

**U.S. Environmental Protection Agency  
Science Advisory Board  
SAB Workgroup on Residue Sampling Plan  
Collected Individual Comments on “Emergency Response Quality Assurance  
Sampling Plan for Hurricane Katrina Response Screening Level Sampling for  
Sediment in Areas where Flood Water Receded, Southeast Louisiana”**

**As of September 12, 2005 (4:00 p.m.)**

**NOTE: The Workgroup will have a public conference call meeting  
Tuesday, September 13 from 1-4 Eastern Time  
For Further Information, visit [www.epa.gov/sab](http://www.epa.gov/sab)**

1. The following three documents were provided for review:
  - A. Emergency Response Quality Assurance Sampling Plan for Hurricane Katrina Response Screening Level Sampling for Sediments in Areas Where Flood Water Receded, Southeast, Louisiana. This document includes Appendix A: Data Quality Objective
  - B. Appendix B: Standard Operating Procedures
  - C. Appendix C: EPA Region 6 Media Specific Screening Levels
  
2. Region 6 is requesting SAB review of the approach and procedures contained in this plan, recognizing that the plan will continue to evolve as experience is gained and application is broadened. The Region would appreciate SAB’s technical input and advice in these areas:
  - Are the project objectives and the preliminary nature of this plan clearly stated ?
  - Please comment on the validity of the sampling approach and the adequacy of the methods to accomplish the project objectives.
  - Are the requirements for containers, preservation techniques, sample volumes, and holding times (Table 4-1) appropriate for the listed analyte categories?
  - Are the analytical methods to be used appropriate for the matrix being sampled?
  - The SAB's advice on constituent analysis would also be appreciated.

- Please comment on the adequacy and the transparency of the quality assurance plan and the plan for project documentation.
3. Comments from the following SAB Workgroup participants are included in this collection: Dzombak, Gilbert, Griffiths, Hayes, Maney, Pitt, Rose, Splitstone, Swackhamer, and Watson. Additional comments may be received later from Luoma, Steinberg, and Thibodeaux.

## **DAVID DZOMBAK**

### **General Comments**

The sediment sampling plan has well-defined objectives and is well formulated. Considering the large area over which sediment has been deposited by the floodwaters, the decision to acquire samples over just one square mile implies an unstated assumption that the sediment/residue will be fairly uniform in quality. This should be explicitly stated, and justified. For this initial sampling, the project team plans to target areas more likely to be highly contaminated. This seems reasonable, but the criteria for identifying areas most likely to be highly contaminated are not clear. Acquisition of all samples from outdoor areas, i.e., residential yards or other residential areas such as parks or streets, is appropriate considering the practical issues of access and need for rapid assessment. Fecal coliform is a reasonable microbiological contaminant on which to focus. This important constituent needs to be added to Table 4-1. Also, disinfection needs to be added to the sampling equipment decontamination procedure to avoid cross-contamination of samples collected for fecal coliform analyses. The constituent list is comprehensive, but it is not clear that all of the chemical constituents listed are appropriate for screening-level analyses. The project team should consider taking more samples over a broader geographical area, but for only a subset of analytes that are the most important for screening analyses. Finally, exposure to airborne sediment “dust” will be an important exposure pathway as the sediment dries. No plans for air sampling are discussed. Air sampling may be lower on the priority list considering that much of the sediment is still wet, but I recommend that plans for air sampling start to be formulated.

### **Specific Comments, organized as responses to Charge Questions**

1. Are the project objectives and the preliminary nature of this plan clearly stated?

The objectives and planned uses of the data are clearly stated on page 1. The objectives are described as follows:

“The objective of this initial sampling is to determine the nature and type of contaminants that may have impacted residential areas due to migration of hazardous materials by flood.”

“The objective is to determine the nature and type of contaminants in sediments in residential areas where flood waters have receded. Sediments samples will be analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs),

pesticides, herbicides, PCBs and metals, fecal coliform, total petroleum hydrocarbons and percent moisture.”

The planned uses of the data are described as follows:

“Further assessment may be warranted based on the results of this initial sampling, and/or if the particular residential area is located near an area of potential concern (such as an area of known chemical storage), and will be addressed in a subsequent QASP. In addition, the information collected during this phase may be used to develop a plan for further detailed sampling of residential areas in the affected parishes.”

“This information will be used to help assess the presence of hazardous substances in residential sediments and the potential for exposure of residents to contaminants in sediments.”

On page 3, in Section 2.2 (Site Concerns), and in Appendix A, under Steps 1 and 6, somewhat broader statements of objectives are given. It is indicated that identification of substances hazardous to the environment is an objective along with substances hazardous to human health. Based on the statements of objectives on page 1, which focus on human health, and the use of screening levels that are entirely human health focused, I recommend omitting mention of protection of environment as a specific objective.

2. Please comment on the validity of the sampling approach and the adequacy of the methods to accomplish the project objectives.

Considering the large area over which sediment has been deposited by the floodwaters, the decision to acquire samples over just one square mile implies an unstated assumption that the sediment/residue will be fairly uniform in quality. This should be explicitly stated, and justified. On page 4, Section 3.2.1, it is stated that “the area of one-square mile was selected based on the team’s judgment that ... [24] samples would not provide meaningful screening level information if collected over a larger area, and based on logistical concerns in trying to cover a larger area.”

For this initial sampling, the project team plans to target areas more likely to be highly contaminated. This seems reasonable, but the criteria for identifying areas most likely to be highly contaminated are not clear.

Sample collection focused on finer grained sediments, and avoidance of coarse or debris laden sediments, is an appropriate approach. The bulk of contaminant mass is likely to be in the finer-grained material.

Acquisition of all samples from outdoor areas, i.e., residential yards or other residential areas such as parks or streets, is appropriate. The explicitly-stated assumption that level of contamination in sediment samples collected outside homes will be approximately the same as the level of contamination found in samples collected inside homes seems reasonable. Concentrations of some particular constituents may be different inside and outside of homes, e.g., due to increased rates of volatilization or photodegradation

outdoors, but considering the practical issues of access and need for rapid assessment, the decision to collect only outdoor samples is defensible.

Fecal coliform is a reasonable microbiological contaminant on which to focus, as it serves as an indicator of the presence of enteric pathogens from humans. In the last paragraph on page 5, analysis for total coliform bacteria is mentioned. This should be changed to fecal coliform bacteria, as is the case elsewhere in the plan. Total coliform results will be much less useful than fecal coliform results.

Exposure to airborne sediment “dust” will be an important exposure pathway as the sediment dries. No plans for air sampling are discussed. Air sampling may be lower on the priority list considering that much of the sediment is still wet, but I recommend that plans for air sampling start to be formulated.

3. Are the requirements for containers, preservation techniques, sample volumes, and holding times (Table 4-1) appropriate for the listed analyte categories?

Fecal coliform bacteria need to be added to the analyte list in Table 4-1. The appropriate EPA method for analysis of fecal coliform bacteria in soil/sediment samples should be listed. If there is not standard EPA method, a standard method is available in: Zuberer, D. 1994. Recovery and Enumeration of Viable Bacteria. p. 199-144. In J.M. Bigham (ed.) Methods of Soil Analysis, Part 2. Soil Science Society of America, Madison, WI.

The equipment decontamination procedures listed in Section 3.5 do not include disinfection. A disinfection step, e.g., with a chlorine solution, will be important to avoid cross-contamination of samples collected for microbiological (fecal coliform) constituent analyses.

