at >5X the spiked amount; RPD ≤30%.	Evaluate impact to data, discuss with manager, determine if corrective action is needed.
Blank Spike/Blank Spike Duplicate (Aqueous Samples)	One per batch/every 20 field samples	%R 50% - 125% for target analytes, RPD ≤30%.	Resolve before proceeding.
Method Blank	One per batch/every 20 field samples	No more than 2 analytes to exceed 5x target MDL unless analyte not detected in associated samples(s) or analyte concentration >10x blank value	Resolve before proceeding. QA coordinator may be contacted to resolve issues surrounding 'minor exceedances'.
Duplicate Sample Analysis (not required for water matrix)	One per batch/every 20 field samples	RPD ≤ 30% if analyte concentration is greater than QL	Evaluate impact to data, discuss with manager, determine if corrective action is needed.
Mass Discrimination	Initial calibration and CCVs (mid-level)	Ratio for the raw areas of n-C36 / n-C20 ≥0.70	Resolve before proceeding.
Surrogates	Every sample	%R 40-125%	Re-extract affected samples. Evaluate impact to data, discuss with manager, determine if corrective action is needed.

TABLE 6.1c
Method Performance Criteria for VOCs

Element or Sample Type	Minimum Frequency	Measurement Quality Objective/ Acceptance Criteria	Corrective Action
Tuning	Prior to every sequence	Per SW846 8260B	Resolve before proceeding
Initial Calibration (ICAL)	Prior to every sequence, or as needed based on continuing calibration/verification check.	Minimum of 5 concentration levels %RSD ≤ 25% for 90% of analytes %RSD ≤ 35% for all analytes >C6	Resolve before proceeding.
Continuing Calibration (CCAL)	Every 12 hours or every 12 field samples	%D ≤ 25% for 90% of analytes %D ≤ 35% for all analytes >C6 Except t-butanol <50%	Perform Instrument Maintenance. Re-analyze affected samples.
Initial Calibration Verification (Second Source or can be met if CCAL is second source)	Per initial calibration	%R target analytes 80-120%. Except 2 analytes can be at 60 - 140%	Resolve before proceeding.
SRMs – No SRMs are available at this time			
MC 252 Reference Oil	One per batch/every 20 field samples	To Be Determined	Resolve before proceeding.
Matrix Spike/Matrix Spike Duplicate (Sediments, Soils)	One per batch/every 20 field samples	%R 50% - 130% for target analytes detected at >5X the spiked amount; RPD ≤30%.	Evaluate impact to data, discuss with manager, determine if corrective action is needed.
Blank Spike/Blank Spike Duplicate (Aqueous Samples)	One per batch/every 20 field samples	%R 50% - 130% for target analytes, RPD ≤30%.	Resolve before proceeding.
Method Blank	One per batch/every 20 field samples	No more than 2 analytes to exceed 5x target MDL unless analyte not detected in associated samples(s) or analyte concentration >10x blank value	Resolve before proceeding. QA coordinator may be contacted to resolve issues surrounding 'minor exceedances'.
Sample Duplicate	One per batch/every 20 field samples	RPD ≤ 30% if analyte concentration is greater than QL	Evaluate impact to data, discuss with manager, determine if corrective action is needed.
Internal Standard (IS)	Every sample	50% - 200% of the area of the IS in the associated calibration standard	Resolve before proceeding.
Surrogates	Every sample	%R 70-130%	Re-extract or re-analyze affected samples. Evaluate impact to data, discuss with manager, determine if corrective action is needed.

