July 24, 2020

Mr. Alan Zamboanga
California Department of Resources Recycling and Recovery
CalRecycle Engineering Support Unit
1001 I Street
Sacramento, CA 95814

Subject: **Camp Fire Incident, Butte County, California**
Final Summary Report

Dear Mr. Zamboanga:

California Department of Resources Recycling and Recovery tasked Tetra Tech, Inc., under Contract DRR18087, to perform debris management and environmental services at the Camp Fire Incident in Butte County, California. Field activities related to these actions were conducted from January 2019 to July 2020 and included:

- **Planning and Pre-Debris Removal Assessment.** Planning efforts consisted of the preparation of multiple planning documents including a traffic study to monitor and minimize traffic impacts, air monitoring plans to evaluate the protection of the community, and soil sampling plans to ensure all hazardous constituents have been removed. Pre-debris removal assessments consisted of the verification of addresses, utility concerns, right-of-way access, and tracking program participants through submittals of Debris Removal Right-of-Entry Permits (ROE). Detailed property assessments consisted of hazardous material screening, biological monitoring, asbestos surveys, and documentation of all physical items within each property, such as septic tanks, hazard trees, vehicles, wells, and ash and structural footprints.

- **Air Monitoring and Surveillance.** Community air monitoring plans were implemented to help protect the overall community, sensitive populations, and receptors on neighboring properties during debris cleanup operations. Activities consisted of air sampling, air monitoring, personal protection monitoring, and reporting.

- **Debris Removal Operations.** Debris removal operations consisted of implementing stormwater best management practices at each property such as use of wattles to prevent off-site migration of waste into municipal systems or nearby waters, tracking vehicles for disposal or recycling, removal of dug wells, tracking the segregation and removal of ash and debris for landfill disposal, including proper asbestos abatement, segregation and removal of metals and concrete for recycling or disposal, removal of trees marked as hazardous, and tracking final removal of near surface soil which may contain hazardous ash or debris.

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- **Confirmation of Hazardous Materials Removal.** Following state inspection and approval of all debris removal operations, confirmation soil samples were collected to help ensure that soil remaining on each property resulting from the Camp Fire Incident was protective of human health and the environment. If sample results were not below established cleanup goals, additional soil was removed, and subsequent samples collected. This iterative process continued until cleanup goals were achieved. Tetra Tech conducted a variety of additional sampling tasks, such as commercial waste profiling, ash sampling, hydrant sampling, and subslab sampling.

The report provides a summary of these actions and provides analytical summaries and documentation for each property within the scope of work. This final report incorporates comments received on July 7 and 10, 2020 from CalRecycle on the draft report, submitted on July 1, 2020. As such, all content, technical approaches, and findings of this final report have been reviewed and approved by CalRecycle.

Sincerely,

Chris Burns
Tetra Tech Incident Commander

Jason Brodersen, P.G.
Tetra Tech Environmental Branch Director

Camp Fire Incident
Butte County, California
Final Summary Report

Prepared for

California Department of Resources, Recycling, and Recovery
CalRecycle Engineering Support Unit
1001 I Street
Sacramento, California 95814

July 24, 2020

Prepared by

TETRA TECH, INC.
2301 Lucien Way, Suite 120
Maitland, Florida 32751

EXECUTIVE SUMMARY

The Camp Fire Incident in Butte County, California, burned 153,336 acres, destroyed 18,804 structures, and caused three injuries and 85 fatalities. The fire started on November 8, 2018 and was contained on November 25, 2018 (CalFire 2019). The fire burned directly through the Town of Paradise where the majority of the structures were destroyed, as shown on Figure ES-1.

The California Governor's Office of Emergency Services (CalOES) and the California Department of Resources Recycling and Recovery (CalRecycle), along with other state and federal agencies, contractors, and consultants executed the state's debris removal program. Debris removal was provided by three contractors: ECC Constructors, LLC (ECC), SPSG Partners (SPSG) and Ceres Environmental Services, Inc. (Ceres). Tetra Tech, Inc. provided debris monitoring, environmental support, and overall reporting.

The Camp Fire Incident was the deadliest and most destructive wildfire in California history and the most expensive natural disaster in the world in 2018 in terms of insured losses. The magnitude of debris and environmental response activities was unprecedented as virtually the entire Town of Paradise was destroyed or impacted. 12,632 individual properties were addressed, including 8 public schools, 31 mobile home parks, and 296 commercial properties. Over 100,000 soil samples, 52,000 air samples, and 100,000 asbestos samples were collected, with bulk asbestos abated at 6,207 properties. Continuous air samples were collected from the community, individual properties, and all workers to help ensure safe working conditions.