4. Are the analytical methods to be used appropriate for the matrix being sampled?

Fecal coliform bacteria should be added to Table 4-1, and an analytical method needs to be specified for the fecal coliform analysis (see response to Charge Question 3).

5. The SAB's advice on constituent analysis would also be appreciated.

The constituent list is comprehensive, but it is not clear that all of the chemical constituents listed are appropriate for screening-level analyses. The project team should consider taking more samples over a broader geographical area, but for only a subset of analytes that are the most important for screening analyses.

6. Please comment on the adequacy and the transparency of the quality assurance plan and the plan for project documentation.

The Quality Assurance plan seems adequate. There is an inconsistency in the discussion of duplicate samples, however, with the plans for collection of duplicates presented on

page 5 and elsewhere. In Section Section 5.1, bullet 4, the plan presented for collection and analysis of duplicates is not consistent with the sampling plan. The sampling plan is to collect a duplicate for each of the 24 samples acquired in this initial sediment sampling (e.g., see page 5). In bullet 4 of Section 5.1, it is stated that only one duplicate will be collected for every 10 samples.

## **RICHARD GILBERT**

### **General Comments**

The project objectives are stated differently in different sections of the plan. It appears that the primary objective is to determine if contamination is present (by sampling at suspected contamination spots) and to identify the types of contaminants present. However, determining whether the contamination is a potential health hazard is also discussed. I am concerned that this last objective cannot be achieved with the proposed 24 samples collected over a single geographical area that may or may not be representative and relevant to some or all segments of the human population that could be potentially exposed throughout the devastated region. The plan states that the 24 samples are only preliminary data, but no mention is made of the type and scope of future samplings that will be required to address the issue of whether people can return to their homes and businesses. The proposed sampling plan is very limited in scope and it relies entirely on judgmental sampling, the basis of which is not adequately addressed. Care must be taken to not use the data to make inferences about risks and exposures that cannot be defended. The public should be informed of the limited inferences possible from the 24 data and that additional sampling will be necessary. I fear that the 24 data will be the basis of public statements about health hazards that will be shown to be false upon further sampling efforts. Don't make statements that go beyond the quality and quantity of the 24 data. Because judgmental sampling is being used, I would not use the 24 data to make inferences to locations and times not actually sampled.

The use of judgmental sampling is appropriate at this preliminary stage for the purpose of determining if contamination is present and the types of contaminants present. However, it is possible that the particular 24 locations chosen using judgment are not representative for specific homes, buildings, and blocks that are of concern to particular citizens or groups. I expect that questions will be asked about whether the data are applicable to non-sampled flooded parts of Louisiana that are close to chemical plants or other potential sources of pollution. The basis of the judgment used to select the 24 sampling locations (the conceptual site model) should be discussed.

### **Specific Comments**

#### **SECTION 1.0: INTRODUCTION**

The objective of the sampling effort is stated to be "...to determine the *nature and type* of contaminants that may have impacted residential areas due to migration of hazardous materials by flood." (What does "*nature*" mean?) Similarly, in Section 3.3 (Sediment Sampling) it is stated that the samples collected will be used to document the *type* of contaminants in residential areas where flood water have receded. However, in Section 4.0 (5<sup>th</sup> line, 1<sup>st</sup> paragraph) it is stated: "In determining the nature and *extent* of potential contamination, analytical results (on a dry weight basis) will be compared to EPA Region 6 Human Health Medium-Specific Screening Levels (MSSLs) for soils in addition to site-specific background levels." This last sentence suggests the objective of the current (screening) sampling effort extends beyond determining the type of contaminants present to also assessing the spatial extent of the contamination and whether the contamination is a potential health hazard. While the proposed sediment sampling is a start at identifying what contaminants are present in suspected contaminated locations, it is not adequate for assessing spatial extent or health hazards for humans for the devastated region.

### SECTION 3.2.1 SAMPLING

What is the target population of residential areas to which sample results will apply? That is, what residential areas are presumed to be represented by the data collected? The proposed sampling plan does not discuss how the sampling area, which is not to exceed 1 square mile in size, will be selected, not where it is located.

In the 4<sup>th</sup> paragraph it is stated that samples will be collected from residential yards, parks or streets, and not from inside homes. The plan states that it is being assumed that the level of contamination in sediment located outside homes will be approximately the same as that inside homes. But clearly, sampling inside homes will be required at some point to assess the validity of this assumption. Why not take samples in both residential yards and within homes now?

Are there quick and inexpensive field measurement instruments that could be used in conjunction with collecting samples for laboratory analysis? Such methods might allow for more measurements to be made at locations spread out more over the areas of flooding.

### SECTION 3.3 SEDIMENT SAMPLING

It is stated that one duplicate sample will be collected for every ten field samples (total of three). What is a "duplicate sample?" For example, is a duplicate sample located as close as possible to the original sample? Will both samples be sent to the same laboratory? How will the duplicate data be used? Why are only three duplicate samples being obtained? If large differences between duplicates samples are observed, how will this be explained to the public? Would it be better to obtain more duplicate samples now so that a more precise estimate of differences between duplicates will be obtained?

## APPENDIX A: DATA QUALITY OBJECTIVE

Step 2 (Specify the Decision) indicates that a measurement will be compared to residential screening benchmarks to decide if there are potential chemicals of concern in sediments. This statement does not agree with the stated objective in Section 1.0 of determining the type of contaminants present. Also, it is stated that if no contaminants exceed the specified benchmarks in sediment, no further screening will be necessary for contaminants being analyzed. Really? Are these preliminary data sufficient to make that decision? Are the samples collected in this plan really representative of all flooded areas?

Step 6 (Specify Limits on Decision Errors). When discussing the Type I Error, reference is made to the “specified area represented by the sediment sample.” That area is not defined. What area is a sediment sample presumed to represent? The duplicate samples may give some insight on this question.

### **JEFFREY K. GRIFFITHS**

Major comments:

The sampling plan is clearly biased towards the detection of chemical contaminants in an area of human habitation deemed to be at high risk because of staining and other visual clues. As a first pass this is okay but a geographically comprehensive monitoring plan will be needed. Anything less will be viewed as an inadequate response.

As the clean-up efforts progress and entry into the city improves then Sampling should be done expeditiously and comprehensively. Having lived in New Orleans, I am fully aware that some parts of the city were closer to petroleum industry sites as well as the Mississippi, and we should expect geographic variation in the deposition of contaminants in the sediments.

The microbial assessment is inadequate. The immediate dangers to humans in the area will be from a certain set of chemicals (VOCs, pesticides, herbicides, etc.) but (I emphasize) mostly microbes.

The hurricane produced two forms of microbial pollution: sewage (human) and environmental. There have now been deaths in the survivors from *Vibrio vulnificus*, a cholera-family bacterium that likes brackish water that is an environmental pathogen that is NOT spread person to person, but rather by contact with contaminated water. These deaths prove that testing for environmental pathogens is necessary.

Hard experience, world-wide, indicates that all of the microbes listed below are of concern. Assays for these organisms are straightforward cultures in many cases and can be done by most clinical labs. Samples could be collected and transported to a clinical lab using transport media, and results would be ready in just a few days. Victor Tsang at the CDC has a method for testing samples for Crypto that is very fast

and sensitive. EPA supported studies have shown that good PCR methods exist for enterococci that give results in 4 hours after the sample has been received.