TABLE 6.1d
Draft Method Performance Criteria for Quantitative Biomarkers

Element or Sample Type	Minimum Frequency	Measurement Quality Objective/ Acceptance Criteria	Corrective Action
Tuning	Prior to every sequence	Tune as specified in laboratory SOP	Resolve before proceeding.
Initial Calibration	Prior to every sequence, or as needed based on continuing calibration/verification check.	5-point calibration curve over two orders of magnitude %RSD ≤ 20	Resolve before proceeding.
Continuing Calibration (CCAL)	Every 12 hours or every 12 field samples	%D ≤ 25 for 90% of analytes %D ≤ 35 for 10% of analytes	Perform instrument maintenance. Re-analyze affected samples.
Oil SRM 1582 (Oil and Water only)	One per batch of oil/every 20 field samples	Biomarker concentrations are not certified; Peak resolution (*m/z* 191) of: (a) oleanane (T18) from hopane (T19); (b) C26 Tricyclic Terpane stereoisomers 22R (T6b) from 22S (T6c) and from C24 Tetracyclic Terpane (T6a)	Resolve before proceeding.
MC 252 Reference Oil	One per batch/every 20 field samples	Peak resolution (*m/z* 191): 30-Norhopane (T15) from 30-Norneohopane (T16) from Diahopane (X). Add'l. criteria To Be Determined.	Resolve before proceeding.
Method Blank	One per batch/every 20 field samples	No more than 2 analytes to exceed 5x target MDL unless analyte not detected in associated samples(s) or analyte concentration >10x blank value	Resolve before proceeding. QA coordinator may be contacted to resolve issues surrounding 'minor exceedance'.
Sample Duplicate	One per batch/every 20 field samples	RPD ≤ 30% if analyte concentration is greater than QL	Evaluate impact to data, discuss with manager, and determine if corrective action is needed.
Internal Standard (IS)	Every sample	50% - 200% of the area of the IS in the associated calibration standard	Resolve before proceeding.
Surrogate	Every sample	%R 40-120%	Evaluate impact to data, discuss with manager, if corrective action is needed.

TABLE 6.1e
Draft Method Performance Criteria for Qualitative Biomarkers

Element or Sample Type	Minimum Frequency	Measurement Quality Objective/ Acceptance Criteria	Corrective Action
Oil SRM 1582 (Oil and Water only)	One per batch of oil/every 20 field samples	Peak resolution (m/z 191) of: (a) oleanane (T18) from hopane (T19); (b) C26 Tricyclic Terpane stereoisomers 22R (T6b) from 22S (T6c) and from C24 Tetracyclic Terpane (T6a)	Resolve before proceeding.
MC 252 Reference Oil	One per batch/every 20 field samples	Peak resolution (*m/z* 191): 30-Norhopane (T15) from 30-Norneohopane (T16) from Diahopane (X). Add'l. criteria To Be Determined.	Resolve before proceeding.
Method Blank	One per batch/every 20 field samples	No interference with biomarker patterns	Resolve before proceeding. QA coordinator may b contacted to resolve issues surrounding 'minor exceedance'.
Sample Duplicate	One per batch/every 20 field samples	Qualitative comparison meets laboratory SOP	Evaluate impact to data, discuss with manager, an determine if corrective action is needed.

TABLE 6.1f
Method Performance Criteria for General/Conventional Chemistry

Conventional Sediment Variables: Total Organic Carbon (TOC), Grain Size, Total Solids
Tissues: Total Extractable Organics (TEO)

QC Element or Sample Type	Minimum Frequency	Acceptance Criteria	Relevant Parameter(s) Reference Methods [1]
Initial Calibration	Prior to analysis (method specific procedure & standards)	Correlation coefficient (r) >0.995	TOC
Continuing Calibration	Must start and end analytical sequence and every 10 samples	%D ≤ 10%	TOC
Method Blank	One per batch/every 20 field samples	Not to exceed QL	TOC, TEO
Blank Spike Samples(s)	One per batch/every 20 field samples	%R 75% - 125% RPD ≤ 25%	TOC
Matrix Spike Sample (s)	One per batch/every 20 field samples	%R 75% - 125% RPD ≤ 25% if analyte concentration is greater than QL	TOC
Sample Duplicate	One per batch/every 20 field samples	RPD ≤ 25% if analyte concentration is greater than QL	TOC, Grain Size, TS, TEO
Reference Material (if available)	One per batch/every 20 field samples	Values must be within ±20% of NIST uncertainty range	TOC, TEO