Over 3.6 million tons of waste was segregated and disposed with 164 debris removal crews working at peak operations. The debris consisted of 2.24 million tons of burned debris and ash, 710,000 tons of recycled concrete, 680,000 tons of contaminated soil and ash, and 52,000 tons of recycled metal. At the peak, over 40,000 tons for debris was removed per day. There was an average of 1,800 truck trips per day with daily peaks of 1,400 total trucks and 3,500 trips. There were over 600,000 total truck trips. The average cost per property was approximately $75,000 and overall project costs over $1.16 billion. The final Camp Fire Incident Status summary is provided below. Note that site counts do not include individual mobile park homes.

CAMP FIRE INCIDENT STATUS SUMMARY
12/20/2019

Total Number of Right of Entry Forms Received:

Project Totals as: 12/20/2019

11,952	**Final** Sites registered for the removal project
917	**Final** Sites withdrawn from program (Self-certification)
128	**Final** Sites not eligible
10,907	**Final** Total sites eligible and registered for the removal project
10,907	**Final** Sites assessed completed
10,907	**Final** Asbestos surveys completed
5,115	**Final** Sites with bulk asbestos containing material
5,115	**Final** Sites abated of bulk asbestos containing material
10,907	**Final** Number of parcels with debris removal completed
10,904	Sample results approved
10,904	Erosion control completed (including waived thus far)
10,897	Approved for redevelopment

Total Debris Removal for the Project (12/19/2019)	Type of Waste
52,174	Tons of metals delivered/recycled
2,238,078	Tons of debris, ash, & soil disposed
708,319	Tons of concrete delivered/recycled
672,964	Tons of contaminated soil
	Tons of Vegetative material
3,671,535	**Total Tons**

Location	Total Abatement Properties	Debris Removal Complete	FSO Completed
County/Town	45	45	44

	CERES	ECC	SPSG	Tetra Tech	Totals
Budget	$300,000,000	$800,000,000	$600,000,000	$250,000,000	$1,750,000,000
Total Budget Remaining	$63,193,661	$135,210,602	$249,757,581	$45,664,357	$493,826,200
Spent to Date	$236,806,339	$464,789,398	$350,242,419	$204,335,643	$1,256,173,800
Contract Termination Date	Friday, January 31, 2020	Friday, January 31, 2020	Friday, January 31, 2020	Tuesday, June 30, 2020	
Current Date	Thursday, December 19, 2019				
Days left on Contract	43	43	43	194	
Budget Remaining/Days Remaining	$1,469,620	$3,144,433	$5,808,316	$235,383	
Average Daily Cost (Previous 5 Days)	$41,919	$34,404	$19,923	$621,534	$717,779
Budget Remaining %	21.06%	22.54%	41.63%	18.27%	28.22%
30 Day Budget Projection	$0	$0	$0	$16,500,000	$16,500,000
30 Day Remaining Budget Projection Total	$63,193,661	$135,210,602	$249,757,581	$29,164,357	$477,326,200

INITIAL HAZARDOUS MATERIALS RESPONSE

In December 2018 and January 2019, California Department of Toxic Substances Control (DTSC) and the U.S. Environmental Protection Agency (USEPA) conducted a preliminary hazardous waste assessment (triage assessment) for suspected asbestos-containing materials (ACM) and other hazardous substances in the area of the Camp Fire Incident. Hazardous materials that were easily handled and managed by the DTSC triage team were removed. Materials that were not immediately dangerous, exceeded the capabilities of the triage team, or required laboratory analysis, were left in place pending further environmental evaluation.

DEBRIS REMOVAL PROGRAM OBJECTIVES

The resulting ash and debris from burned residential structures can contain concentrated amounts of metals, such as antimony, arsenic, cadmium, cobalt, copper, lead, zinc, and other metals. These metals and their potential impacts are discussed in Assessment of Burn Debris - 2007 Wildfires San Bernardino and San Diego Counties, California (DTSC 2007), and Assessment of Burned Debris - 2015 Wildfires Lake and Calaveras County, California (DTSC 2015). As a result, these large-scale fire incidents can significantly impact individual properties, local communities, and watersheds if the ash and debris are not removed.

Residual materials such as stucco, roofing, flooring and mastic, fireplaces, furnaces, sheetrock wall systems, cement pipe, exterior home siding, thermal system insulation, concrete and mortar, and other building materials commonly used in homes built before 1984 may also contain other hazardous materials, such as asbestos.

