TETRA TECH, INC.

July 16, 2020

Lynn Nakashima
Department of Toxic Substances Control
700 Heinz Avenue, Suite 200C
Berkeley, California 94710

Sara Ziff
U.S. Environmental Protection Agency, Region 9
75 Hawthorne Street
San Francisco, California 94105

Subject: Corporation Yard, Triplicates Sampling Approach
Richmond Field Station
University of California, Berkeley

Dear Ms. Nakashima and Ms. Ziff:

On behalf of the University of California Berkeley, Tetra Tech, Inc. proposes to conduct additional data gap sampling as a follow-up to the removal action conducted at the Corporation Yard in 2017-2018 and data gap sampling presented in the Corporation Yard Data Gaps Sampling Results letter, dated November 22, 2019. At the request of DTSC, this letter also provides clarifications regarding the results presented in the November 2019 letter and discussions at a meeting conducted on May 8, 2020 regarding relative standard deviations (RSD) and the calculations of a weighted 95 upper confidence limit of the mean (weighted 95UCL).

This letter has been updated to incorporate comments received from DTSC on June 17, 2020. The comments and response-to-comments are provided as Attachment A.

PROPOSED SUPPLEMENTAL TRIPLICATE ANALYSIS

The purpose of this investigation is to further determine the mean concentrations of polychlorinated biphenyls (PCB) within the near surface (0-2 inches below ground surface) within the Corporation Yard between Building 120 and the fence line south of Building 185. This area is covered by DU09 through DU17, shown on Figure 1. In response to DTSC recommendations for additional triplicate analysis provided on May 15, 2020 and comments provided on June 17, 2020, UC Berkeley proposes to collect laboratory and field triplicates at DU09, DU10, and DU17. Total PCB sample results presented in the November 2019 letter are presented on Figure 1.

Sampling Approach

Incremental sampling methodology (ISM) will be used to collect soil samples from DU09, DU10, and DU17. ISM was selected for this project to provide a comprehensive and thorough evaluation of chemical concentrations in a specific volume of soil, or decision unit. ISM triplicate sample results enable the

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quantification of field and laboratory measurement variability, which is not typically quantified in projects with discrete sample results. While ISM presents measured variability, the ISM sampling procedure is designed specifically to reduce field and laboratory variability when compared to discrete sampling.

The result of each ISM sample will be used as the mean concentration for the decision unit it was collected from. The approach presented below is consistent with the ISM sampling presented in the November 2019 letter.

- A minimum of 75 increments will be collected from within each decision unit. The corners and edges of each decision unit will be marked with flags, and the spacing of increments will be determined in the field based on the shape of each decision unit. The precise location of each increment is not critical, as long as they are distributed evenly throughout the decision unit. Increments will be collected from the top 2 inches of the native surface with a disposable scoop or other disposable sampling apparatus. In some areas, the native surface is the current surface cover; however, where gravel is present, the gravel will be removed prior to collecting the increment. Each increment will be approximately 20 grams of soil.

- Increments from each decision unit will be placed directly into a 32-ounce glass jar, or multiple jars if necessary. The target weight of each ISM sample is approximately 1.5 kilograms. Each jar will be labeled and packed into an insulated cooler; the use of ice packs is not necessary for the preservation of samples analyzed for PCBs. The samples will be transported under chain-of custody procedures to Agriculture & Priority Pollutants Laboratories, Inc. (APPL) in Clovis, California.

- Field triplicates will be collected from all three decision units. A field triplicate consists of the collection of 75 increments thrice within the same decision unit from different locations. The locations of increments comprising the first triplicate will be placed at 75 locations based on equally spaced grid nodes within each decision unit. The second and third triplicate increments will be collected 3 feet away from the each of the first triplicate increment locations. This method will help ensure that each set of triplicates is independent and collected consistently. The primary purpose of the field triplicate is to evaluate the effectiveness of the ISM sample to capture any PCB contaminant variability within the decision unit. The field triplicate results will also inherently include any laboratory variability discussed below.

Health and safety measures will adhere to the *Final Field Sampling Workplan, Appendix B, Health and Safety Plan*, dated June 2, 2010. Protocols to be followed specific to COVID-19 protections are included as Attachment B.

Laboratory Analyses

Soil samples will be processed according to APPL's internal ISM protocol. The 1.5 kilogram sample will be ground and subsampled to a final analytical aliquot of 30 grams. Samples will be analyzed for PCBs by EPA Method 8082 with 3540C Soxhlet extraction.

One laboratory triplicate will be identified from each field triplicate set and analyzed for PCBs by the laboratory three times. Each laboratory triplicate will be ground, subsampled. and evaluated separately.

The primary purpose of the laboratory triplicate is to evaluate the effectiveness of the subsampling protocol and any laboratory variability. Together, the field and laboratory triplicates constitute a nested triplicate.

Laboratory Triplicate Evaluation

The RSDs for laboratory triplicate results from DU09, DU10, and DU17 will be compared to RSD goals based on simulated triplicate results without laboratory variability. Triplicate results can be highly dependent upon the relative detected concentrations due to instrument accuracy and precision limitations. RSD goals are therefore based on simulated ranges of triplicate concentrations.

Actual combinations of triplicate results are not known and therefore all possible scenarios cannot be estimated. Five scenarios were selected to capture a reasonable range of possible scenarios based on the results from DU09 through DU17. The concentration ranges were selected as they represent acceptable expected triplicate concentration ranges with very low laboratory variability. For Scenarios 1 through 4, three trials A, B, and C were conducted to estimate mean, standard deviation, and RSD for simulated triplicate sample results within each range. The concentrations are based on estimated triplicate results from the low and high concentrations within each scenario.

Scenario 1: Triplicate Detection Range: Non detect to 0.2 mg/kg			
	Trial A	Trial B	Trial C
Lab Triplicate A	0.03	0.03	0.03
Lab Triplicate B	0.1	0.04	0.19
Lab Triplicate C	0.2	0.2	0.2
Mean	0.11	0.09	0.14
Standard Deviation	0.09	0.10	0.10
RSD	77.7%	106.0%	68.1%

Scenario 2: Triplicate Detection Range: 0.2 to 0.7 mg/kg			
	Trial A	Trial B	Trial C
Lab Triplicate A	0.20	0.20	0.20
Lab Triplicate B	0.45	0.21	0.69
Lab Triplicate C	0.70	0.70	0.70
Mean	0.45	0.37	0.53
Standard Deviation	0.25	0.29	0.29
RSD	55.6%	77.3%	53.9%

Scenario 3: Triplicate Detection Range: 0.7 to 2 mg/kg			
	Trial A	Trial B	Trial C
Lab Triplicate A	0.70	0.70	0.70
Lab Triplicate B	1.0	0.71	1.9
Lab Triplicate C	2.0	2.0	2.0
Mean	1.23	1.14	1.53
Standard Deviation	0.68	0.75	0.72
RSD	55.2%	65.8%	47.2%

Scenario 4: Triplicate Detection Range: 2 to 4 mg/kg			
	Trial A	Trial B	Trial C
Lab Triplicate A	2.0	2.0	2.0
Lab Triplicate B	3	2.1	3.9
Lab Triplicate C	4.0	4.0	4.0
Mean	3.00	2.70	3.30
Standard Deviation	1.00	1.13	1.13
RSD	33.3%	41.7%	34.1%

The highest RSD identified in the each of the three trials is used as the RSD goals for that scenario. For Scenario 5, the ISM industry standard of 35% is selected.

Scenario	Range of Detected Laboratory Triplicate Total PCB Concentrations (mg/kg)	RSD Goal
1	Less than 0.2	106%
2	0.2 to 0.7	77%
3	0.7 to 2	66%
4	2 to 4	42%
5	Greater than 4	35%

The trials and scenarios demonstrate how elevated RSDs can be expected at low concentrations regardless of laboratory variability, and that RSDs are not a good metric to evaluate laboratory variability at those concentrations. Note that UC Berkeley and Tetra Tech have been working with the current laboratory APPL to help reduce variability through application of rigorous sieving, grinding, and subsampling techniques. The RSD goal is intended to provide an overall framework to evaluate laboratory triplicate results and is not intended to be a pass/fail analysis.

Field Triplicate Evaluation and Weighted 95UCL Calculations

The field triplicate results will be used to calculate RSDs for DU09, DU10, and DU17 in further support of the weighted 95UCL for the area defined above. The general approach is to apply pooled variances from the DUs with triplicates to obtain an average RSD that is applied to calculate 95%UCLs for the

singlet DUs, and subsequently calculating a weighted 95UCL for the area encompassed by DU9 through 17.

The weighted 95UCL will apply the first laboratory triplicate sample reported, unless the laboratory triplicate results yield poor precision, then the triplicate mean will be used if the results support such as the most representative value. Evaluation of all triplicate results and application of RSDs should always be evaluated on a case-by-case basis, and will be discussed with EPA and DTSC.

The weighted 95UCL will be calculated consistent with the information presented at the May 8, 2020 meeting and as summarized in the section below.

UC Berkeley will provide preliminary recommendations regarding the appropriate use of the triplicate results in conjunction with all previous sampling results for the area, including discrete samples presented in the Site Characterization Report, Figure 6-8, attached to this letter. The calculation of a weighted 95UCL for this area is consistent with the Corporation Yard boundary evaluated in the risk assessment conducted in support of the RAW, as shown on RAW Figure 2-3, included as an attachment to this letter. The proposed approach will be discussed with EPA and DTSC prior to issuance of a sample results summary or formal weighted 95UCL calculations to ensure concurrence regarding the approach.

Following discussion with DTSC and EPA, the sample results will be presented in a sampling letter report providing complete details regarding the updated weighted 95UCL. Methods and equations and calculation results will be presented within the sample results summary.

The data collected during this investigation will ultimately be presented with the comprehensive data following completion of all Corporation Yard removal action activities.

NOVEMBER 2019 LETTER CLARIFICATIONS

The Corporation Yard Data Gaps Sampling Results letter, dated November 22, 2019, provided a summary of data gaps investigation and the sampling event conducted at the East Meadow, adjacent to the Corporation Yard Boundary, as defined by the Final Removal Action Workplan, dated July 18, 2014. The purpose of the letter was to provide the mean concentrations of PCBs within the near surface (0-2 inches below ground surface) within the entire Corporation Yard, Building 185, and north of Building 197.