Needed for sewage contamination: assays for:

- Coliforms, Enterococci, Clostridia (classic sewage indicators; can use PCR)
- Shigella, Salmonella, Campylobacter, Helicobacter (cultures)
- Hepatitis A, other enteric viruses (multiple assays)
- Cryptosporidium, Giardia (multiple assays; Method 1623)

Environmental microbes testing:

- Vibrios (simple culture)
- Aeromonas and other water Pseudomonads (simple culture)
- Algae and algal toxins (toxin assays)
- Leptospira (culture, PCR)

In the comments from other SAB members elicited earlier, most of these were noted, but not leptospira. Leptospirosis is spread from the urine of infected rodents, primarily by water contamination, and anyone in New Orleans water is at clear risk, given the very large number of surviving rats. Recent very large epidemics of leptospirosis occurred because of water exposures, and it used to be a very common disease in the US until water treatment became widespread. US docs are experienced in detecting this illness and we know from US studies that most US docs will miss the diagnosis, increasing the actual public health risk that we will have untreated and unrecognized disease.

I believe the microbial sampling must be made more robust and comprehensive as outlined above, and the overall sampling scheme must be made more geographically comprehensive in the short (but not immediate) term.

### **KIM F. HAYES**

*(A) Are the project objectives and the preliminary nature of this plan clearly stated?*

Yes, the project objectives are clearly stated. The goal of this project is to determine the nature of the contaminants in the sediments in residential areas in southeast Louisiana where flood waters have receded. At least 24 samples per square mile in residential areas affected will be collected. The focus will be on VOCs, semi-VOCs, pesticides, herbicides, PCBs, metals (TAL and Hg), fecal coliform, TPH, and % moisture. In determining the nature and extent of potential contamination, the measured levels of these contaminants will be compared to site-specific background and EPA Region 6 Human Health MSSLs (Medium-Specific Screening Levels). Based on these results or known proximity to chemical storage, potentially areas of concern will identified with the possibility of more extensive sampling in a subsequent QASP.

*(B) Please comment on the validity of the sampling approach and the adequacy of the methods to accomplish the project objectives.*

**SAMPLING PLAN.** The sampling plan is reasonably well described. One issue, however, is how the 24 sampling locations within the 1 square mile will be identified. It is stated that residential areas where the public is or could return at this time will be targeted and that the 24 samples will be spread throughout the sampling area at locations determined by the field personnel (GPS coordinates of samples will be documented). Based on conservative estimate of say 1 resident per ¼ acre, the 24 sampling points per square mile, would translate into approximately 1 residential location out of 100 selected for sampling. How will that site be picked? It would seem prudent to set up a grid that allows a balance of geographical areas to be sampled in each square mile, to select specific residence or block or residences that provides this balance, and then to perform the bias sampling within the pre-selected site area. Maybe this is the intention but it was not entirely clear from the wording in the document.

Also since contaminated water would also cause residential soil to become contaminated, it may not appropriate to select only locations within the selected sites areas where new sediments are deposited. Soil may also have become quite contaminated even where deposits may appear light. This may also complicate distinguishing flood contamination from site specific background levels (see comment on background levels below).

**BACKGROUND LEVELS.** It was not clear from the QASP whether site specific background data was going to come from historical data of the affected areas or if background samples were to be collected as part of the QASP. It would certainly be useful to have “background samples” but it is not clear how such samples would be collected, since any soil that was exposed to polluted flood waters may have become contaminated. A clarification on how “site specific background levels” will be established is needed.

**SAMPLING AND ANALYTICAL METHODS.** The analytical methods proposed for the analyses have been taken from EPA Publication SW-846, and EAP approved standard methods for evaluating for fecal coliform and moisture content. The referenced methods are appropriate to test for the contaminants and the detection limits that may be needed.

**COMPOSITING OF SAMPLES.** Some additional discussion on the way in which the samples are to be collected is needed. For example, when surface grab samples are taken, it is likely that the 16 ounces needed for VOC and TPH (which includes VOCs) analysis would be taken with as little disturbance as possible according to procedures to preserve samples for VOC analysis (discussed in summary fashion in the SOP provided as Appendix B), while the remainder of the sample needed for the other analyses would be taken from a mixed composite from the targeted area, if possible. For the mixed composite sample, the 48 ounces needed to fill the jars for all the analyses (other than VOC and TPH), would be placed into a large container and mixed to get a composite sample that is representative of the targeted area.

*(C) Are the requirements for containers, preservation techniques, sample volumes, and holding times (Table 4-1) appropriate for the listed analyte categories?*

The amount of sample, size of jars, type of containers, and preservation conditions, appear to be appropriate for soil sample analyses indicated. For VOC and TPH samples, collection by using the En Core sampler described in Appendix B may be warranted in view of the likely desire to keep the sampling approach consistent and simple for all site personnel.

*(D) Are the analytical methods to be used appropriate for the matrix being sampled?*

The analytical methods are appropriate for the compounds and detection limits that are likely to be important. The methods selected have been taken from EPA standard methods documents for solid matrices (e.g., from specific protocols for the desired compounds and compound classes listed in EPA Publication SW-846 and from ASTM methods). Each analytical method in turn lists a variety of appropriate (but different) EPA approved solid sample extraction methods to recover a given analyte from the solid matrix for analysis. Since the specific sample extractions methods for a given analyte (or analyte class) is not specified in Table 4.1, apparently the choice will be left up to the selected EPA certified laboratory.

*(E) The SAB's advice on constituent analysis would also be appreciated.*

The tests to be performed cover the range of compounds and elements that are likely to be of concern in contaminated sediments from the receding flood waters. These include metals (specifically Hg using a cold vapor extraction approach, and others important metals that will be detected by an ICP/AES scan), VOCs, Semi-VOCs, (e.g., PAHs), PCBs, pesticides, herbicides, petroleum hydrocarbons (TPH), and bacterial threats from sewage (i.e., fecal coliform).

*(F) Please comment on the adequacy and the transparency of the quality assurance plan and the plan for project documentation.*

The QAP plan is, for the most part, clearly written and adequate. As discussed above, clarification, however, would be helpful on how the 24 residential sites will be selected to achieve geographical balance, how sample compositing will be handled, and how site-specific background levels will be established.

The project documentation plan including COC, location verification, logbook information, custody seal, and photographic documentation seems adequate and complete. For location verification, the most accurate method would be to stake out a circular area of known diameter from which the composite samples are taken, and then to record the GPS position as the center of this area, if GPS is to be used as stated.

The data validation audit by a contractor independent of the laboratory as proposed is appropriate. It may be worthwhile to also have inter-laboratory calibrations performed (e.g., by occasionally splitting and sending the same samples to different laboratories if more than one EPA laboratory will be performing the analyses) to insure that lab to lab variations can be distinguished from actual concentration differences.

## **JOHN MANEY**

### **I. GENERAL**

- QASP doesn't follow the content guidelines detailed in EPA guidance (EPA QA/G-5). The reason for this should be explained – e.g., streamlined for the purposes of the emergency. It should be noted, however, that this abbreviated QAPP lacks important content such as Analytical QA/QC.
- QASP does not have a QA Officer sign off. EPA QA/G-5 specifies that “QA staff independent of project management, and project field and laboratory technical staff, should review the plan.” (Page 6).
- No conceptual model is presented in the QASP, however, it is likely that the Agency does have theories about the release, transport, and dispersion of sediments in the New Orleans area (e.g., from a given levee break towards the south over the area of interest).