SCOPE OF WORK

Debris removal activities consisted of removing all burned debris, including ACM, building materials, concrete, vegetation, other construction debris, electronic waste, and household hazardous chemicals. The total number of properties addressed in the response consisted of 12,632 individual properties, which includes 1,530 individual spaces within 31 mobile home parks. These 12,632 properties comprise the 10,968 main assessor parcel numbers (APN) as prescribed on the CalOES database, which does not include mobile home park spaces, but does include withdrawn properties, those addressed in alternate programs, and other properties not addressed within the CalOES debris removal program.

All activities were conducted under the oversight and approval of the State Incident Management Team (IMT) and in accordance with the Debris Removal Operations Plan (DROP) for the Camp Debris Removal Incident, (CalRecycle 2019), as well as activity-specific work plans. The DROP was revised several times while the debris removal program was underway. The approved DROP in affect at the time of any action was followed.

The general scope of work and steps consisted of:

- **Planning and Pre-Debris Removal Assessment.** Planning efforts consisted of the preparation of multiple planning documents including a traffic study to monitor and minimize traffic impacts, air monitoring plans for protection of the community, and soil sampling plans to ensure all hazardous constituents have been removed. Pre-debris removal assessments consisted of the verification of addresses, utility concerns, right-of-way access, and tracking program participants through submittals of Debris Removal Right-of-Entry Permits (ROE). Detailed property assessments consisted of hazardous material screening, asbestos surveys, biological monitoring, and documentation of all physical items within each property, such as septic tanks, hazard trees, vehicles, wells, and ash and structural footprints.

- **Air Monitoring and Surveillance.** Community air monitoring plans were implemented to help protect the overall community, sensitive populations, and receptors on neighboring properties during debris cleanup operations. Activities consisted of air sampling, air monitoring, personal protection monitoring, and reporting.
- **Debris Removal Operations.** Debris removal operations consisted of stormwater best management practices at each site such as use of wattles to prevent off-site migration of waste into municipal systems or nearby waters, segregation of vehicles for disposal or recycling, segregation and removal of ash and debris for landfill disposal, including proper asbestos abatement, segregation and removal of metals and concrete for recycling or disposal, removal of trees marked as hazardous, and final removal of near surface soil which may contain hazardous ash or debris.
- **Confirmation of Hazardous Materials Removal.** Following state inspection and approval of all debris removal operations, soil samples were collected to help ensure that soil remaining on each property resulting from the Camp Fire Incident was protective of human health and the environment. If sample results were not below established cleanup goals, additional soil was removed, and subsequent samples collected. This iterative process continued until cleanup goals were achieved.
- **Erosion Control.** Once the State IMT determined the property met the overall cleanup objectives of the debris removal action, contractors implemented erosion control measures, if authorized by the property owner. Erosion control measures stabilized disturbed soil and reduced potential soil runoff by installing fiber rolls, compost filter socks, silt fences, erosion control blankets, hydraulic mulch and tackifier, soil binders, and other mechanisms to reduce soil erosion.
- **State Approval.** Following completion of erosion control measures, the State IMT conducted a final on-site review of the property, approved all work completed, and recommended to Butte County that the debris removal objectives were complete. Butte County completed the process with approval of the Debris Removal Final Signoff Form.