The November 2019 letter included a discussion of quality assurance based on the ISM results of the laboratory and field triplicate sample results. The collection of triplicates allowed for the calculation of the RSD for each triplicate set. The laboratory RSD provides an indication of the variability associated with subsampling and analytical procedures. The field RSD provides an indication of how well the sample result represents the average concentration of the area sampled. The field RSD inherently includes variability associated with subsampling and analytical procedures.

The November 2019 letter provided a qualitative summary of the triplicate results and RSDs using several lines-of-evidence to support the conclusions. The evaluation was not intended to provide the basis for applying a confidence interval to a risk-based evaluation.

Subsequent to submittal of the November 2019 letter, EPA, DTSC, and UC Berkeley have conducted several meetings to discuss the strategies and technical approaches for transitioning from a "not-to-exceed" PCB concentration compliant with the Toxic Substances Control Act (TSCA) Section 761.61(a) presented in the Removal Action Workplan (RAW) to a risk-based approach compliant with TSCA Section 761.61(c). As a part of those discussions, UC Berkeley has proposed the calculation of a weighted 95UCL to meet the needs of a risk-based approach with a confidence interval applied. DTSC requested that UC Berkeley provide clarification regarding the proposed approach and discrepancies with the November 2019, as presented below.

RSD Calculations

The weighted 95UCL calculation: (1) normalizes the areal dimensions of the sample results to ensure that results from larger areas are more represented than smaller areas, and (2) incorporates the measured variability measured in triplicate results to the singlet sample results. The application of the triplicate results within the weighted 95UCL calculation is independent of the qualitative analysis of the triplicate results presented in the November 2019 letter. The approach for calculating a weighted 95UCL for the area south of Building 120 and outside of the previous excavation boundary was presented to EPA and DTSC on May 8, 2020, and is summarized below. This area is represented by sample results from DU09 though DU17. The calculation of a weighted 95UCL for this area is consistent with the Corporation Yard boundary evaluated in the risk assessment conducted in support of the RAW, as shown on RAW Figure 2-3, included as an attachment to this letter.

- The weighted 95UCL calculation applies triplicate results from decision units which are most representative of the decision units they will be applied to. For DU09, DU10, and DU12 through 17, triplicate results from DU11 were selected because they best represent the conceptual site model for contaminant release as the other decision units, and the concentrations are similar with regards to concentrations.
- The weighted 95UCL applies only the field triplicate results and not the laboratory triplicate results, since the field triplicates best represent how well the sample results represent the average concentration of the area sampled.
- The weighted 95UCL applies the first laboratory triplicate sample reported, not the average of the three laboratory triplicates. This supports the statistical evaluation of the three field triplicate results since they are all singlet results, and the third is not an average. The first laboratory triplicate reported is always the result selected, regardless of concentration. If laboratory triplicate results yield poor precision, then the triplicate mean can be used if the site-specific data support such as the most representative value.

Consequently, the RSD values presented in the November 2019 letter are different than the RSD values presented in the weighted 95UCL equations presented during the May 8 meeting. The letter presented the average of the three lab results for DU11 (0.23 micrograms per kilogram [µg/kg]) to estimate the value of the third field triplicate to calculate the field RSD; however, the weighted 95UCL uses only the first lab triplicate DU11-T3A, which was reported as non-detect.

The surrogate value for the non-detect result is based on an evaluation of half the reporting and method detection limits for Aroclor 1254 and 1260, which are the primary detected PCBs.

- The Aroclor 1254 half reporting limit was 65 µg/kg and the method detection limit was 54 µg/kg. If the actual concentration was 65 µg/kg, then the method detection limit of 54 µg/kg would have resulted as 65 J µg/kg, which it was not. As a result, half the method detection limit of 27 µg/kg is the appropriate surrogate concentration for Aroclor 1254.

- The Aroclor 1260 half reporting limit was 65 µg/kg and method detection limit was 90 µg/kg. If the actual concentration was 65 µg/kg, then the method detection limit of 90 µg/kg would have resulted as a non-detect, which it was. As a result, half the reporting limit of 65 µg/kg is the appropriate surrogate concentration for Aroclor 1260.

The surrogate sample result used for the weighted 95UCL for DU11-T3A is 27 µg/kg + 65 µg/kg = 0.092 µg/kg.

The RSD based on the field triplicate set from DU11-T1 (0.060 µg/kg), DU11-T2 (0.070 µg/kg), and DU11-T3A (0.092 µg/kg) is 21%, which differs from the November 2019 letter presenting 80% RSD.

If you have any questions or comments regarding this submittal, please call me at (415) 497-9060 or Alicia Bihler at (510) 725-2528.

Sincerely,

Jason Brodersen, P.G.
Project Manager

Attachments: Figure 1: Site Map
Figure 6-8, Site Characterization Report
Figure 2-3, Removal Action Workplan
Attachment A: Comments and Response-to-Comments
Attachment B: COVID-19 Activity Hazard Analysis

cc: Alicia Bihler, UC Berkeley EH&S
Bill Marsh, Edgcomb Law Group

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DU6
3.3

DU5
1.02

Excavation 3B

2.35
1.2
0.69
0.71
3.53
5.09
33.9

120

Excavation 3A

5.48
13.6
0.47
4.94
0.202
17.1
8240
9.7
3.52
0.243
92
2.9
60.6
6.46
12.5

DU7
4,530

DU8
6.7

Concrete Pad

DU9
0.68

DU10
2.76

1.8
7.45
0.75
0.72

Excavation 2

DU11
T1 - 0.06
T2 - 0.07
T3A - 0.00
T3B - 0.28
T3C - 0.27

DU12
0.61

178

DU13
0.06

DU14
0.20

Excavation 1

185

DU15
0.47

DU16
0.84

Excavation 5

DU17
0.92

Final Excavation Depth 1.5 feet
Final Excavation Depth 3.5 feet
New Decision Unit
Buildings
Fenceline
Roads and other Landscape Features

Note:

1. Results presented are total PCBs shown in mg/kg.

N

0 30 60
Feet

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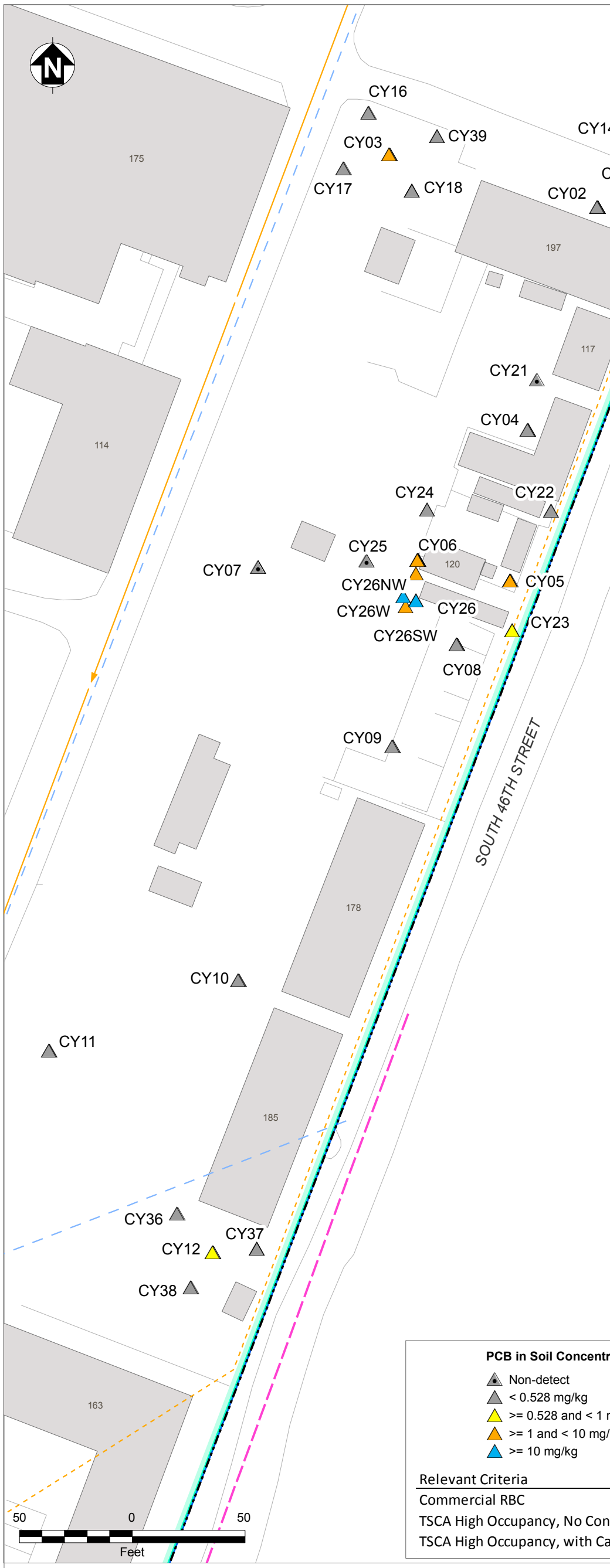
Richmond Field Station Site
University of California, Berkeley