### **II. SECTIONS 1, 1.1, 2.2 and Appendix A as Pertaining to Varying Objectives and Data Use.**

This QASP lacks specificity and consistency in its objective and there is a disconnect between the stated objective and the proposed use of the collected data in decision-making.

#### OBJECTIVES

- 1) SECTION 1: “The objective of this initial sampling is to determine the nature and type of contaminants that may have impacted residential areas due to migration of hazardous materials by flood.”
- 2) SECTION 1.1: “The objective is to determine the nature and type of contaminants in sediments in residential areas where flood waters have receded.”
- 3) SECTION 2.2: “The primary concern being addressed by this QASP is to screen for hazardous substances, which are hazardous to human health and the environment, in areas where flood waters have receded.”
- 4) APPENDIX A, STEP 1: “Residue (sediment) samples will be collected from areas where flood waters from Hurricane Katrina have receded to screen for the presence of hazardous waste (potential contaminants of concern) that could present an unacceptable risk to human health and the environment, including residents either revisiting or occupying their residences.”

The term ‘nature’ is a non-specific term – unclear as to what is meant since the word ‘type’ follows. Does the term mean to imply how the contaminants are distributed? ‘Nature’ is used in the first two above citations while the word ‘screening’ is used in the later two and the title of the QASP. Is ‘nature and type’ equivalent to ‘screening’?

An easily missed but meaningful difference exists between the first two objectives. The first talks about “residential areas” in general. The second citation refers to “residential areas where flood waters have receded”. How are the data to be used? To infer to the more restricted recently receded areas or all of New Orleans?

The last two citations also introduce the term ‘human health and the environment’. Does this mean that ecological issues are to be addressed at this time?

More problematic is the fact that the objectives appear to be different from how the data will be used. The objectives use the terms ‘nature and type’ and ‘screening’ in a preliminary fashion, while the stated uses of the data are more final in their application.

#### STATED DATA USE

- 1) SECTION 1: “Further assessment may be warranted based on the results of this initial sampling, and/or if the particular residential area is located near an area of potential concern”
- 2) SECTION 1.1: “This information will be used to help assess the presence of hazardous substances in residential sediments and the potential for exposure of residents to contaminants in sediments.”
- 3) APPENDIX A, STEP 2: “If any contaminant exceeds the specified benchmark in the sediment, the sediment will need for further characterization.”
- 4) APPENDIX A, STEP 2: “If no contaminants exceed the specified benchmarks in sediment, no further screening will be necessary for contaminants being analyzed.”

In particular, the 3<sup>rd</sup> and 4<sup>th</sup> citations indicate a use that is more definitive (i.e., determining whether a yard needs further investigation) than the objectives indicate and could lead decision makers to arrive at decisions regarding the sampled areas that can not be based on the collected data. *These proposed data uses are quite an extrapolation since the QASP sampling plan, as designed, will complicate extrapolation beyond those immediate areas perceived as hotspots by the sampler.*

**SUGGESTION:** Change objective to the following, “To estimate concentration levels of expected contaminants in sediments deposited in representative residential yards after flood waters have receded.”

Sampling changes to support this objective will be proposed in Section IX of these comments.

### **III. SECTIONS 3.1, 3.2, as Pertaining to Sampling Design.**

Section 3.1 states, “The EPA OSC and designated sampling personnel will determine appropriate sample locations.” The reader assumes that the OSC will employ the logic described in Section 3.2.1 when selecting “appropriate sample locations.”

Section 3.2.1 indicates that “biased sampling” will be employed “to give the highest probability of finding contamination.” The section continues to encourage the use of “grab samples collected from the surface” from “areas that contain oily sediments or large stains,” with efforts made “to collect samples that contain finer grained sediments and limit collection of coarse or debris laden sediments.”

The QASP further “assumes that level of contamination in sediment samples collected outside the homes will be approximately the same as the level of contamination found in samples collected inside the home.”

This plan is based on a number of underlying *assumptions*, including the following;

- 1) *Biased sampling gives the highest probability of collecting samples with the highest contamination:* This is often true when one has a defensible conceptual model and understanding of how contamination is dispersed. No conceptual model of contaminant distribution has been proposed in this QASP.
- 2) *Oily and stained sediment will yield the highest contaminant levels:* Without a sound conceptual model this requires a leap of faith. Inorganic contaminants or pathogens which could be the risk-controlling contaminant are not necessarily associated with such stained areas. Besides, a flood’s mechanism of mixing and contaminant dispersal is unlikely to create small area staining. The small scale staining found in a residential yard following flooding is likely to be from such activities as paint spills or from the resident pouring crankcase oil on the ground prior to the flood.
- 3) *Sediments inside the house and outside the house are similar:* This is a defensible assumption to be made during an emergency, especially in light of the legal issues raised in the QASP. **SUGGESTION:** verified later, as time allows, by comparison sampling.
- 4) *Collection of finer grained sediment versus coarser sediments:* It is usually legitimate to discriminate against large artifacts, especially those that are impervious and have small surface areas. However the QASP guidance has the potential to lead to variable interpretations of what a coarse grain is and create uncertainty. What is a coarse grain versus a fine grain and how do we know that the coarse grain, that is being discriminated against, is not some toxic metallic particle? **SUGGESTION:** Discard rocks, branches, bicycles, and softballs, but keep the coarse grains.
- 5) *Not necessary to sample underlying or exposed soils, only sample sediments:* This approach assumes that the Agency is not concerned with the combined exposure resulting from the flood and the original soils and for unstated reasons the Agency is only interested with Katrina’s contribution. This is contradictory to the QASP expressed concern for ‘human health’ and is also difficult to achieve. We don’t know what portion of soil contaminants were present before the flood and what portion were adsorbed or absorbed from the flood waters and the juxtaposed sediments. **SUGGESTION:** Sample exposed surface soil and sediment as suggested by the proposed sampling design in Section IX.

Care must be taken to ensure that an ill-made assumption doesn't lead one in the wrong direction.

#### **IV. SECTIONS 3.2.1 and 4.0 Contaminants of Concern**

The QASP references SW-846 analytical methods. Some of these methods (i.e., especially Methods 6010B, 8260B and 8270C) are implemented differently with different laboratories employing different analyte lists and different standards.

**SUGGESTION:** The Agency should review the laboratory's calibrated analyte list when choosing labs and should specify analytes.

**SUGGESTION:** The QASP should ensure that all GC/MS analyses (Methods 8260B and 8270C) include the identification of TICs (Tentatively Identified Compounds). In addition, metal analyses should be performed on an instrument with a scanning ICP spectrometer or one that has a focal curve with many elements – so that significant concentrations of non-routine elements do not go undetected. These are very cost-effective modifications.

**SUGGESTION:** Due to the heavy presence of the petroleum industry in New Orleans, it is good that Method 8015B was specified; however, the Agency should be more specific and request FID fingerprint chromatograms and gasoline and diesel range analyses. Can we assume that the other Method 8015B analytes will be measured using Method 8260?

**SUGGESTION:** As mentioned when commenting on the Floodwater QASP, the specified gas chromatographic methods do not detect strongly polar, labile or large organic compounds that are detectable by LC/MS/MS and are now of increasing environmental concern. EPA should have Bill Budde of EPA's Cincinnati laboratory conference with EPA's Region VI staff to determine if a manufacturer of these compounds exists in the flooded areas. If such a manufacturer exists, then LC/MS/MS can be considered for samples collected in areas surrounding these facility.