SUMMARY REPORT CONTENT

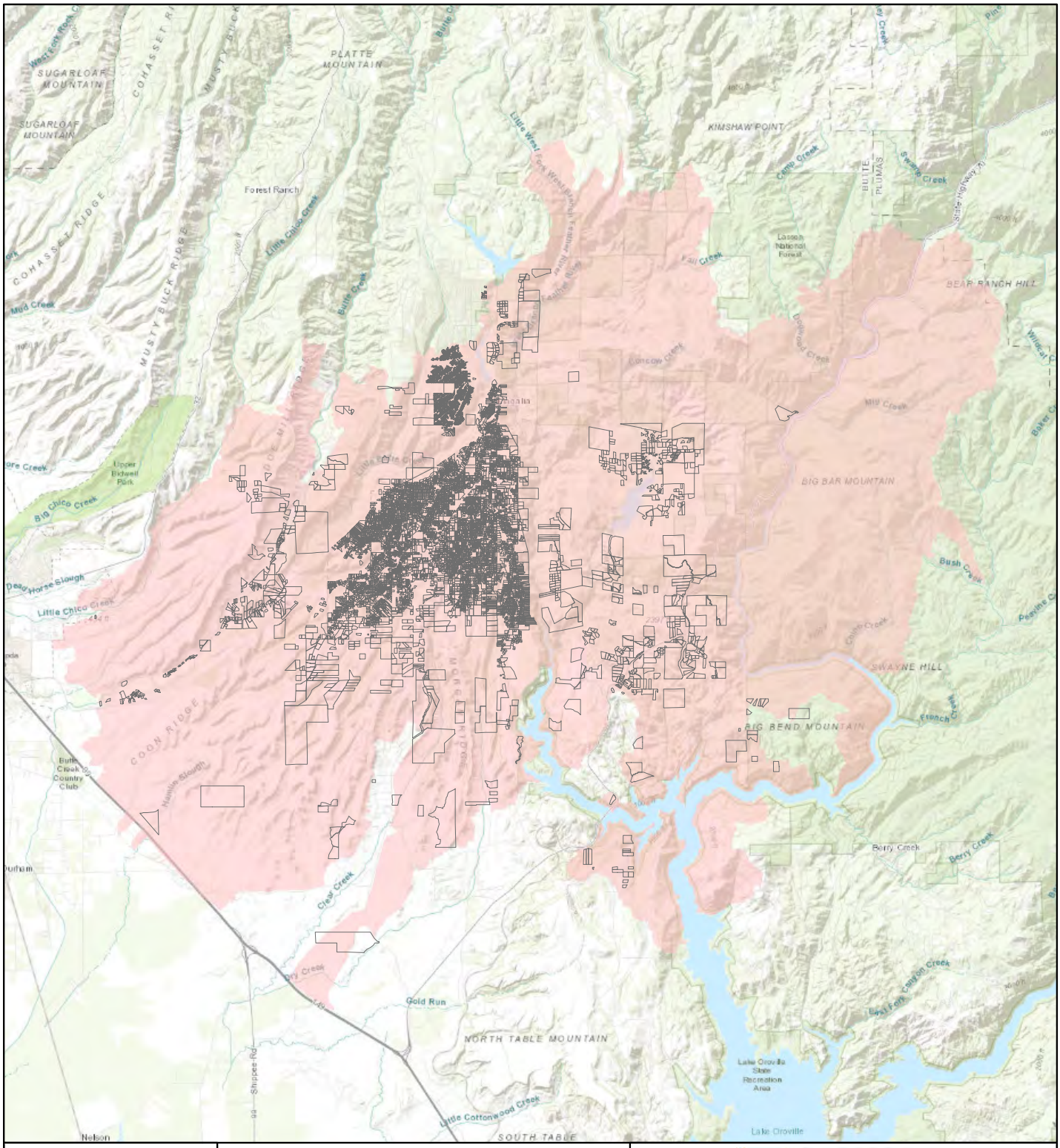
The summary report provides methods, means, details, and results from all elements of the scope of work. The summary report provides complete references, appendices, and attachments necessary to document the complete scope of work.

- Section 1 presents the background, scope of work, and the report content
- Section 2 identifies the initial response conducted by DTSC and USEPA
- Section 3 summarizes debris removal activities
- Section 4 summarizes data management activities conducted throughout the response
- Section 5 presents environmental site activities including site assessments, asbestos sampling, air monitoring and sampling, and soil sampling
- Section 6 summarizes laboratory data validation activities
- Section 7 presents confirmation sampling results and statistical evaluations
- Section 8 summarizes additional activities and tasks completed throughout the response
- Section 9 provides the content included within the individual property reports (IPR)
- Section 10 introduces the project costs and overall debris removal and disposal evaluation
- Section 11 presents complete references

Appendices consist of supporting information prepared for the summary report including biological reports, asbestos data summaries, air particulate and monitoring results, personal air sampling results, background soil evaluation, analytical data validation, lead arsenical example results, staging area results, and well

abandonment logs. Individual property reports and cost summary tables are also included as appendices which provide all pertinent information regarding the debris removal program for each property.

Attachments consist of existing documentation or information previously prepared in support of the summary report, including the Debris Removal Operations Plan, Emergency Waivers, all analytical laboratory reports, and documents previously submitted by Tetra Tech in support of the debris removal program.