FIGURE 1
DECISION UNITS 9 THROUGH 17



Point ID	Depth (feet bgs)	Aroclor-1254	Aroclor-1260	Total PCB
CY01	0-0.5	0.72	0.035 U	0.72
CY01	2-2.5	0.041 U	0.041 U	0 U
CY01	4-4.5	0.042 U	0.042 U	0 U
CY01	6-6.5	0.038 U	0.038 U	0 U
CY02	0-0.5	0.2	0.035 U	0.2
CY02	2-2.5	0.038 U	0.038 U	0 U
CY02	4-4.5	0.042 U	0.042 U	0 U
CY02	4-4.5	0.043 U	0.043 U	0 U
CY02	6-6.5	0.038 U	0.038 U	0 U
CY03	0-0.5	2.3	0.036 U	2.3
CY03	2-2.5	0.038 U	0.038 U	0 U
CY03	4-4.5	0.04 U	0.04 U	0 U
CY03	6-6.5	0.04 U	0.04 U	0 U
CY04	0-0.5	0.056	0.035 U	0.056
CY04	2-2.5	0.038 U	0.038 U	0 U
CY04	4-4.5	0.04 U	0.04 U	0 U
CY04	6-6.5	0.038 U	0.038 U	0 U
CY05	0-0.5	3.3	0.037 U	3.3
CY05	2-2.5	0.038 J	0.038 U	0.038
CY05	4-4.5	0.04 U	0.04 U	0 U
CY05	6-6.5	0.041	0.038 U	0.041
CY06	0-0.5	5.5	0.18 U	5.5
CY06	0-0.5	5.4	0.18 U	5.4
CY06	2-2.5	0.039 U	0.039 U	0 U
CY06	2-2.5	0.039 U	0.039 U	0 U
CY06	4-4.5	0.04 U	0.04 U	0 U
CY06	4-4.5	0.04 U	0.04 U	0 U
CY06	6-6.5	0.04 U	0.04 U	0 U
CY06	6-6.5	0.04 U	0.04 U	0 U
CY07	0-0.5	0.037 U	0.037 U	0 U
CY07	2-2.5	0.039 U	0.039 U	0 U
CY07	4-4.5	0.039 U	0.039 U	0 U
CY07	6-6.5	0.037 U	0.037 U	0 U
CY08	0-0.5	0.035 U	0.033 J	0.033
CY08	2-2.5	0.04 U	0.04 U	0 U
CY08	4-4.5	0.042 U	0.042 U	0 U
CY08	6-6.5	0.039 U	0.039 U	0 U
CY09	0-0.5	0.11	0.041 U	0.11
CY09	2-2.5	0.041 U	0.041 U	0 U
CY09	4-4.5	0.041 U	0.041 U	0 U
CY10	0-0.5	0.029 J	0.039 U	0.029
CY10	2-2.5	0.04 U	0.04 U	0 U
CY10	4-4.5	0.041 U	0.041 U	0 U
CY11	0-0.5	0.089	0.037 U	0.089
CY11	2-2.5	0.04 U	0.04 U	0 U
CY11	4-4.5	0.041 U	0.041 U	0 U
CY12	0-0.5	0.97	0.036 U	0.97
CY12	2-2.5	0.041 U	0.041 U	0 U
CY12	4-4.5	0.041 U	0.041 U	0 U
CY13	0-0.5	4.3	0.0043 U	4.3
CY13	2-2.5	0.0054 J	0.0022 UJ	0.0054
CY14	0-0.5	0.0017 J	0.0022 U	0.0017
CY14	0-0.5	0.00078 UJ	0.0022 UJ	0 U
CY14	2-2.5	0.00078 UJ	0.0022 UJ	0 U
CY15	0-0.5	0.021 U	0.8	0.8
CY15	2-2.5	0.0044 J	0.0022 UJ	0.0044
CY16	0-0.5	0.064	0.0043 U	0.064
CY16	2-2.5	0.00078 UJ	0.0022 UJ	0 U
CY17	0-0.5	0.054 J	0.0022 UJ	0.054
CY17	2-2.5	0.00078 UJ	0.0022 UJ	0 U
CY18	0-0.5	0.072 J	0.0022 UJ	0.072
CY18	0-0.5	0.045 J	0.0022 UJ	0.045
CY18	2-2.5	0.0031 J	0.0022 UJ	0.0031
CY21	0-0.5	0.00078 U	0.0022 U	0 U
CY22	0-0.5	0.019 0	0.0022 U	0.019
CY22	2-2.5	0.055 J	0.0022 UJ	0.055
CY23	0-0.5	0.6	0.055 UJ	0.6
CY23	2-2.5	0.36	0.055 U	0.36
CY24	0-0.5	0.082	0.0022 U	0.082
CY24	2-2.5	0.014	0.0022 U	0.014
CY25	0-0.5	0.00078 U	0.0022 U	0 U
CY25	2-2.5	0.00078 U	0.0022 U	0 U
CY26	0-0.5	110	2.2 U	110
CY26	2-2.5	7.2	0.22 U	7.2
CY26NW	0-0.5	1.1	0.022 U	1.1
CY26SW	0-0.5	8.3	0.22 U	8.3
CY26W	0-0.5	12	0.22 U	12
CY36	0-0.5	0.0092 J	0.0022 U	0.0092
CY36	2-2.5	0.00078 UJ	0.0022 UJ	0 U
CY37	0-0.5	0.091	0.0057 U	0.091
CY37	0-0.5	0.26	0.0057 U	0.26
CY37	2-2.5	0.0034 J	0.0022 UJ	0.0034
CY38	0-0.5	0.13	0.0022 U	0.13
CY38	2-2.5	0.00078 UJ	0.0022 UJ	0 U
CY39	0-0.5	0.062	0.0022 U	0.062
CY39	2-2.5	0.17 J	0.0022 UJ	0.17

PCB in Soil Concentrations[1]

- Non-detect
- < 0.528 mg/kg
- >= 0.528 and < 1 mg/kg
- >= 1 and < 10 mg/kg
- >= 10 mg/kg

Relevant Criteria	mg/kg
Commercial RBC	0.528
TSCA High Occupancy, No Conditions	1
TSCA High Occupancy, with Cap	10

- RES Area
- Approximate Site Boundary
- Existing Building
- Road or Other Landscape Feature
- Slurry Wall

Sanitary Sewer Lines:

- Existing Sewer Line
- Removed Sewer Line
- Abandoned Sewer Line

Storm Drain Line:

- Underground Culvert
- Underground Culvert, Abandoned (Grouted at Manholes)

Notes:
All soil data for the analyte collected as part of the FSW investigation are shown.
Results in table are presented in mg/kg.

1	Total PCB concentration is the sum of detected concentrations of Aroclors -1254 and -1260 in each sample. The maximum concentration at each location is represented.
bgs	Below ground surface
DTSC	California Department of Toxic Substances Control
J	Estimated
mg/kg	Milligram per kilogram
PCB	Polychlorinated biphenyl
RBC	Risk-Based Concentration
RES	Research, Education & Support Area
TSCA	Toxic Substances Control Act
U	Not Detected

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Proposed Richmond Bay Campus

FIGURE 6-8
PCB CONCENTRATIONS IN SOIL IN THE CORPORATION YARD

Site Characterization Report

Carbon Tetrachloride Area

Building 474 Transformer Area

MFA

Building 150 Transformer Area

Corporation Yard

Building 112 Transformer Area

201 EPA Lab

Concrete Pad

0 250 500

Feet

Notes:
1. The maximum concentration at each location is represented.

BAP(EQ)	Benzo(a)pyrene equivalent
DTSC	Department of Toxic Substances Control
MFA	Mercury Fulminate Area
mg/kg	Milligram per kilogram
ng/kg	Nanograms per kilogram
PCB	Polychorinated biphenyl
RBC	Risk-Based Concentration
RES	Research, Education and Support Area
RFS	Richmond Field Station
TEQ	Toxic equivalent quotient
TSCA	Toxic Substances Control Act

Soil Sampling Locations

- All Chemical Concentrations < Remedial Goals
- Mercury Concentrations[1] ≥ 275 mg/kg (Commercial RBC)
- PCB Concentrations[1] ≥ 1 mg/kg (TSCA High Occupancy, No Conditions)
- Lead Concentrations[1] ≥ 320 mg/kg (Commercial RBC)
- Dioxin TEQ Concentrations[1] ≥ 16.4 ng/kg (Commercial
- BAP(EQ) Concentrations[1] ≥ 0.4 mg/kg (Background)
- Arsenic Concentrations[1] ≥ 16 mg/kg (Background)

Area Boundaries

- MFA
- Corporation Yard
- Transformer
- Carbon Tetrachloride

- Slurry Wall
- Biologically Active Permeable Barrier
- Former Seawall (Approximate)
- Fenceline
- Asphalt/Concrete Pads
- Buildings
- Marsh Boundary
- Surface Water
- RES Area within the
- Portion of RFS Property Subject to DTSC order, Defined as
- Richmond Bay Campus
- Roads and other Landscape Features

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Richmond Bay Campus

FIGURE 2-8
RES SOIL SAMPLING LOCATIONS WITH REMEDIAL GOAL EXCEEDANCES

Removal Action Workplan

ATTACHMENT A

COMMENTS AND RESPONSE-TO-COMMENTS

Department of Toxic Substances Control

Jared Blumenfeld
Secretary for
Environmental Protection

Meredith Williams, Ph.D., Director
700 Heinz Avenue
Berkeley, California 94710-2721

Gavin Newsom
Governor

June 17, 2020

Greg Haet, P.E.
EH&S Associate Director, Environmental Protection
Office of Environment, Health & Safety
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Berkeley, California 94720
Email: ghjaet@berkeley.edu

Dear Mr. Haet:

The Department of Toxic Substances Control (DTSC) received the *Corporation Yard, Triplicate Sampling Approach* letter (Sampling Approach) dated June 3, 2020, for the Richmond Field Station site, located at 1301 South 46th Street in Richmond, California. The Sampling Approach prepared by Tetra Tech, Inc. on behalf of the University of California, Berkeley proposes to conduct additional data gap sampling at the Corporation Yard, and provides clarifications regarding the calculation of the relative standard deviation presented in a November 22, 2019 data summary letter. DTSC program, Human and Ecological Risk Office (HERO) and Geologic Services Unit staff have reviewed the proposal and have the following comments. Also enclosed is a memorandum with comments prepared by Dr. Karen DiBiasio of HERO.