**SUGGESTION:** Others commenting on the Floodwater QASP convincingly argued that viruses and pathogens other than coliform should be included in the list of analytes. Possibly, the suggested list of pathogens can be modified for soils and sediments. Maybe best to focus on those resilient pathogens that will form spores or somehow persist through the drying/re-wetting cycle typical of soils and sediments and result in future risks.

**QUESTION:** Would particle size analysis of the sediments be useful in anticipating later wind dispersal or would all of the sediment particles be similarly dispersed?

**QUESTION:** Should limited Toxicity Characteristic Leaching Protocol (TCLP) testing be done to answer the next burning question – “How can we dispose of the removed sediments?” Longer turnaround times can be requested for these analyses.

## **V. Sample Disposal**

The QASP is mute regarding the storage of sample containers, residual samples, extracts and digestates following analysis.

**SUGGESTION:** As stated for the floodwaters, this is not appropriate for at least the initial samples of a short-lived phenomenon of such significant importance and for samples that may prove to have historical value. The original sample container labels can be used to answer questions that arise later, sample residuals, sample extracts and sample digestates could be re-analyzed to answer unanticipated questions. Instruct the lab to archive empty sample containers and properly store all unused samples, extracts and digestates.

The laboratory should also be instructed to maintain all instrumental raw data and preparation data for future review.

## **VI. Table 4-1, Sample Containers and Handling**

**SUGGESTION:** Table 4-1 and the associated text in Section 4 should specify certified clean sample containers and that the certificates be maintained on file.

**QUESTION:** Regarding fecal coliform, is the stated 6 hour holding time realistic?

**SUGGESTION:** Requirements for VOCs are WRONG! Refer to SW-846 Method 5035a for containers and preservatives. Also refer to page 9 of the QASP enclosed 2012 SOP, which discusses En Core samplers (not sure of their effectiveness with biologically active and potentially outgassing sediments). Methanol preserved samples would be preferable for compositing and for inhibiting biological activity, if method detection limits greater than 200 ug/kg are acceptable.

**QUESTION:** Why is the term 'N/A' used for % moisture? It should be defined in a footnote to table. Will a separate sample be collected for % moisture or will an aliquot from another sample be employed?

## **V. SECTION 5.1, Quality Control Samples**

This section is lacking a discussion of laboratory quality control samples. It appears to focus on field quality control samples, but is also lacking in that regard as well. Trip blanks (VOCs) and the possible use of temperature blanks are not discussed.

**SUGGESTION:** The QASP mentions both duplicate (collocated) and split samples, but does not define these terms. This would be a good section to define the terms to eliminate the common misunderstanding regarding duplicates and split samples. The QASP should define all QC samples that will be employed.

**QUESTION:** What are material spikes/material spike duplicates? Are these the same as laboratory matrix spikes and matrix spike duplicates? If they are field quality control samples, the QASP authors should be aware that field spiking has proven to be cursed with confounding factors that complicate their use. If these refer to laboratory quality control samples, the suggested sample volumes should suffice.

## **VI. SECTION 5.3, Documentation**

The person who actually collects the sample is not documented in the Field Logbook or the Sample label. Should be recorded in both places (initials on Sample label are sufficient).

## **VII. APPENDIX A, Data Quality Objectives**

Many of the statements in this section have been addressed by earlier comments and later in the proposed alternative sampling design. But it should be noted that error rates cannot be properly assigned when the QASP-suggested biased sampling is employed, ""When a probability-based design is used, statistical inferences may be made about the sampled population from the data obtained from the sampling units" and "Provides ability to calculate uncertainty associated with estimates". While biased sampling "Cannot reliably evaluate precision of estimates." (EPA QA/G-5S)

## **VIII. Attached SOPs**

The QASP should be a standalone document so that all necessary documentation is available to field personnel. Therefore, the referenced SOPs (i.e., 2003, 2006, ASTM D1586-99 and En Core sampling procedures) should be included.

Because of site conditions in New Orleans, disposable sampling equipment will be preferable over equipment requiring decontamination.

## **IX. Proposed Alternative Sampling Design**

The following rudimentary outline of a sampling design is intended to achieve the following objective which was originally proposed above in Section II and to suggest an alternative to address the prior comments.

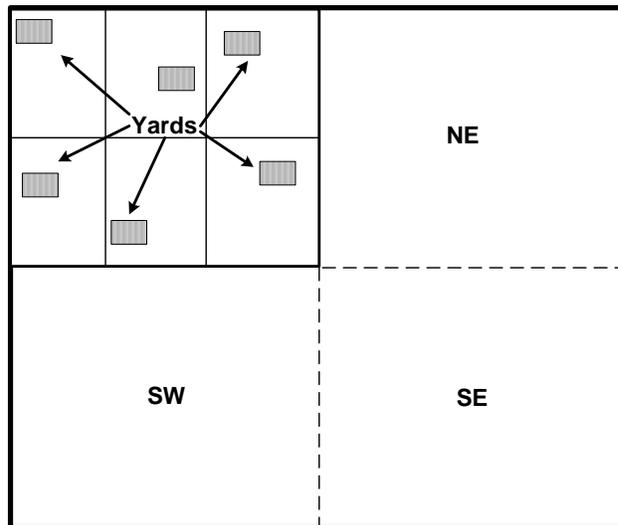
“To estimate concentration levels of expected contaminants in sediments deposited in representative residential yards after flood waters have receded.”

Since the following sampling design is constructed to estimate mean concentrations in a residential yard (i.e., an exposure unit), the collected data should also assist in estimating the exposure of sediment contamination to returning residents. The sampling design is probabilistic to preclude sampler bias and allows for inferences and uncertainty estimates.

The proposed sampling design is as follows;

- Assume a population of 1 square mile as proposed in the QASP. (This seems like a large area (how many residential yards in a square mile?), but it will be used for the sake of discussion.
- If possible choose a 1 square mile residential area that is representative of other areas, Choose the sampled area so that extrapolations, although tenuous, can be made, until time allows for those other areas to be directly sampled (e.g., if only one residential area is down flood of a POTW, and all other residential areas are not; choose from the latter).
- Study Google satellite pictures of the chosen 1 square mile area beforehand to determine the number of residential yards, elevations and the lay-out (Google has before and after flood pictures). Print-out maps for use and mark-up in the field since city plans are not likely to be available.
- Upon arriving at the site, walk it and observe differences between areas. Stratify the 1 square mile area into strata that experienced similar exposure to flood waters and sediments (e.g., areas of different elevations, or areas where floodwaters were channeled through versus other areas that were only exposed to more gently rising and ebbing waters, or areas heavily covered with sediments versus those with little to no sediments deposits.) Strata do not have to be contiguous, (i.e., heavily sedimented residential yards vs. slightly/no sediment yards) but contiguous strata are usually easier to manage. If strata are not obvious, then divide 1 square mile into strata geographically, (i.e., the northwest, northeast, southwest, and southeast quadrant).
- If strata are roughly the same size, sample the same number of residential yards per strata. If they are very different in size, proportionally sample the strata (i.e., more residential yards sampled in larger strata).
- One composite sample will be collected per yard. Assuming that time or budget only allows for the analysis of only 24 samples (not counting duplicates), 24 residential yards will be sampled.
- To facilitate the following discussion, let's assume there were no obvious strata and that the 1 square mile area was divided into 4 quadrants of equal size. This would mean that six residential yards would be randomly sampled per stratum. (Figure 1.) Alternatively, if sediment deposits are extremely variable across all of the 4 strata, then 3 heavily and 3 lightly sedimented residential yards could be randomly selected from each strata.