1. Reference Methods

TOC	Plumb 1981/SW 846, Method 9060A
Grain Size	ASTM D422 (gravel, coarse sand, medium soil, very fine soil, and silt/clay)
TS (percent)	EPA 160.3

Method 9000 series - analytical methods from SW-846 (U.S. EPA 1986) and updates
The SW-846 and updates are available from the web site at: http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm
Plumb (1981) - U.S. EPA/U.S. Army Corps of Engineers Technical Report EPA/CE-81-1

TABLE 6.1g
Draft Method Performance Criteria for Analysis of Dioctylsulfosuccinate sodium salt (DOSS)

Element or Sample Type	Minimum Frequency	Measurement Quality Objective/ Acceptance Criteria	Corrective Action
Initial Calibration	Prior to every sequence, or as needed based on continuing calibration/verification check.	5-point calibration curve over two orders of magnitude %RSD ≤ 20	Resolve before proceeding.
Continuing Calibration (CCAL)	Every 12 hours	%D ≤ 30	Perform instrument maintenance. Re-analyze affected samples.
Initial Calibration Verification (Second Source or can be met if CCAL is second source)	Per initial calibration	%R target analytes 70-130%	Resolve before proceeding.
MC 252 Reference Oil	One per batch/every 20 field samples	Criteria to be developed	Resolve before proceeding.
Matrix Spike/Matrix Spike Duplicate (Sediments, Soils, Tissues only)	One per batch/every 20 field samples	%R 50% - 125% if sample concentration detected at >5X the spiked amount; RPD ≤30%	Evaluate impact to data, discuss with manager, determine if corrective action is needed.
Blank Spike/Blank Spike Duplicate (Aqueous Samples)	One per batch/every 20 field samples	%R 50% - 125; RPD ≤30%	Resolve before proceeding.
Method Blank	One per batch/every 20 field samples	Not to exceed 5x target MDL unless analyte not detected in associated samples(s) or analyte concentration >10x blank value	Resolve before proceeding.
Sample Duplicate (not required for water matrix)	One per batch/every 20 field samples	RPD ≤ 30% if analyte concentration is greater than QL	Evaluate impact to data, discuss with manager, and determine if corrective action is needed.
Internal Standard (IS)	Every sample	50% - 200% of the area of the IS in the associated calibration standard	Resolve before proceeding.
Surrogates	Every sample	%R 40-120%	Re-extract affected samples. Evaluate impact to data, discuss with manager, if corrective action is needed.
			[A5]

6.3.1 Initial Calibration

Acceptable calibration (initial and continuing) must be established and documented before sample analyses may begin. NIST-traceable calibration materials must be used where available in establishing calibration. Initial calibrations will be established according to the criteria in **Tables 6.1a – 6.1d , 6.1f and 6.1g**. A specific requirement for this project is to use methodology (and tune instrumentation) for low detection limits, therefore, samples with analytes above the calibration range will be diluted and reanalyzed. If samples require a dilution, results from the initial analytical run that were within the calibration range should be reported. Results from the diluted analyses should be reported for only those analytes which exceeded the calibration. .

6.3.2 Continuing Calibration Verification

Continuing calibration verification (CCV) standards will be run at the frequencies indicated in **Tables 6.1a – 6.1d, 6.1f and 6.1g**. If CCV results do not meet the specified criteria, then the instrument must be re-calibrated and all samples analyzed since the last acceptable CCV must be re-analyzed.

6.3.3 Reference Materials

Reference materials of a matrix appropriate to the samples being analyzed, will be analyzed every 20 samples throughout the analytical program, if available. The data resulting from the analysis of these samples will be reported in the same manner as that from the field samples. These data will be the prime materials used to determine and document the accuracy and precision of the associated field sample data. The reference materials to be used are listed in the criteria tables.