1. Page 4 of 5: In regard to applying the weighted UCL to the first laboratory triplicate sample reported instead of the average of the three laboratory triplicates, a data quality objective for the relative standard deviation of laboratory triplicates should be articulated in the Sampling Approach. DTSC would not support the representativeness of a singlet when its replicate samples yield poor precision. If sufficient precision in laboratory replicates cannot be obtained, then use of the laboratory triplicate mean value to represent the field sample concentration could be used. (See also Comment 5 of the enclosed memorandum)

2. Page 4 of 5: Decision units with PCB concentrations above laboratory reporting limits should be selected for triplicate sampling to provide the basis for a RSD of field replicates. The use of a surrogate value of half the reporting limit or the method

detection limit would add uncertainty in the measure of the RSD critical to the project approach. Therefore, DU15, DU16 or DU17 should be sampled in triplicate in lieu of DU 13 to reduce the uncertainty in the true observed variance in field triplicates. DTSC acknowledges that these recommended DUs have been covered with gravel recently but is concerned that ND surrogate or J-flagged values would not appropriately inform a measure of triplicate RSD. (See also Comment 2 of the enclosed memorandum)

3. Page 2 of 5: The document states that health and safety measures will adhere to the Final Field Sampling Workplan, Appendix B, Health and Safety Plan dated June 2, 2010. Please ensure that the Health and Safety Plan is updated to address all state and local COVID-19 requirements.

The Sampling Approach needs to be revised to address the above comments and those found in the enclosed memorandum. Please submit a revised document within 30 days of the date of this letter. If you have any questions regarding this letter, please contact Lynn Nakashima at lynn.nakashima@dtsc.ca.gov.

Sincerely,

Lynn Nakashima

Lynn Nakashima, Project Manager
Senior Hazardous Substances Scientist
Site Mitigation and Restoration Program
Berkeley Office - Cleanup Operations

Gerard F. Aarons

CERTIFIED HYDROGEOLOGIST
GERARD AARONS
CHG 771
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STATE OF CALIFORNIA

Gerard F. Aarons, PG, CHG
Senior Engineering Geologist
Site Mitigation and Restoration Program
Geological Services Branch

Enclosure

cc: See next page

cc: Sent via Email

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From:	DiBiasio, Karen@DTSC
To:	Nakashima, Lynn@DTSC
Cc:	Mathrani, Vivek@DTSC; Sorrentino, Claudio@DTSC; Endlich, Brian@DTSC
Subject:	Comments on review of UC BERKELEY – RICHMOND FIELD STATION, CORPORATION YARD, RICHMOND, CALIFORNIA - ISM SAMPLING PLAN Project Code: 201605-00 Activity Code: 11018
Date:	Tuesday, June 16, 2020 12:58:20 PM

TO: Lynn Nakashima
Project Manager
Site Mitigation and Restoration Program
700 Heinz Avenue
Berkeley, California 94710-2721

FROM: Karen W. DiBiasio, Ph.D.
Staff Toxicologist
Human and Ecological Risk Office (HERO)
Site Mitigation and Restoration Program

DATE: June 16, 2020

SUBJECT: UC BERKELEY – RICHMOND FIELD STATION, CORPORATION YARD, RICHMOND, CALIFORNIA

ISM SAMPLING PLAN

Project Code: 201605-00 Activity Code: 11018

DOCUMENT REVIEWED

HERO reviewed the June 3, 2020 memorandum with the subject “Corporation Yard, Triplicates Sampling Approach, Richmond Field Station, University of California, Berkeley” (Tech Memo) prepared by Tetra Tech in Oakland, California.

BACKGROUND

The Richmond Field Station (RFS) Corporation Yard (Corp Yard or Site) had surface releases of PCBs in transformer oil and is currently used primarily for parking of PG&E trucks. Additional sampling for PCBs is proposed using the incremental sampling method (ISM) as a follow-up to the removal action conducted at the Corporation Yard in 2017-2018 and data gap sampling presented in the Corporation Yard Data Gaps Sampling Results letter dated November 22, 2019. The Tech Memo also provides clarifications regarding the ISM results presented in the November 22, 2019 letter and recent teleconferences on the relative standard deviation (RSD) of laboratory and field replicates and the calculation of the weighted 95 percent upper confidence limit of the arithmetic mean (95%UCL).

SCOPE OF REVIEW

The review comments herein focus solely on the ISM sampling for PCBs and use of the

ISM results to calculate a 95%UCL.

GENERAL COMMENTS

1. HERO Does Not Concur with the Proposal: HERO does not concur with some of the technical aspects of the proposed sampling, as detailed below. Furthermore, HERO observed some internal inconsistencies within the Tech Memo. HERO recommends revising the proposed ISM sampling per the below comments.

2. DUs for Triplicates – Three DUs are proposed for additional triplicate ISM collection and analysis of PCBs. HERO concurs with use of DU9 and DU10, but recommends using DU16 or DU 17 as the third DU rather than DU13. Use of DU13 is inappropriate for assessing variability (RSD) because the one replicate collected thus far from DU13 was non-detect for PCBs and therefore not representative of the RSD for DUs with PCB contamination.

3. Increment Locations – Within each DU 75 increments are proposed for collection. The Tech Memo says the spacing of increments will be determined in the field. ISM guidance (ITRC, 2012) recommends systematic planning and random locations. Furthermore, the guidance notes that the magnitude of error in the mean may be higher with simple random sampling as compared with systematic random sampling. To reduce potential error in the estimate of the mean, to guard against bias in increment sampling locations and to provide even spatial coverage in each DU, HERO recommends use of a systematic random sampling approach using 75 grids and a random number generator to determine placement of replicates 1, 2 and 3 within the first grid and applying those relative locations to the remaining 74 grids.

4. 95%UCL – Since the exposure area for risk-based decision making (exposure unit) is the entire Corp Yard, a weighted 95%UCL is proposed from the ISM data collected from DUs 9 through 14 and 16 through 18. While the concept of a weighted 95%UCL is appropriate for the Corp Yard, the proposed methods and equations are not presented. HERO recommends transparently providing the proposed 95%UCL methodology with all equations.

    - One option is using pooled variances from the DUs with triplicates to obtain an average RSD that is applied to calculate 95%UCLs for the singlet DUs and subsequently calculating a weighted 95%UCL. This method is appropriate for CSM-equivalent DUs where a statistical test that compares variances demonstrates that the differences in variances are not significantly significant (e.g., at the 95% level of confidence).
    - Another method for computing a 95%UCL could employ the random selection of 1 replicate result from each DU with multiple replicates (for example, the first replicate) after establishing in the systematic planning process how the replicate for use in calculating the UCL would be randomly selected. This approach would specify a RSD limit in the systematic planning process that must be met limit error in estimating the 95%UCLs from singlet DUs.

5. RSD Calculations – The Tech Memo provides clarification on RSD calculations in the November 2019 letter and noted those RSDs were not intended for use in

calculating 95%UCLs for risk-based decisions. However, it is unclear whether the procedure discussed is intended for the application to the proposed triplicate ISM results. HERO recommends either (a) setting lab RSD limits in the Data Quality Objectives if at random the first of the lab triplicate results will be used as the 3rd field triplicate for calculating the weighted 95%UCL, or (b) using the averaging of the lab triplicates for the 3rd field triplicate because the lab RSDs are very high in the data collected to date. HERO recommends clearly presenting the proposal for field triplicate RSD calculations that is intended for application to the ISM triplicate data results to calculate the weighted 95%UCL for the Corp Yard.

CONCLUSIONS

HERO reviewed the June 3, 2020 Tech Memo for additional ISM sampling and analysis at the Corp Yard. HERO does not concur with the proposed ISM sampling. HERO recommends addressing the comments above in a revised ISM work plan submission.

Please contact me at (916) 255-6633 or Karen.DiBiasio@dtsc.ca.gov if you have any questions.

Reviewed by: Vivek Mathrani, Ph.D., DABT
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Removal Action Workplan
Research, Education, and Support Area and Groundwater
Corporation Yard Triplicate Sampling Approach
June 3, 2020

Response to Comments from
Department of Toxic Substances Control
June 17, 2020

DTSC Comment No.	Page	Comment	UC Berkeley Response
1	4	In regard to applying the weighted UCL to the first laboratory triplicate sample reported instead of the average of the three laboratory triplicates, a data quality objective for the relative standard deviation of laboratory triplicates should be articulated in the Sampling Approach. DTSC would not support the representativeness of a singlet when its replicate samples yield poor precision. If sufficient precision in laboratory replicates cannot be obtained, then use of the laboratory triplicate mean value to represent the field sample concentration could be used. (See also [HERO] Comment 5 of the enclosed memorandum)	A table indicating recommended RSD goals has been added to the sampling approach. The table is based on estimated ranges of anticipated triplicate concentrations. Text has been updated that if the laboratory triplicate results yield poor precision, then the triplicate mean can be used if the site-specific data support such as the most representative value. In order to clarify the value of incremental sampling methodology (ISM), the following text was included in the letter: "ISM triplicate sample results enable the quantification of field and laboratory measurement variability, which is not typically quantified in projects with discrete sample results. While ISM presents measured variability, the ISM sampling procedure is designed specifically to reduce field and laboratory variability when compared to discrete sampling."
2	5	Decision units with PCB concentrations above laboratory reporting limits should be selected for triplicate sampling to provide the basis for a RSD of field replicates. The use of a surrogate value of half the reporting limit or the method detection limit would add uncertainty in the measure of the RSD critical to the project approach. Therefore, DU15, DU16 or DU17 should be sampled in triplicate in lieu of DU 13 to reduce the uncertainty in the true observed variance in field triplicates. DTSC acknowledges that these recommended DUs have been covered with gravel recently but is concerned that ND surrogate or J-flagged values would not appropriately inform a measure of triplicate RSD. (See also [HERO] Comment 2 of the enclosed memorandum)	UC Berkeley will sample DU17 instead of the previously recommended DU13.

3	5	The document states that health and safety measures will adhere to the Final Field Sampling Workplan, Appendix B, Health and Safety Plan dated June 2, 2010. Please ensure that the Health and Safety Plan is updated to address all state and local COVID-19 requirements.	All project staff are required to follow UC Berkeley, Contra Cost County, State of California, and Tetra Tech internal guidelines regarding COVID-19 health and safety requirements. Project staff will follow the COVID-19-specific Activity Hazard Analysis included as Attachment B to the sampling approach.