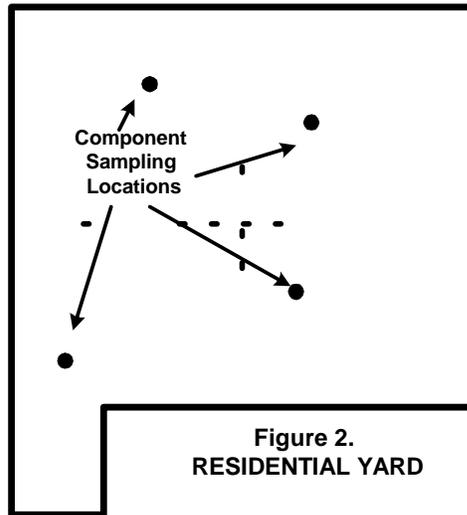
- To ensure coverage of these sizable strata, each strata will be further subdivided into six geographical substrata. Each of these substrata will be randomly sampled, with one residential yard chosen and sampled per substrata. (Figure 1.)
- Randomly select one residential yard within each substratum. The selection of yards for sampling can be done by using a random number generator (Microsoft Excel or a calculator) or random number tables to interpolate the latitude and longitudes of the substrata.



**Figure 1. Square Mile Area with Strata & Substrata**

- Each yard will be divided into 4 roughly equal strata, from each of which a random component sample will be collected. These 4 component samples will be combined into one composite sample per yard. (Refer to Figure 19, page 68 of EPA530-D-02-002 and EPA/540/R-96/018, Exhibit 7, page 13)
- The sampling locations for each of the four component samples will be chosen randomly. (Figure 2.) If no sediment is present at the randomly chosen sampling location, then the top 2 cm of soils (EPA/540/R-96/018) will be sampled. If the randomly chosen component sampling point falls on pavement with no significant sediment, choose another random sampling location. Preferably, for a given analyte type, (metals, VOCs, SVOCs) component samples for a residential yard will be placed in the same container so that compositing will not be required by the laboratory. This will not be possible for VOCs, if methanol preservation is not employed.
- A minimum 500 gram sample of sediment and soil samples will be collected to control Fundamental Error (FE) for particles up to 0.37 cm in diameter. Use disposable sampling equipment when possible. Syringe type coring tools should be used for VOC sampling (ASTM D4547-98).
- Artifacts such as windswept vegetation, debris and impervious rocks will be precluded. A few samples of these artifacts will be collected, archived and analyzed later to prove they are not significant contributors.

- At least one yard in each stratum should be sampled a second time to generate a duplicate composite sample (using four new randomly chosen component sample locations) to yield variability data.
- Use GPS to locate strata, substrata, yards and sample locations as described in the QASP.



The proposed subsampling design is as follows;

- Organic parameters: Analytical aliquots for organic parameter analysis should be the typical 30 gram sample size that will accommodate a maximum particle size of 0.15 cm while controlling fundamental error before requiring particle size reduction. Beware of any automated laboratory extraction systems that decrease sample mass.
- Inorganic parameters: Be aware of the limitation of the specified SW-846 metal preparation methods (i.e., minimum 1 gram sample size for Method 3050B and maximum 0.5 gram sample size for Method 3051). Avoid Method 3051 because of the small sample sizes that are employed. Request that the laboratory employ minimum 10 gram sample sizes and increase digestion reagent volumes proportionally. The increased sample mass will improve representativeness when employing Method 3050B. Refer to EPA guidance regarding particle size versus fundamental error (EPA 530-D-02-002, pages 197 -200).
- Subsampling of the 500 gram field samples for the above analytical subsamples must be done correctly. Refer to the following for subsampling guidance;
  - Nocerino, et al. (Environmental Forensics, 6:35-44, 2005)
  - EPA 530-D-02-002, pages 135 – 138
  - ASTM Standard D6323 for additional subsampling guidance
  - Piere Gy’s Sampling Theory and Sampling Practice, Francis F. Pitard, CRC Press
- Pitard (Piere Gy’s Sampling Theory and Sampling Practice, Francis F. Pitard, CRC Press, Page 241) suggests a ‘one-dimensional Japanese slab-cake’ which

- should work with wet sediments. Subsampling of methanol preserved VOC samples merely involves syringe sampling of the methanol layer.
- Specify subsampling methods in the QASP and in the laboratory scope of work since typical subsampling in environmental labs is casual and incorrect.

## **ROBERT PITT**

### **Overall general comments:**

Will this be a preliminary sampling effort, to be followed-up with additional sampling in other areas? I am concerned that the limiting sampling effort of only 24 samples in one area during one day can be used to generalize the conditions for other residential areas. Obviously, this is a good initial sampling effort that can be used to design a more comprehensive sampling effort in the future.

The analytical list is quite specific and comprehensive, with the exception of the bacteria analyses. In some places, the sampling plan lists total coliforms, while in other places, it lists fecal coliforms. Either way, these bacteria data may not be very useful. It would be much more suitable to also directly monitor likely pathogens.

It is suggested that the analytical list be expanded to simultaneously include indicators of the type of contamination that may be present. Indicators could then be used over a wider area in the future. If they indicate significant contamination, then formal samples could be collected and analyzed to verify the presence of potential health risks.

When the water is pumped out, the sediments left behind will rapidly dry. Potential aerosol problems may occur from the dust during the cleaning operations, so these hazards should also be considered in the risk evaluation.

### **Specific comments (page numbers refer to actual document page, from front):**

#### **Sampling Approach and Procedures**

Pg 7: "Samples collected...will be used to evaluate the types of contaminants present"

There is no overall discussion of the sampling program. Is this the only effort envisioned, or is it just the preliminary effort? Will these results be presented as being representative of all the sediments that residents will likely be in contact with near their homes?

Pg 8: "The area to be sampled will be a residential area where the public is or could return at this time. Twenty-four samples will be collected over an area not exceed one-square mile."

What about areas of likely contamination? The bias sampling will target areas likely having elevated contamination, such as oily sediments or large stains.

This is a one day effort, will further sampling be conducted? Will these initial samples be used to make judgments for the whole area?

Pg. 9. “This plan assumes that level of contamination in sediment samples collected outside the homes will be approximately the same as the level of contamination found in samples collected inside the home.”

Sediments insides homes may be contaminated further by household toxicants.

Pg. 9. “Volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, pesticides, herbicides, polychlorinated biphenyls (pcbs), total coliform analyses, and total petroleum hydrocarbons (TPHs)”

The summary listed fecal coliforms, not total coliforms. However, neither are good indicators of pathogens for these types of waters. The bacteria tests should also include viable enteric pathogens that are likely present. Fecal and total coliform analyses will be extremely misleading for these types of wastes. It would also be straight-forward to also analyze for Coprostanol by GC/MSD SIM at the same time as for the traditional SVOCs in the sediments as a better indication of fecal contamination.

What about sediment toxicity screening tests to supplement, or possibly for use over a wider area? Azur Environmental’s Microtox system has a rapid sediment toxicity test available, for example.