Accuracy is computed by comparing the laboratory's value for each analyte against either end of the range of values reported by the certifying agency. The laboratory's value must be within 20% of either the upper or lower end of NIST's 95% uncertainty range. For oil and water analyses, the SRM is not extracted, but analyzed only on the instrument. The MC252 Reference Oil will be run with each batch of samples (e.g., GU2988-A0521-O9805 or equivalent as approved by the QA Coordinator). Chromatographic resolution criteria of selected peak pairs in the Reference Oil are indicated in Tables 6.1a-6.1e. After initial data sets are acquired, additional criteria for the Reference Oil will be determined.

6.3.4 Method Blanks

Method blanks are laboratory derived samples which have been subjected to the same preparation or extraction procedures and analytical protocols as project samples. A method blank will be analyzed with every 20 field samples analyzed. Acceptance criteria are provided in **Tables 6.1a – 6.1g**. Failure to meet acceptance criteria requires definitive corrective action to identify and eliminate the source(s) of contamination before the subsequent reanalysis and re-extraction of the blank and affected samples. Sample results will not be blank corrected.

6.3.5 Sample Duplicates

A duplicate sample aliquot from a representative matrix will be prepared and analyzed with every 20 field samples, except for water samples for SHC/TEH and PAH. Water samples for SHC/TEH and PAH will not be analyzed in duplicate because of the difficulty in subsampling representative aliquots from a sample container. If duplicate VOA vials are collected, then volatile organic analyses may be performed in duplicate. Acceptance criteria the other matrices are provided in **Tables 6.1a – 6.1g**.

6.3.6 Matrix Spike/Matrix Spike Duplicates or Blank Spike/Blank Spike Duplicate

Matrix spike/matrix spike duplicates (MS/MSDs) will be analyzed every 20 samples, except for water samples. MS/MSDs will not be analyzed with the water sample batches because of the difficulty in subsampling representative aliquots from a sample container. Instead, blank spike/blank spike duplicates (BS/BSDs) will be analyzed with each batch of water samples. Samples will be spiked prior to extraction. Spike solution concentrations for the MS must be appropriate to the matrix and anticipated range of contaminants in the sample; that is 2 to 10 times analyte concentration. However, because it is not possible to know the concentration of contaminants prior to analysis, professional judgment may be exercised in choosing concentrations that are reasonable under the circumstances.

6.3.7 Internal Standards

All samples will be spiked with internal standards prior to analysis, when required by the analytical method. Control criteria for internal standard recovery are listed in **Tables 6.1a – 6.1d, and 6.1g**.

7.0 DATA REDUCTION, VALIDATION AND REPORTING

7.1 Data Reduction

Data reduction is the process whereby raw data (analytical measurements) are converted or reduced into meaningful results (analyte concentrations). This process may be either manual or electronic. Primary data reduction requires accounting for specific sample preparations, sample volume (or weight) analyzed, and any concentrations or dilutions required.

Primary data reduction is the responsibility of the analyst conducting the analytical measurement and is subject to further review by laboratory staff, the Laboratory Project Manager and finally, independent reviewers. All data reduction procedures will be described in the laboratory SOPs. Any deviations from the laboratory SOPs will be discussed in the laboratory case narratives.

- Concentrations will be reported as if three figures were significant.
- Data generated from the analysis of blank samples will not be utilized for correction of analyte data.
- Surrogate compounds, matrix spikes, and spike blanks will be evaluated as %R.
- Reference materials will be reported in units indicated on the certificate of analysis.

- Continuing calibration factors will be presented as %D
- Duplicate sample results will be expressed as RPD.

7.2 Data Review and Validation

Data review is an internal review process where data are reviewed and evaluated by personnel within the laboratory. Data validation is an independent review process conducted by personnel not associated with data collection and generation activities.