DTSC HERO Comment No.	Page	Comment	UC Berkeley Response
1	--	HERO Does Not Concur with the Proposal: HERO does not concur with some of the technical aspects of the proposed sampling, as detailed below. Furthermore, HERO observed some internal inconsistencies within the Tech Memo. HERO recommends revising the proposed ISM sampling per the below comments.	Responses are provided to specific comments detailed below.
2	--	DUs for Triplicates – Three DUs are proposed for additional triplicate ISM collection and analysis of PCBs. HERO concurs with use of DU9 and DU10, but recommends using DU16 or DU 17 as the third DU rather than DU13. Use of DU13 is inappropriate for assessing variability (RSD) because the one replicate collected thus far from DU13 was non-detect for PCBs and therefore not representative of the RSD for DUs with PCB contamination.	UC Berkeley will sample DU09, DU10, and DU17 in field triplicate.
3	--	Increment Locations – Within each DU 75 increments are proposed for collection. The Tech Memo says the spacing of increments will be determined in the field. ISM guidance (ITRC, 2012) recommends systematic planning and random locations. Furthermore, the guidance notes that the magnitude of error in the mean may be higher with simple random sampling as compared with systematic random sampling. To reduce potential error in the estimate of the mean, to guard against bias in increment sampling locations and to provide even spatial coverage in each DU, HERO recommends use of a systematic random sampling approach using 75 grids and a random number generator to determine placement of replicates 1, 2 and 3 within the first grid and applying those relative locations to the remaining 74 grids.	The locations of the 75 increments will be collected in a random systematic pattern, consistent with all previous ISM sampling at RFS. The locations of increments comprising the first triplicate will be placed at 75 locations based on equally spaced grid nodes. The second and third triplicate increments will be collected 3 feet away from the each of the first triplicate increment locations. Use of a random number generator within each grid is not required or necessary for the collection of triplicates provided that each set of triplicates is independent and collected consistently.

4	--	95%UCL – Since the exposure area for risk-based decision making (exposure unit) is the entire Corp Yard, a weighted 95%UCL is proposed from the ISM data collected from DUs 9 through 14 and 16 through 18 (*sic*). While the concept of a weighted 95%UCL is appropriate for the Corp Yard, the proposed methods and equations are not presented. HERO recommends transparently providing the proposed 95%UCL methodology with all equations. • One option is using pooled variances from the DUs with triplicates to obtain an average RSD that is applied to calculate 95%UCLs for the singlet DUs and subsequently calculating a weighted 95%UCL. This method is appropriate for CSM-equivalent DUs where a statistical test that compares variances demonstrates that the differences in variances are not significantly significant (e.g., at the 95% level of confidence). • Another method for computing a 95%UCL could employ the random selection of 1 replicate result from each DU with multiple replicates (for example, the first replicate) after establishing in the systematic planning process how the replicate for use in calculating the UCL would be randomly selected. This approach would specify a RSD limit in the systematic planning process that must be met limit error in estimating the 95%UCLs from singlet DUs.	UC Berkeley concurs that while the proposed methods and equations were not submitted in the sampling approach letter, they were presented at the May 8, 2020 meeting. The proposed approach will be consistent with the first option outlined in the DTSC HERO comment. The details regarding the use of all triplicate results will be based on the protocols presented in the sampling approach letter and review of existing triplicate results from DU11 and new triplicate results from DU09, DU10, and DU17. The proposed approach will be discussed with EPA and DTSC prior to issuance of a sample results summary to ensure concurrence. Methods and equations and calculation results will be presented within the sample results summary.

5	--	RSD Calculations – The Tech Memo provides clarification on RSD calculations in the November 2019 letter and noted those RSDs were not intended for use in calculating 95%UCLs for risk-based decisions. However, it is unclear whether the procedure discussed is intended for the application to the proposed triplicate ISM results. HERO recommends either (a) setting lab RSD limits in the Data Quality Objectives if at random the first of the lab triplicate results will be used as the 3rd field triplicate for calculating the weighted 95%UCL, or (b) using the averaging of the lab triplicates for the 3rd field triplicate because the lab RSDs are very high in the data collected to date. HERO recommends clearly presenting the proposal for field triplicate RSD calculations that is intended for application to the ISM triplicate data results to calculate the weighted 95%UCL for the Corp Yard.	RSD goals for laboratory triplicates have been included in the sampling approach, as discussed in response to DTSC Comment 1. The goals are to be used as a guideline; the proposed process for submitting the method and equations for applying triplicate results is discussed in response to DTSC HERO Comment 4. UC Berkeley concurs that if laboratory triplicate results yield poor precision, then the triplicate mean can be used if the site-specific data support such as the most representative value.

ATTACHMENT B

COVID-19 ACTIVITY HAZARD ANALYSIS

ACTIVITY HAZARD ANALYSIS (AHA)

Tetra Tech Inc.

Procedures for Working in Areas Potentially Impacted by COVID-19

Task Description

This Activity Hazard Analysis (AHA) applies to field work in areas potentially impacted by COVID-19. The "essentiality" of field work should be determined by the office manager and Health & safety Department (HSD). It has been developed and approved by the HSD for Tetra Tech EMI. This AHA contains potential hazards posed by working in the field during pandemic conditions, lists procedures to control hazards to minimize possible exposure, and presents required safety equipment, inspections, and training.

Overall Job Risk Assessment code (RAC)			**Low**
Hazards		**Actions**	
Task Steps	**Potential Hazards**	**Critical Safety Procedures and Controls**	**Risk Assessment Code (RAC)**
Determine work essentiality. Work with your OM, PM and HSD to determine if the work is essential.	Exposure to persons or locations potentially impacted by COVID-19	• **DO** review SWP 5-55, *Infectious Disease Guidance*, and Tetra Tech EMI *COVID-19 Response and Contingency Plan* (attached) • **DO NOT** just show-up. These are trying times, and some may not appreciate it. The client should be amenable to this. • **DO** determine if work can be done virtually or remotely. • **DO** call ahead and tell them who you are, what you would like to do, why you need to do it, and what time to expect you. • **DO** ask the clients or persons you may be working with: 1. Has anyone working/residing in or that recently visited the facility travelled out of the country or to any location (i.e. nursing home, daycare center, etc.) where someone has been diagnosed with COVID-19 in the past three weeks? 2. Has anyone working/residing in or that recently visited the facility been diagnosed with COVID-19? 3. Has anyone working/residing in or that recently visited the facility experienced any of the following symptoms? Fever? Sore throat? Cough? New shortness of breath? • If **YES to ANY**, inform the client and work with your OM, PM, supervisor and Safety Manager to determine essentiality of trip.	**Low**

Work deemed essential. Travel to the worksite,	Exposure to persons or locations potentially impacted by COVID-19	• **DO** travel in separate vehicles if possible. • **DO** voluntarily use of respirators IAW 29 CFR 1910.134 Appendix D (attached) with P-100 cartridges if you have one and prefer to wear it. • **DO** have all Tetra Tech personnel perform self-evaluations each day PRIOR to work. If any new symptoms or if any potential exposures have occurred, the employee should STAY HOME or in the hotel if on travel. • **DO** maintain a supply of soap and water, alcohol-based hand sanitizer (ABHS), AND sanitizing wipes at all times.	**Low**
Arrive at facility and preparing to conduct assigned tasks.	Exposure to persons or locations potentially impacted by COVID-19	• **DO** voluntarily use of respirators IAW 29 CFR 1910.134 Appendix D (attached) with P-100 cartridges if you have one and prefer to wear it. • **DO** maintain social distancing from everyone, including the client and your coworkers, even during safety briefings and planning sessions. • **DO NOT** shake hands or touch anyone. • **DO NOT** touch your face. • **DO** wash your hands with soap and water for at least 20 seconds or use ABHS PRIOR to donning Nitrile gloves. • **DO** don Nitrile gloves PRIOR to approaching other persons. This will keep them from wanting to shake hands. • **DO** wear two pair of Nitrile gloves and keep the inner pair on continuously while replacing the outer pair after each sampling event. • **DO** place all supplies in a 5-gallon bucket or similar non-porous container. • **DO NOT** approach if you hear, see, or suspect that someone at the site may be ill and inform the client. • **DO NOT** attempt to persuade someone that you need to enter if they disagree with the essentiality of why you are there. Thank them, leave, and inform the client. • **DO NOT** use conversation to explain your visit. You explained this when you called. If appropriate, print any documentation explaining why you are there and present it when you arrive. • **DO NOT** accept any food or drinks offered to you by unknown persons. • **DO** proceed immediately to the area to conduct required tasks.	**Low**

Conduct assigned tasks.	Exposure to persons or locations potentially impacted by COVID-19	• **DO** voluntarily use of respirators IAW 29 CFR 1910.134 Appendix D (attached) with P-100 cartridges if you have one and prefer to wear it. • **DO** keep everything (i.e. sampling supplies, tools, logbook, pens etc.) you have in the bucket or similar non-porous container and NEVER set anything down inside buildings or on the ground except the container. • **DO** conduct required tasks. • **DO** thank the client or persons you worked with and depart. • **DO** continue wearing gloves to manage the samples. • **DO** wipe the outside and bottom of the bucket with a sanitizing wipe prior to placing it back in the vehicle. • **DO** wash your hands with soap and water for at least 20 seconds or use ABHS immediately AFTER doffing Nitrile gloves. • **DO** wash your hands with soap and water for at least 20 seconds or use ABHS and re-don Nitrile gloves while handling and documenting the samples at the end of the day. • **DO** update this procedure as you learn more or recognize additional steps or controls are needed.	**LOW**
Equipment to be Used • Ensure that you have the minimum PPE and supplies for ALL other assigned tasks (see task specific AHAs) • Minimum PPE: steel-toed boots, safety glasses, nitrile gloves and Type 2 or better reflective safety vest • Disinfecting hand soap • Alcohol-based hand sanitizer (>60%) • Sanitizing wipes • First Aid Kit • 5-gallon bucket or similar non-porous container	**Inspection Requirements** • Inspect all PPE for proper operation, wear and defects	**Training Requirements** • See task specific AHAs	

- **Part Number:** 1910
- **Part Number Title:** Occupational Safety and Health Standards
- **Subpart:** 1910 Subpart I
- **Subpart Title:** Personal Protective Equipment
- **Standard Number:** 1910.134 App D
- **Title:** (Mandatory) Information for Employees Using Respirators When not Required Under Standard.
- **GPO Source:** e-CFR

Appendix D to Sec. 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard.

You should do the following:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.

2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.