During analyses of sediment from industrial manholes from around the nation, we found that sediment texture (fine grained) and color (especially dark, or reddish) related well to high SVOC contamination. I am sure sediment color (and odor) will be noted when collected, and I would recommend also analyzing for particle size distributions (at least clay content).

Another rapid on-site detector we found useful for SVOCs was the PetroSense by FCI Environmental, Inc. This fiber-optical sensor can be used in water and vapors (plus sediment slurries). We found it to be very useful for determining the presence of petroleum product contamination (BTEX and TPH, for example).

Finally, aerial photography should not be overlooked as a possible method to track sediment accumulations (and some characteristics) in the area as the water is pumped out.

Pg 11. “The nondisposable sampling equipment used during the sample collection process will be thoroughly pre-cleaned before initial use, between use, and at the end of the field investigation.”

It will be difficult to clean samplers between use in the devastated area. If grab samples, can they be collected directly into clean sample bottles? Will samples be collected as composites in small area? Then they will need to be split. If only 24 samples, can bring

pre-cleaned “surface samples” (small trowels?) for each sample, and then clean all at end of sampling day (if all to be collected in one day, won’t have time to clean between samples, especially as the protocol specifies air-drying).

Pg 11. Holding times. Since this is a screening program, it may not be a serious problem if the bacteria are held on ice for up to 24 hours. See Borst’s (EPA Edison lab) recent papers on bacteria holding time tests for wet weather samples. Not much is lost with a slightly extended holding time. It is better than tossing the samples and not having the data.

Pg 13. Containers and holding times.

Should the metals be in polyethylene bottles and not glass?

Should the organics be in dark bottles (not clear)?

If the samples for metal analyses are digested, and the SVOCs organics are extracted within the holding time designated (with the extract frozen), the final GC/MSD analyses can be conducted much later (helpful when collecting samples for a recon survey, with composing, and when there is a need for later specific sample analyses, etc.)

#### **Appendix A: Sediment Data Quality Objective**

Pg 24. “If no contaminants exceed the specified benchmarks in sediment, no further screening will be necessary for contaminants being analyzed.”

What about for other contaminants not analyzed? This sampling program has a high potential for false negatives (type II errors) due to the few samples, limited area, and limited analyte list (especially for pathogens).

Pg 27. “The assignment of probability values is not applicable to this DQO because these samples are being collected for baseline and screening purposes.”

The DQOs should always be specified. A screening program obviously can tolerate lower standards, but they still must be specified. A preliminary program is often needed to establish the variability so the errors associated with the data can be determined afterwards, and further sampling can be based on that preliminary guidance. However, this document does not describe any follow-up sampling activity and implies that this effort will be all that will be done. In either case, the DQOs need to be stated.

#### **JOAN B. ROSE**

I will respond for the most part in regard to the microbial sampling that is mentioned in the document (fecal coliform bacteria) as that is my area of expertise.

In general: First the document is fairly well prepared and the objectives are clear. It is a good idea to have the lat/longs and GPS coordinates documented while sampling.

Page 1: 1.1 Project Objectives states that the sampling will focus on fecal coliform bacteria, however, page 5 it states that total coliform bacteria will be sampled. Since these are very different bacteria, then it seems that this needs to be clarified ASAP. Total coliform bacteria would not be appropriate and in fact *E.coli* should perhaps be tested for in addition to fecal coliform bacteria. It seems that *Clostridium perfringenes* would also be appropriate. This would address those sites associated with sewage contamination.

Page 5: The sentences at the bottom of this page are odd and should be split into two separate sentences on addressing the EPA publication SW-846 and one addressing the EMPAT. The holding time listed here is inconsistent with Table 4-1 on the holding times so this needs to be corrected.

It is not clear to me what EMPAT is. Is this a NELAC program? This should be clarified.

Page 9: Table 4-1 suggests that the fecal coliform bacteria will be measured by ASTM 9222D method. I do not believe that this is an ASTM method. I could not find it at any rate. It seems this is the membrane filtration method in *Standard Methods for the Examination of Water and Wastewater*. The top part of the soil will be sampled for the bacteria. This should be sampled with a sterile spatula and bleach treated in between samples. A sterile plastic jar or whirl pac should be used.

A method which describes sampling microbes from sediments or soil will need to be used. A soil microbiologist should be consulted. I would suggest that the group use the biosolids/ sludge methods that EPA has approved and the laboratories that are set up and have had experience with sampling the sludges/ biosolids. Membrane filtration is probably not the best method as the solids would interfere with the enumeration.

Exposure to any of these top soils if there is load of fecal organisms is a potential human health risk. Thus it will be important to know where the bacteria are. As the top of the soil dries the bacteria may die, but survive just below in the few top inches.

I would also suggest that the group look into a toxicity testing as described in the ASTM standard: SEE BELOW:

**D5660-96(2004) Standard Test Method for Assessing the Microbial Detoxification of Chemically Contaminated Water and Soil Using a Toxicity Test with a Luminescent Marine Bacterium**

Developed by Subcommittee: [D34.03.01](#)  
See [Related Work](#) by this Subcommittee  
Adoptions:  
Book of Standards Volume: 11.04

**1. Scope** 1.1 This test method (1) covers a procedure for the rapid evaluation of the toxicity of wastewaters and aqueous extracts from contaminated soils and sediments, to the luminescent marine bacterium *Photobacterium phosphoreum*, prior to and following biological

treatment. This test method is meant for use as a means to assess samples resulting from biotreatability studies. Sensitivity data for *P. phosphoreum* to over 1300 chemicals have been reported in the literature (2). Some of the publications are very relevant to this test method (3). The data obtained from this test method, when combined with respirometry, total organic carbon (TOC), biochemical oxygen demand (BOD), chemical oxygen demand (COD), or spectrophotometric data, can assist in the determination of the degree of biodegradability of a contaminant in water, soil, or sediment (3). The percentage difference between the IC20 of treated and untreated sample is used to assess the progress of detoxification.

1.2 This test method is applicable to the evaluation of the toxicity (to a specific microbe) and its implication on the biodegradation of aqueous samples from laboratory research bio-reactors (liquid or soil), pilot-plant biological treatment systems, full-scale biological treatment systems, and land application processes

## **DOUGLAS SPLITSTONE**

I will provide comments on the following charge items:

- Are the project objectives and the preliminary nature of this plan clearly stated ?
- Comment on the validity of the sampling approach and the adequacy of the methods to accomplish the project objectives.
- Comment on the adequacy and the transparency of the quality assurance plan and the plan for project documentation.

First I have one suggested editorial change to the *Emergency Response Quality Assurance Sampling Plan*. This ignores the few misspellings found.

### **The first full sentence at the top of page 3.**

“EPA Region IV is providing assistance to the States of Mississippi and Alabama”. To be consistent I suggest the following replacement. “EPA Region 4 is providing assistance to the States of Mississippi and Alabama.”

This minor change provides an opportunity for me to mention that Region 4 has a very well documented set of SOPs readily available from their web site [www.epa.gov/region4/sesd/sesdpub\\_guidance.html](http://www.epa.gov/region4/sesd/sesdpub_guidance.html). One would hope that this resource would be tapped in developing OASPs.

### **Comments on the Charge Items**

- *Are the project objectives and the preliminary nature of this plan clearly stated ?*

I believe that the objective and preliminary nature of the plan are clearly stated. The objective is to determine whether contaminants are present in residential areas impacted by flood sedimentation. Further, it is desired to identify these contaminants. It is clearly

stated that this is a “screening” program the results of which may trigger further investigation.