Data review is initiated at the bench level by the analyst, who is responsible for ensuring that the analytical data are correct and complete, the appropriate SOPs have been followed, and the QC results are within the acceptable limits. The Laboratory Project Manager has final review authority. It is the Laboratory Project Manager's responsibility to ensure that all analyses performed by that laboratory are correct, complete, and meet project data quality objectives.

External and independent data validation will be performed for all samples by the QA Contractor using a full data package containing sufficient information to allow the independent validation of the sample identity and integrity, the laboratory measurement system, and resulting quantitative and qualitative data. The required information with associated instrument print-outs are listed in **Table 7.1**.

TABLE 7.1 Laboratory Data Deliverables Per Sample Batch

Chain-of-Custody/Sample Receipt Checklist	
Sample Data:	Result summaries including surrogate recoveries, percent total solids, dilutions, etc
Standards Data:	Target MDL data based on the method in *40 CFR, 136* Calibration summaries: Initial calibration data, standard curve equation, correlation coefficient or %RSD, continuing calibration %D.
Quality Control Data (Method Blanks, CRMs, Duplicates, Matrix Spikes, Spike Blanks):	Results summaries including surrogate recoveries, plus %R and RPD, as applicable.
Case Narrative:	Special handling or analysis conditions. Any circumstance that requires special explanation such as an exception to QA/QC conditions or control criteria, dilutions, reanalysis, etc. Corrective actions/procedure alterations
Chromatograms and Extracted Ion Profiles	Appropriately scaled (1) GC/FID chromatograms for samples and associated QC analyzed for extractable hydrocarbons; (2) GC/MS EIPs for samples and associated QC analyzed for qualitative biomarkers
Electronic Data Deliverable:	As specified in laboratory contract.

Three levels of data validation will be performed (see USEPA, *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use.* EPA-540-R-08-005. January 2009 for definitions): full (stage 4), summary (stage 2B), or cursory (stage 2A) validation. Full validation will consist of a review of the entire data package for compliance with documentation and quality control criteria for all the following items, plus recalculations of instrument calibration curves, sample and QC results. Summary validation will consist of a review of all the following items, but without recalculations. Cursory validation will consist of a review of only the starred (*) items:

- Package completeness*
- Holding times from extraction to analysis*
- Instrument calibration, initial and continuing
- Blank results*
- Instrument performance
- Spike recoveries*
- Standard reference material results*
- Laboratory duplicate results*
- Reported detection limits*
- Compound quantitation
- Compound identification
- Verification of electronic data deliverable (EDD) against hardcopy (10% verification)*

As the project proceeds and the quality of the data is verified and documented, the level of validation will decrease at the discretion of the QA Coordinator. At a minimum, cursory validation will be performed on all data packages, i.e., only the starred items will be reviewed.

Qualifiers (**Table 7.2**) may be assigned to individual data points by the QA Contractor. These validation qualifiers will not replace qualifiers or footnotes provided by the laboratory, but will be added to the data summary tables to inform the data user whether or not the data met all project quality objectives. Both sets of qualifiers will be maintained in the database.

TABLE 7.2 Data Validation Qualifier Codes

U	Analyte concentration is not significantly greater than the associated blank result. The result is judged to be the detection limit.
R	Rejected result. Data should not be used.
N	The analysis indicates the present of an analyte for which there is presumptive evidence to make a "tentative identification".
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
J	Reported concentration is an estimate with potentially more bias, or less precision than an unqualified concentration, as judged by associated calibration and/or reference material results.
UJ	Not detected. Detection limit is an estimate with potentially more bias or less precision than an unqualified detection limit as judged by the associated quality control results
DNR	Do not report; A more appropriate result is reported from another analysis or dilution.
F	Found. Analyte detected at less than the MDL, however, peak height is greater than 3 times the noise level and ID criteria are met.