3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.

4. Keep track of your respirator so that you do not mistakenly use someone else's respirator.

[63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998]

TETRA TECH

TETRA TECH EMI
COVID-19 RESPONSE AND CONTINGENCY PLAN

INTRODUCTION

The health and safety (H&S) of Tetra Tech employees is our number one priority. During this world-wide crisis, Tetra Tech has taken actions to inform and protect our employees at their local offices and field worksites. We have established a dedicated COVID-19 Information and Guidance page on My.TetraTech.com to provide the most recent company guidance and policies regarding our response to Coronavirus Disease 2019 (COVID-19).

COVID-19 is a respiratory illness that can spread from person-to-person. The virus that causes COVID-19 is a novel (newly discovered) coronavirus that was first identified during an investigation into an outbreak in Wuhan, China and has only been known to spread in people since December 2019. For the latest summary on the COVID-19, visit the CDC Situation Summary page.

The purpose of this Tetra Tech EMI COVID-19 Response and Contingency Plan is to ensure that EMI employees are prepared to respond to a potential outbreak within our work environments. This situation is very fluid, and you are advised to stay updated by checking the Coronavirus Disease CDC website frequently. In addition, continually monitor the emails shared by your leadership and Safety Managers on this topic, as well as on the employee COVID-19 Information and Guidance page on the Tetra Tech intranet.

SYMPTOMS AND DISEASE TRANSMISSION

Person-to-person contact is the primary mode of transmission. Respiratory droplets from coughs and sneezes can infect others within close contact – about 6 feet. Touching contaminated surfaces then touching your own mouth, nose, or eyes is a possible route, but is not considered as significant as close contact with infected people; however, exposure pathways are still being studied by the Centers for Disease Control and Prevention (CDC). People are thought to be most contagious when they are most symptomatic (the sickest). Some exposure might be possible before people show symptoms (asymptomatic); there have been reports of this, but this is not thought to be the primary way the virus spreads. Monitor the CDC How COVID-19 Spreads site for up-to-date information on transmission.

The CDC believes the typical incubation period before symptoms appear is 2 to 14 days after infection. An analysis of publicly available data on infections estimated **5.1 days** for the median disease incubation period, according to a study led by Johns Hopkins Bloomberg School of Public Health. Symptoms include:

- Fever, usually over 100.4° F
- Cough, usually dry
- Shortness of breath

Check the CDC COVID-19 Symptoms page for updates.

TREATMENT AND PREVENTION

There is currently no FDA-approved medication or vaccine available for COVID-19. People infected with this virus should receive supportive care such as rest, fluids, and fever control, to help relieve symptoms. However, hospital care, including use of ventilators may be required for severe cases.

Steps to prevent the spread of COVID-19 are:

- Tetra Tech's corporate work-at-home policy has been revised to encourage all staff to work at home, whenever feasible, and in communication with project managers, their supervisor, and Operations Manager (OM), as appropriate.
- **Stay home** when you are sick.
- If you are sick, follow the CDC Prevention Measures for Persons Under Investigation.
- Wash your hands often with soap and water for at least 15-20 seconds. If soap and water are not available, use a hand sanitizer with at least 60% alcohol.
- Avoid touching your eyes, nose, and mouth with unwashed hands.
- Avoid crowds and close contact (within 6 feet) with others who may be infected.
- Cover your cough or sneeze with a tissue, then throw the tissue in the trash.
- Standard household cleansers and wipes are effective in cleaning and disinfecting frequently touched objects and surfaces.
- As it is currently flu and respiratory disease season, CDC recommends getting vaccinated for flu, taking everyday preventive actions to stop the spread of germs, and taking flu antivirals if prescribed.

REGARDING DOMESTIC AND INTERNATIONAL BUSINESS TRAVEL

Travelers

All non-essential domestic travel is prohibited. All travel will be limited to essential matters only with appropriate approvals by the EMI President, Jeremy Travis. Specific requests for travel approval should be routed through the appropriate supervisor and OM. Questions regarding definitions of "non-essential" or "essential matters" shall be determined by your OM.

International travel to any countries identified by the CDC as either Level 2 or Level 3 is **currently prohibited**. For the most current list of Level 2 and Level 3 countries see: https://wwwnc.cdc.gov/travel/notices. Any international travel must be approved by the EMI President, Jeremy Travis, and completion of a hazard assessment by H&S on a case-by-case basis. Check this site to determine if your planned international travel may involve countries with travel restrictions ***before*** you travel.

Level 3 Countries: Warning	Level 2 Countries: Alert	Level 1 Countries: Watch
Prohibited	***Prohibited***	**No non-essential travel**

All non-essential travel has been cancelled. Essential travel requests must be approved by Jeremy Travis.

Essential travel approved by Jeremy Travis should be limited.

To protect yourself during approved, essential travel:

- Travel MUST be booked using the Tetra Tech Travel Hub Dashboard.
- For international travel, have the International SOS (ISOS) app on your phone and check frequently for updates.
- Avoid contact with sick people.
- Avoid touching your eyes, nose, or mouth with unwashed hands.
- Discuss travel plans with CORE (855-683-9006), Tetra Tech's occupational medical consultant, and your personal provider.
- Older adults and travelers with chronic medical conditions may be at risk for more severe disease.
- Clean your hands often by washing them with soap and water for at least 20 seconds or using an alcohol-based hand sanitizer that contains at least 60%-95% alcohol.
- Sanitizer wipes are recommended for air travel.
    - It is especially important to clean hands after going to the bathroom; before eating; and after coughing, sneezing, or blowing your nose.

If you have spent time in a Level 2 or 3 location during the past 14 days (for work OR personal reasons) and feel sick with fever, cough, or have difficulty breathing:

- **Do not come to work!** Avoid public places and public transportation. Notify your supervisor, Human Resources (HR) representative, and H&S representative of your health condition.
- Seek medical advice. Call ahead before you go to a doctor's office or emergency room. Tell them about your recent travel and your symptoms.
- Use Tetra Tech's Teladoc service and app or similar telemedicine services to consult with physicians.
- Avoid contact with others.
- **Do not travel while sick.**

If you have spent time in a Level 2 or 3 location during the past 14 days (for work OR personal reasons) and are asymptomatic:

- **Do not come to work!** Avoid public places and public transportation. Notify your supervisor, HR, and H&S representatives of your health condition.
- Be sure you have your laptop and charger with you to facilitate working from home if necessary.
- Continue communicating with your supervisor on your status.
- After completing the self-quarantine 14-day period and if you do not exhibit any signs or symptoms mentioned above, you may be allowed to return to work.

PREVENTING OUTBREAKS IN THE WORKPLACE

The Tetra Tech Safe Work Practice, *Infectious Disease Guidance* (SWP 5-55), provides guidance to identify risk management techniques to protect employees who may be at increased risk of infection, address related complications, and maintain business operations. Tetra Tech has additionally eliminated in-person meetings of over 10 persons and is using "virtual meetings" whenever possible.

OMs are encouraged to work with their building management to ensure an appropriate cleaning schedule. Work surfaces should be regularly cleaned to maintain good housekeeping in the work environment. Clean surfaces that are touched by the hands or face diligently; such as, but not limited to: doorknobs, light switches, elevator buttons, remote controls, handrails, computer keyboards, mice, telephones, microphones, tables and chairs, coffeemakers, vending machines, etc.

If building management is non-responsive to our cleaning requests, OMs are encouraged to implement regular cleaning schedules of office space and restrooms using outside contracted janitorial personnel.

OMs should procure facial tissue, hand sanitizer (greater or equal to 60% alcohol), and disposable disinfectant wipes for employees to facilitate self-cleaning of frequent hand-contact surfaces (e.g., doorknobs, light switches, computer keyboards, telephones, vending machines). Employees or designated persons should inspect common areas and frequent hand-contact surfaces for cleanliness. If necessary, clean these areas with available disinfectant wipes. OMs should encourage personnel to clean their own workstation surfaces with available disposable disinfectant wipes.

Common areas should be regularly checked to ensure dishwashing detergent, sponges, and cleaning cloths are available and replaced as necessary.

Posters communicating COVID-19 prevention strategies shall also be posted in common areas throughout all office locations, including satellite offices and field sites with office trailers or facilities. Web resources for these posters can be found here:

- CDC Print Resources: https://www.cdc.gov/coronavirus/2019-ncov/communication/factsheets.html,
- ISOS Education and Communication: https://pandemic.internationalsos.com/2019-ncov/ncov-education-and-communication

Recommendations for EMI worksites include:

- Consider Skype meetings, use of Microsoft Teams, or SharePoint sites as opposed to meetings.
- Tetra Tech personnel should perform self-evaluations each day PRIOR to work. If any new symptoms or if any potential exposures have occurred, the employee should STAY HOME or at the hotel.
- Field workers should consider texting or emailing daily communications, such as safety briefings, to increase social distancing.
- Maintain soap and water, alcohol-based hand sanitizer (ABHS), AND sanitizing wipes in the vehicle.
- Do not shake hands. Maintain social distancing from everyone, including clients and your coworkers.
- Ensure workspaces are cleaned frequently.
- Ensure all staff members are provided information on disease transmission, symptoms, and prevention as discussed above.
- Supervisors shall work with OMs to determine the applicable actions regarding work arrangements other than normal work environments. This includes employees who may need to be home to care for children or other family members who are sick or affected by institutional closures.
- Managers and supervisors should be flexible with work at home assignments.
- All employees are responsible for notifying their supervisors or project/program mangers if project work will be affected during absence.

REPORTING AND MONITORING SUSPECTED CASES

Employees who become ill should report their illness to their Project Manager, OM, and H&S immediately. All employees absent from work three or more days because of their health, or to care for a family member, should report the absence to HR and may be eligible for Family Medical Leave Act. Contact your personal physician and consider using Tetra Tech's Teladoc service and app or similar telemedicine services. See the COVID-19 General Guidelines for Response flowchart at the end of this plan.

OMs should verify that more than one method of communicating with staff is available. Please ensure all telephone numbers / email distribution lists are up to date.