What is not specified in the program objective is any goal as to how likely this program is to find hazardous substances when in fact they are present. Thus, there is little assurance that a health hazard does not exist in areas for which the sampling program has not detected contaminants.

- *Comment on the validity of the sampling approach and the adequacy of the methods to accomplish the project objectives.*

The judgmental sampling plan is obviously one of practicality. Twenty-four grab samples can be collected in an area no larger than one square mile (approximately 640 acres) by a single sampling crew in a day.

If these 24 samples were to be allocated to 640 acres according to a fixed rectangular grid there would be a 50 percent chance of detecting a circular contaminated area 888 feet in diameter. There would be a 90 percent chance of detecting a circular area of contamination 1,442 feet in diameter. Assuming a nominal lot size of 30 feet-by-100 feet, there is a 50 percent chance of detecting a contaminated area equivalent to 206 contiguous lots, and a 90 percent chance of detecting a contaminated area equivalent to 544 contiguous lots.

Assuming that potentially contaminated sedimented areas will be visually different from other areas, judgmental sampling might improve upon the above detection probabilities. However, quantifying the improvement is not straightforward. I would like to propose the following changes to **the last two sentences beginning at the bottom of page 4** so as to avoid any ambiguity.

“For this screening level analysis, **biased** sampling was selected as the most appropriate method in order to give the highest **probability** of finding contamination. Therefore, efforts should be made to **bias** the samples **toward areas that are more likely to contain elevated levels of contamination, such as areas that contain oily sediments or large stains**”.

My suggested replacement is:

“For this screening level analysis, **judgmental** sampling was selected as the most appropriate method in order to give the highest **success rate** of finding contamination. Therefore, efforts should be made to **select** the samples **from** areas that, in the judgment of the field team, are more likely to contain elevated levels of contamination. **Such areas are those that exhibit oily sediments or large stains**”.

The word “bias” often has a negative connotation. While the results of the judgmental sampling may well be biased in terms of estimating the arithmetic mean required by the “Risk Assessment Paradigm,” it is unnecessary to use the term here.

It appears that the analytical results for each collected sample are to be compared to the Medium-Specific Screening Levels (MSSLs) for soils in addition to site-specific background levels. How site-specific background levels are determined is not discussed. What is, or is not, site-specific background is often a subject of debate. My view is that all stake holders agree on the boundaries of what is to be site-specific background and then one designs a sampling plan to characterize it. Perhaps at this point reference to site-specific background should be left to future site characterization plans and deleted from this document.

In terms of a decision rule, I see nothing wrong in comparing the analytical results for each sample to the MSSLs. This certainly provides for fixed criteria in deciding whether or not to initiate further investigation. My fear is that this comparison will be interpreted as inferring something beyond the making of a simple further investigation decision.

It is my understanding that MSSLs are developed consonant with the Risk Assessment Paradigm. As such they are levels of concentration applicable to the MEAN exposure concentration. This sampling plan is geared toward finding “extreme” concentrations not estimating arithmetic means. The decision rule does not support any inference regarding the potential risk to human health and the environment that is consonant with the Risk Assessment Paradigm.

Given the comment above, I suggest that the specific statement of the null and alternate hypotheses be made specific. I offer the following suggestions.

$H_0$ : At least one sample from the selected area is above the screening level.

$H_1$ : No sample from the selected area is above the screening level.

*- Comment on the adequacy and the transparency of the quality assurance plan and the plan for project documentation.*

My comments on this item are confined to those one might expect from a statistician. The effort is commendable given the circumstance and time frame in which it was constructed. However, I would like to see more specificity regarding interpretation of the decision outputs.

Given the judgmental nature of the sampling effort, it is not possible to a priori quantify the probability of a decision error. Certainly if at least one result of the sampling effort is above the MSSLs the only potential loss is the cost of further study. However, I am uneasy that if none of the results of the judgmental sampling effort exceed the MSSLs then there is nothing one can say except none of the results exceeded an MSSL. I would not be confident in saying that such an area sampled did not pose a risk to human health.

Assuming that the “potentially contaminated” 24 sampling locations within an area have been randomly sampled, one can make statements such as the following:

- One is 99.5 percent confident that at most 20 percent of the potential samples will exceed the observed maximum.
- One is 92 percent confident that at most 10 percent of the potential samples will exceed the observed maximum.
- One is 71 percent confident that at most 5 percent of the potential samples will exceed the observed maximum.

I think that the logical underpinnings are reasonably transparent. Some decision must be made regarding the potential for contamination due to post flooding sedimentation over an extremely large area. There are limited resources and time in which to make some decision. Field personnel have valuable experience in identifying potentially contaminated sediments. Employing a judgmental sampling scheme takes advantage of the available expertise and may likely result in a “good” outcome.

#### **A final speculation.**

I can not help but wonder if rapid response field analytical techniques might not be adequate to make the decisions specified in this QASP. I have had some experience with the Dextsil Cl ion analyzer and XRF. Using such rapid response analytical techniques opens the door to efficient sequential statistical sampling.

#### **DEBORAH SWACKHAMER**

I only had about an hour to look these over, but am very familiar with SOPs and QAPPs for sediment sampling so could go through them efficiently.

I only had one major objection, and it may be that I didn't understand this part. The plan calls for sampling 24 locations within a square mile - is this to be done throughout the city, or just once..? To get a feel for one square mile, 24 samples seems adequate (hard to say without a bit more knowledge of the heterogeneity of the sites, but for screening purposes seems ok) but certainly an assessment of just one square mile is inadequate to characterize the city. So it needs to be clear what parts of the city would be sampled, how they would be selected, etc.

Also, if recently sedimented material is the focus, that should be clearly stated - and directions as to sampling only the well-mixed portion of that layer should be included (rather than a constant depth). The warning about preventing the sampling of existing soil is a good one. Not sure if its in there, but the minimum volume of wet sediments should be specified, and be sufficient for meeting the lab's detection limits.

## **JAMES WATSON**

Are the project objectives and the preliminary nature of this plan clearly stated?

As presently stated in Section 1.1, "Project Objectives", the objectives may be interpreted to be more comprehensive than the project to be conducted will accomplish. It is not clearly stated, in this section, that this project is an initial screening assessment within a limited area. There is the potential for confusion on the applicability of the results of this project to areas outside of the area sampled - or to all areas within the area sampled.

Please comment on the validity of the sampling approach and the adequacy of the methods to accomplish the project objectives.

A significant decision in the sampling approach is to use biased sampling. This appears to be a reasonable approach for an initial screening assessment. This approach is also consistent with the plan to sample a rather limited number of sites. The implications of this approach, as well as the limited size of the area sampled, should be clearly explained.

Section 5.1 of QASP - Material Spike/Material Spike Duplicate: Details are not given on how many spiked samples and on what spiked materials will be included. I wish to emphasize that the analyses of spiked samples are important for the validation of program results.

The SAB's advice on constituent analysis would also be appreciated.

The sampling program does not include screening analyses for radioactivity in the sediment. I have no reason to suspect that radioactivity is present, other than normal background radioactivity. As a precaution, I recommend that consideration be given to performing screening analyses for radioactivity on a subset of the sediment samples. Screening analyses, such as analyses of total beta and total gamma activity, are relatively simple to perform.