All discrepancies and requests for additional corrected data will be discussed with the laboratory prior to issuing the formal data validation report. Review procedures and findings during data validation will be documented on worksheets. A validation report will be prepared for each data group/data package summarizing QC results, qualifiers, and possible data limitations. Only validated data with appropriate qualifiers will be released for general use. Data are not considered final until QA Coordinator has performed assessment and accepted the data.

In addition, the validated data will be reviewed by the QA Reviewer on behalf of BP America. The following process shall be used should the independent validation of the laboratory data results in a material difference in how qualifiers have been assigned or in the actual value itself:

- The QA Coordinator and QA Reviewer will meet to determine the source of the difference, and resolve. No changes to validated results will be made if the differences are considered immaterial to both the QA Coordinator and QA Reviewer.
- If the validated data have already been released by the QA Coordinator, then the data will be updated in accordance with the resolution and reposted.
- Should there be no agreement on how to resolve the difference, the QA Coordinator and QA Reviewer shall request further assistance from the Assessment Managers and BP America, respectively.
- The basis for all material changes to validated results will be documented along with the resubmitted validated data.

8.0 CORRECTIVE ACTION AND PROCEDURE ALTERATION

The analytical laboratories are required to adhere to the SOPs submitted by them to the QA Coordinator for this project. When the data from the analyses of any quality control sample exceeds the project specified control limits or indicates that the analytical method is drifting out of control, it is the immediate responsibility of the analyst to identify and correct the situation before continuing with sample analysis.

A narrative describing the problem noted, the steps taken to identify and correct the problem and the treatment of the relevant sample batches must be prepared and submitted with the relevant data package. If the action indicates a revision to the accepted SOP is warranted, the laboratory will revise the SOP and resubmit the SOP to the QA Coordinator within 30 working days after the problem was noted. Until the revised SOP is approved, any data sets reported with the revised method will have the any changes to the method noted in the laboratory's case narrative.

9.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Quality Assurance/Quality Control (QA/QC) reports will be submitted periodically to the Assessment Manager(s) by the QA Coordinator. These reports may be either formal or informal in response to the Assessment Manager's request. Upon termination of the analytical work for this damage assessment, a formal QA report will be submitted. This report will include:

- General compliance with QA objectives
- Summary of technical and performance evaluation audits
- Summary of data validation reports
- Summary of laboratory control charts

10.0 REFERENCES

Bence, A.E., K.A. Kvenvolden, and M.C. Kennicutt, II. 2006. Organic geochemistry applied to environmental assessments of Prince William Sound, Alaska, after the Exxon Valdez oil spill--a review. *Org. Geochem.* 24(1):7-42.

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USEPA, 2002. *Guidance for Quality Assurance Project Plans*, (EPA QA/G-5) EPA/240/R-02/009, December 2002. http://www.epa.gov/quality/qs-docs/r5-final.pdf

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Deepwater Horizon: Subsurface Monitoring Mapping Products
DRAFT, June 15, 2010

These are recommended processes- improvements are expected and welcome. Please update document

Change Log

Date	Updates	Analyst
6/29/2010	Subsurface Coverage Zones guidance	Ben
7/7/2010	Updated Samples by cruise and coverage zones guidance	Ben
7/9/2010	Updated Samples by cruise (Map 2)	Ben
7/8/2010	Updated Samples by cruise (Map 2)	Brittany

Data including mxd's will be posted to the SFTP site for exchange. FTP directory:
/Deepwater_Horizon_Ext/Subsurface_Monitoring/GIS

To keep MXD links from being broken, use the following folder structure:
under Subsurface_Monitoring\GIS\

- Arc_Projects – [mxd files]
- Base – [useful layers that don't change daily or very frequently]
- Daily_Status – [daily status/updated layers, like vessel info]
- Documents – [docs, like this one]
- Export – [digital map products, .pdf and .png]
- Glider – [glider data from Aaron/ERMA]
- Hydro_Bathy – bathy data]
- Logos – [logos]
- NESDIS – [daily NESDIS composite polygons]
- Trajectory – 24-hr nearshore and offshore trajectories