If your risk profile includes recent foreign travel, close contact with infected individuals, or a household member diagnosed with COVID-19, or you experience symptoms:

- Isolate – if at home, stay at home. If at the office, go home immediately and notify your supervisor of your health condition. If you are on business travel, isolate in the hotel and contact CORE and your supervisor immediately for guidance. Continue isolation until cleared by your physician or state or local health department.
- Seek medical attention as described above.
- Report to your supervisor, HR, and H&S representative. Report confirmed COVID-19 cases to help us track and monitor for possible workplace outbreaks. A suspected/confirmed case register will be maintained. The case register will include employee's name, dependent name, if applicable, current location, contact information, and emergency contact information. Actions outlined below may be necessary. CORE Occupational Medicine will be contacted to verify test results performed by an employee's physician or state or local health department. ***All personally identifiable information must be kept confidential.***
- Notify HR if an employee requests to self-quarantine because they have reason to believe that reporting to work would pose an imminent or serious danger to themselves or others.

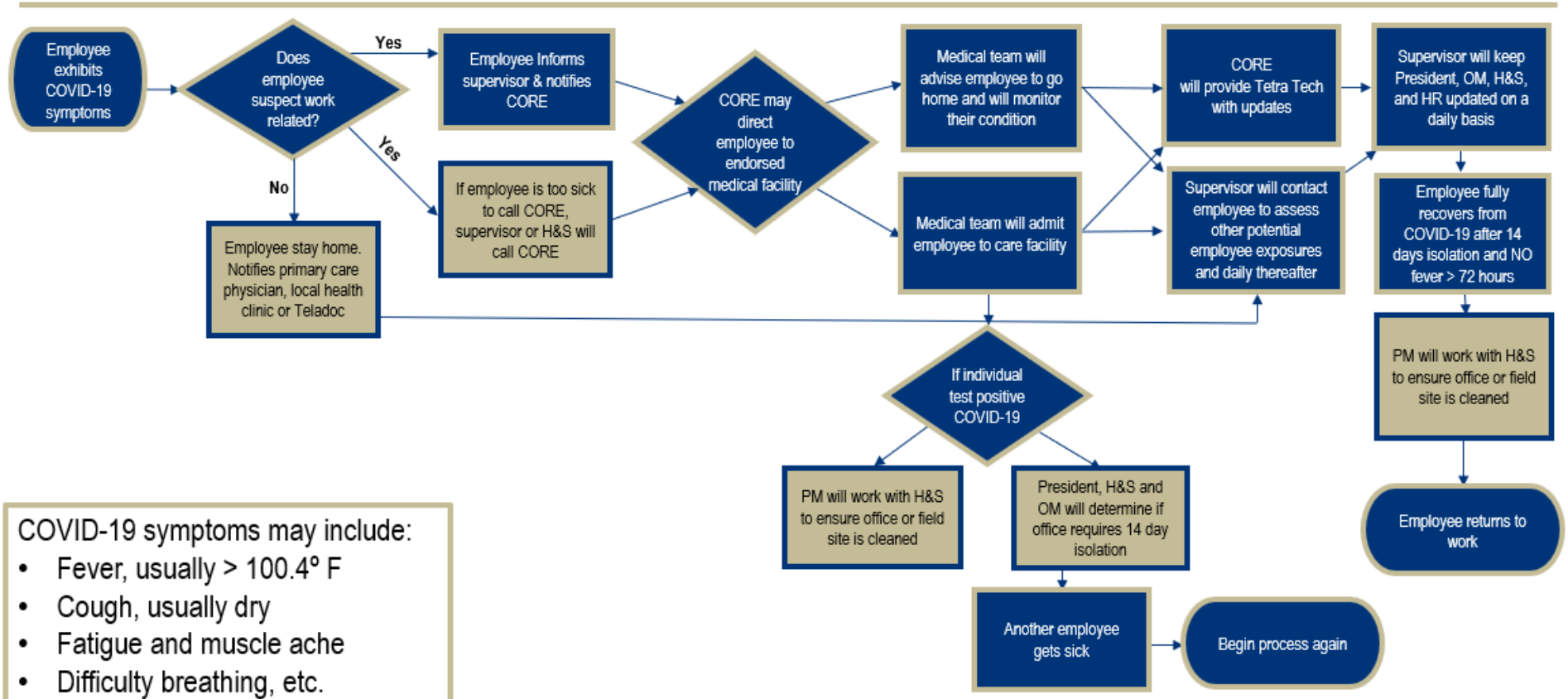
Response to Possible Outbreak

In the event of a confirmed case of COVID-19 in the workplace:

- OM and H&S representative will provide for guidance on cleaning procedures for a confirmed employee's work environment, including offices, field worksites, and hotel rooms.
- OM, H&S, and HR will coordinate notice to staff of the confirmed case and possible exposure to the virus, without revealing the individual's identity.
- Ask all employees to remain vigilant and immediately isolate and report any symptoms.
- The OM for the office location will notify the building landlord.
- Field team leaders will notify the client and any others that have been in contact with a potentially infected employee.
- Notify Jeremy Travis. Executive leadership will determine appropriate contingency plan for the specific location with local OMs. This may include shutting down the site or office to minimize the spread of COVID-19.
- H&S representative will notify the hotel and any local or state public health agencies and complete reporting requirements, if any.
- Executive leadership and H&S will coordinate care for employees quarantined in hotels or areas apart from their families as necessary.

If a worksite or office is closed, EMI leadership will continue to monitor and communicate with affected work site or office leadership during closure.

COVID-19 General Guidelines for Response



COVID-19 symptoms may include:

- Fever, usually > 100.4° F
- Cough, usually dry
- Fatigue and muscle ache
- Difficulty breathing, etc.

TETRA TECH

CORE: **1-855-683-9006**
H&S: Chris Draper – 615-969-1334; Denny Cox – 816-668-7464; or Dave Brown – 619-446-7261
HR: Shannon Stuver – 541-482-8938 or Diane Stopa – 703-885-5518
President: Jeremy Travis – 703-885-5520

INTRODUCTION

Tetra Tech recognizes the need to prepare for and minimize the impact of either a localized outbreak of serious infectious disease, pandemic disease events or other events that may present a health risk to employees. The objective of this guidance is to identify risk management techniques and coordinate response, protect employees who are at increased risk of infection, address related complications, and maintain business operations.

Given the diversity in the size and nature of Tetra Tech operations, appropriate responses to these health events will depend on several key indicators such as:

- Disease severity in general and high risk populations;
- Extent of disease at the location;
- Amount of worker absenteeism; and
- Other factors that may affect an employee's ability to get to work (restrictions on travel, school closures, care for sick family members, conflicts, etc.).

Tetra Tech offices and project locations are encouraged to take appropriate actions based on conditions at each location.

In the event the severity of a pandemic event increases and key business operations are impacted, Tetra Tech may elect to activate its Business Continuity Plan (BCP) to maintain enterprise essential business functions. The decision to activate the BCP will be at the discretion of Tetra Tech's executive management.

This guidance outlines measures to identity risk in the workplace, appropriate work practice control measures, work policies, continuity of business operations, and communication methods. **While these general guidelines have been established, Tetra Tech may modify this guidance as needed based on current recommendations from public health authorities, Tetra Tech clients or specific business needs.**

RESPONSIBILITIES

Executive Management

Tetra Tech Management has the overall responsibility for effective and appropriate response to pandemic or disease outbreak events, including assuring that necessary resources are provided and that line managers and employees are held accountable for their responsibilities under this guidance.

Line Management (Chief of Party, Program Managers)

Line Management is responsible to evaluate the current situation based on their detailed knowledge of the project, location and available resources.

Line Management is responsible for ensuring that all project personnel are aware of and abide by company and project specific guidelines.

Line Managers must also be familiar with signs and symptoms of disease infection and ensure that the appropriate work practices and guidelines have been addressed for operations and tasks conducted by the employees they manage.

Health and Safety

Health and Safety personnel are responsible to provide overall direction for the health related components of this guidance at individual operating units. They will assure response effectiveness and act as a resource regarding health guidelines. Health and Safety may also consult with Tetra Tech's Medical Director or other medical resources regarding medical issues as appropriate.

Human Resources

Human Resource personnel will be responsible to provide direction for workplace policies related to this guidance at individual operating units. They will also assure response effectiveness and act as a resource regarding these issues.

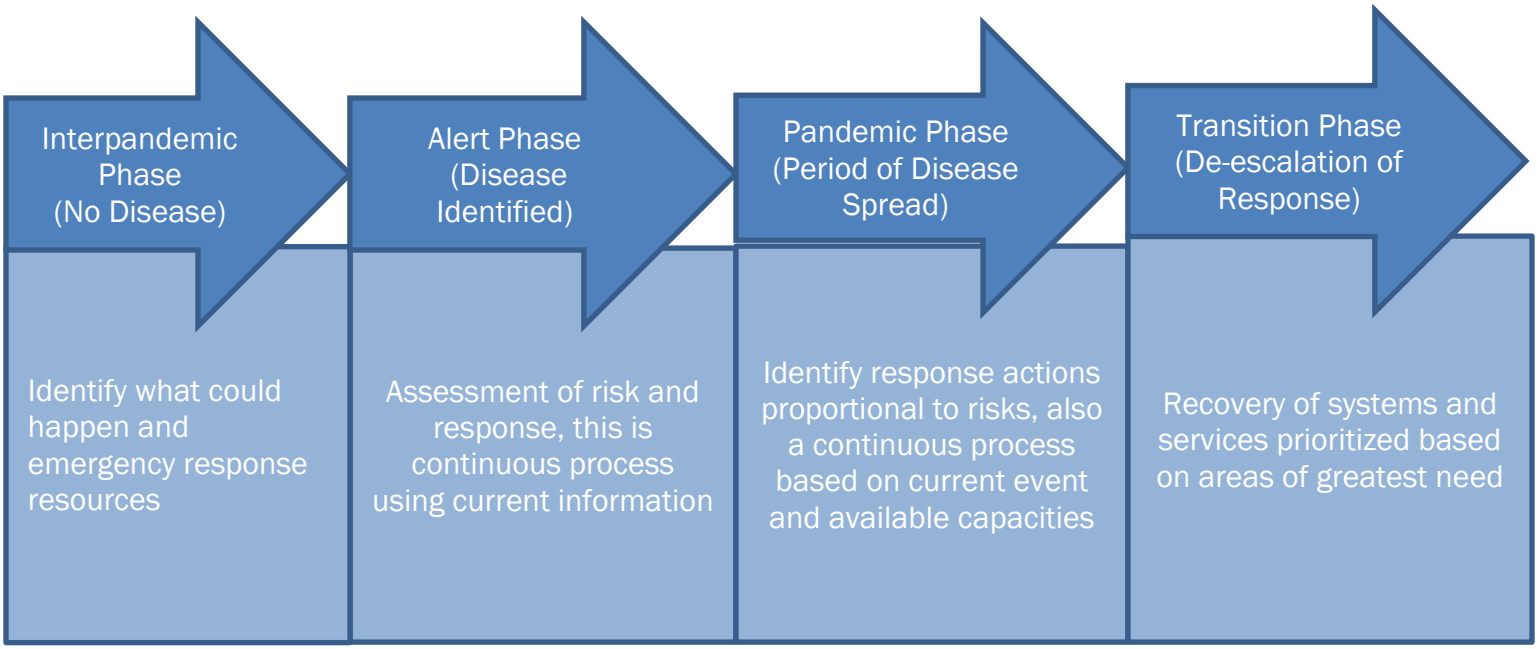
Employees

Employees are responsible for performing their job duties in a manner that is compliant with guidance established. During infectious disease events, employees are encouraged to report relevant health symptoms to either their appropriate line manager or, if they prefer, to their Human Resources or Health and Safety contacts so that proper control methods can be implemented.

RISK ASSESSMENT

The World Health Organization (WHO) has developed an interim guidance document that addresses the management of pandemic influenza events. As part of this guidance, WHO has identified pandemic phases that identify the continuum of pandemic disease in the context of preparedness, response and recovery. This guidance will be used to frame the company's risk based response to these types of events.

The following figure identifies broad categories of risk assessment actions addressed at each phase:



The US Centers for Disease Control (CDC) has adopted a classification system to address international travel when impacted by global health events. This system identifies levels of risk for the traveler and recommended preventive measures to take at each level. Established levels, definitions and with specific examples are listed below. Tetra Tech will rely on both the WHO and CDC guidance when responding to global health events.

Notice Level	Traveler Action	Risk to Traveler	Outbreak/Event Example
Level 1: Watch	Reminder to follow **usual** precautions for this destination	Usual baseline risk or slightly above baseline risk for destination and limited impact to the traveler	**Dengue in Panama-Outbreak Watch:** Because dengue is endemic to Panama, this notice most likely would signify that there is a slightly higher rate of dengue cases than predicted. Travelers are to follow "usual" insect precautions. **Olympics in London-Event Watch:** There may be possible health conditions in London that could impact travelers during the Olympics, such as measles. Travelers are to follow usual health precautions making sure they are up to date on their measles vaccine, follow traffic safety laws and use sunscreen
Level 2: Alert	Follow **enhanced** precautions for this destination	Increased risk in defined settings or associated with specific risk factors	**Yellow Fever in Brazil-Outbreak Alert:** Because an outbreak of yellow fever was found in areas of Brazil outside of the reported yellow fever risk areas, this would be a change in "usual" precautions. Travelers should follow "enhanced precautions" for that risk area by receiving the yellow fever vaccine.
Level 3:	Avoid all non-	High risk to	**SARS in Asia-Outbreak Warning:**

Notice Level	Traveler Action	Risk to Traveler	Outbreak/Event Example
Warning	essential travel to this destination	travelers	Because SARS spread quickly and had a high case fatality rate; a warning notice signifies there was a high chance a traveler could be infected. Travelers should not travel if possible. **Earthquake in Haiti-Event Warning:** The destination's infrastructure (sanitation, transportation, etc.) cannot support travelers at this time.

Tetra Tech will also refer to US OSHA established various risk levels to address occupational exposure to infectious disease during a pandemic or disease outbreak event. These risk levels are based on the whether job assignments require close proximity to people potentially infected and whether they are required to have repeated or extended contact with known or suspected sources such as coworkers, the general public, outpatients, school children or other such individuals.

Typical work tasks conducted by Tetra Tech personnel are considered office employees with minimal occupational contact with the general public and other coworkers and present a low risk of exposure. The majority of Tetra Tech employees fall under this risk category. The intent and scope of this plan addresses this target population and associated risk level. Control measures for employees supporting contracts where the risk of exposure may be classified at higher designated levels will be evaluated and addressed on a case by case basis.

In these cases, Tetra Tech's Medical Director or other medical resources will be consulted to provide additional prevention measures that may include medical screening including the use of antiviral agents for prophylaxis or treatment of infection if available.

WORK PRACTICE CONTROLS

Work practice controls are procedures that will reduce the duration, frequency or intensity of exposure. The following work practice controls shall be implemented at Tetra Tech work locations during pandemic flu or other infectious disease events:

- Provide resources to promote good personal hygiene. This includes tissues, hand soap, hand sanitizers, surgical masks, disinfectants and disposable towels so that employees can clean work surfaces.

- Communicate risk factors, signs and symptoms of illness and proper infection control behavior. Information specific to current health events will be developed and distributed to affected employees as needed.

- Employees with signs and symptoms of disease infection should remain at home until at least 24 hours after they are free of fever (100^{o}F or greater) without the use of fever reducing medications.

- Employees are encouraged to report signs and symptoms of infection to either their immediate supervisor or Human Resources or Health and Safety personnel.

- Sick employees may be asked to go home. Employees who appear to have symptoms upon arrival or become ill during the day should be promptly separated from other workers and advised to go home. When possible and if tolerated, employees with illness symptoms should be given a surgical mask to wear before they go home if they cannot be placed in an area away from others.

Employees exposed to a sick co-worker or who care for sick family members can report to work. However these employees should monitor their health every day. Before coming to work, employees should ask themselves:

- Do I have a fever?
- Do I have a sore throat?
- Am I coughing?
- Do my muscles ache?
- Do I feel ill?

If yes is answered to any of the above, employees should stay at home, notify their supervisor and seek medical guidance.

Employees who become ill and are at increased risk of complications from infectious diseases should call their health care provider for medical advice.

Encourage vaccinations if they are available.

In the event of health events with severe outcomes, Tetra Tech may elect to activate additional work practice control measures such as:

- Proactive screening of employee's health;
- Increase the number of days an employee may be required to stay at home when ill;
- Apply social distancing measures;
- Consider alternative work environments for employees at higher risk for complications of infection;
- Require travel approval to areas of high risk; and
- Restrict employee business travel to affected areas.

HUMAN RESOURCES POLICIES AND PROCEDURES

Impacted operating units shall maintain a current roster of affected employees, dependent names if applicable, current location, contact information and emergency contact information.

Notifications of potential exposure events will be sent by Human Resources to all affected employees when probable exposure events occur. At all times the confidentiality of the ill employee will be protected to the degree practical.

Tetra Tech's standard sick leave and disability policies will apply in these events. Tetra Tech reserves the right to modify these policies as necessary to be consistent with public health guidance. As an example, a doctor's note may not be required to return to work as doctor's offices and medical facilities may be overcrowded. Human Resources is responsible for identifying legally mandated actions that are required in regard to regulations that may apply to the general workforce, US examples - the Family and Medical Leave Act, the Americans with Disabilities Act, etc.

The Tetra Tech Employee Assistance Program is available to all benefits eligible personnel. Human Resources will encourage employees to utilize these services to manage additional stressors related to the pandemic or other similar events. These are likely to include distress related to personal and family illness, life disruption, loss of routine support systems and similar challenges.

CONTINUITY OF BUSINESS OPERATIONS

Managers responsible for an office or project should plan for continuity of operations if there is significant absenteeism from sick workers. Contingency plans must be put in place to ensure that client-related work and deliverables are not impacted by employee absenteeism. Plans must be developed to notify key contacts including both customers and suppliers in the event an outbreak has impacted the company's ability to perform contracted services. All employees are responsible for notifying their immediate supervisor or office manager if project work will be affected during their absence. These plans may include:

- Identify essential business functions;
- Cross train employees in essential business functions;
- Establish flexible worksites and work hours, telecommuting, staggered shifts;
- Enhance where possible communications and IT technology as needed to support employee telecommuting;
- Identify sources of replacement employees; and
- Identify critical elements within supply chains as applicable.

In the event the severity of a heath event escalates and key business operations are impacted, Tetra Tech may elect to activate its Business Continuity Plan (BCP) to maintain enterprise essential business functions. The decision to activate the BCP will be at the discretion of Tetra Tech's executive management. Tetra Tech's BCP is reviewed with key personnel and includes periodic testing of emergency communications procedures during table-top exercises.

COMMUNICATION METHODS

Tetra Tech has established several methods of communication to ensure that timely information is received and communicated as appropriate.

Tetra Tech has partnered with several resources such as International SOS to provide real time medical updates and alerts. Employees can elect to directly receive these alerts via their email address. The International Assistance wallet card lists the contact information needed to access these resources.

Up to date disease guidance and illness information and training material are available on the ISOS website and can be accessed using the Tetra Tech member number 11BCMA000238. Depending on current events and circumstances, information may also be posted on the My.TetraTech main landing page or included in the Health and Safety portion of the site.

For US based employees, Tetra Tech has partnered with the National Safety Council and participates in a real time health alert system that is directly linked to the US Centers for Disease Control. These alerts are distributed as applicable to H&S staff for publication or response.

Tetra Tech also relies on our medical surveillance provider to provide periodic updates and medical guidance on specific health care issues.

Employees will be provided information regarding the relevant components of this guidance, as well as local instructions through various methods such as safety meetings, newsletters, posters, and employee training, etc. Information and training will include illness prevention topics, how to avoid the spread of disease, and company policies concerning illness.

Email communication is the most direct method to reach the majority of Tetra Tech employees and will be utilized in the event critical information must be distributed. Tetra Tech has the ability to send All Tetra Tech or all unit email notifications. Tetra Tech also has the ability to send SMS text messages to traveling employees that may be at risk. Line managers are responsible for having alternative means of communications available to them in order to communicate with employees who do not readily have access to these systems.