Legend

Affected Parcel

Polygons

N

0 2.5 5 Miles

TETRA TECH

Camp Fire Incident
Butte County, California

Figure ES-1
Camp Fire Incident Location

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2 Laboratory Analytical Results: Bulk Asbestos Samples

3 Laboratory Analytical Results: Community, Perimeter, and Personal Air Samples

4 Laboratory Analytical Results: Background Soil Samples

5 Laboratory Analytical Results: Confirmation Soil Samples

6 Laboratory Analytical Results: Ash Samples

7 Previously Submitted Plans and Reports:

- Air Monitoring and Sampling Plan – Camp Fire Incident. Revision 0
- Community Air Monitoring and Sampling Plan – Camp Fire Incident. Revision 0
- Health and Safety Plan, Camp Fire Incident, Butte County, California
- Soil Sampling Plan, Camp Fire Incident, Butte County, California. Revision 3
- Soil Sampling Plan, Camp Fire Incident, Butte County, California. Addendum 1, Revision 1
- Abbreviated Sampling Plan for the Camp Fire Incident Site Hydrant Sampling.
- Abbreviated Sampling and Analysis Plan for Ash Sampling
- Background Sampling and Cleanup Goals Report, Revision 2, Camp Fire Incident, Butte County, California
- Community Air Monitoring and Sampling Plan – Camp Fire Incident. Revision 1.0
- Soil Sampling Plan, Camp Fire Incident, Butte County, California. Addendum 2, Revision 2
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- Hydrant Sampling and Employee Industrial Hygiene Exposure Monitoring, Revision 0, Camp Fire Incident, Butte County, California
- Final Assessment of Ash Sampling – Camp Fire Incident
- Commercial Properties Waste Profile Report, Camp Fire Incident
- Elevated Arsenic and Lead Patterns, Camp Fire Incident, Butte County, California
- ECC Truck Staging Areas Summary, Camp Fire Incident, Butte County, California
- SPSG Partners Truck Preload Staging Areas Summary, Camp Fire Incident, Butte County, California
- Neal Road Concrete Staging Area Summary, Camp Fire Incident, Butte County, California
- Granite Site Concrete Staging Area Summary, Camp Fire Incident, Butte County, California
- CHP Metal Processing Center Staging Area Summary, Camp Fire Incident, Butte County, California

8 Contractor Air Sampling Summary Tables

ACRONYMS AND ABBREVIATIONS

95UTL	95 percent Upper Tolerance Limit
µg/m^3	Microgram per cubic meter
µg/L	Micrograms per liter
µm	Micron
AAC	Asbestos Abatement Clearance
ACF	Asbestos Chimney Form
ACM	Asbestos-containing materials
ADMS	Automated Debris Management System
AEC	Agnew Environmental Consulting
AETL	American Environmental Consulting
Alpha	Alpha Analytical Laboratories
ALS	ALS Environmental
AMSP	Air Monitoring and Sampling Plan
APN	Assessor Parcel Number
AQI	Air Quality Index
ASF	Asbestos Survey Form
ASR	Asbestos Survey Result
BCAQMD	Butte County Air Quality Management District
BCL	BC Laboratories, Inc.
bgs	Below ground surface
BMP	Best management practices
BSK	BSK Associates Laboratory
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CAC	California Certified Asbestos Consultant
Cal OSHA	California Occupational Safety and Health Administration
CalEPA	California Environmental Protection Agency
CalOES	California Governor's Office of Emergency Services
CalRecycle	California Department of Resources Recycling and Recovery
CalScience	Eurofins CalScience
Caltrans	California Department of Transportation
CAMSP	Community Air Monitoring and Sampling Plan
CARB	California Air Resources Board
CCR	California Code of Regulations
CERES	Ceres Environmental Services, Inc.
CFR	Code of Federal Regulations
CHHSL	California Human Health Screening Level
CHP	California Highway Patrol
CSST	Certified Site Surveillance Technician
cy	Cubic yard
DROP	Debris Removal Operations Plan
DTSC	California Department of Toxic Substances Control
DU	Decision unit
DustTrak	TSI DustTrak II Aerosol Monitor 8530
ECC	ECC Constructors, LLC

EDD	Electronic data deliverables
EDR	Environmental Data Resources
ELZ	Equipment Limitation Zone
EMAX	EMAX Laboratories, Inc.
Enthalpy	Enthalpy Analytical
EPP	Environmental Protection Plan
ExcelChem	ExcelChem Laboratories
f/cc	Fibers per cubic centimeter
FEMA	Federal Emergency Management Agency
GIS	Geographic information system
GPS	Global positioning system
HAZWOPER	Hazardous Waste Operator
HCl	Hydrochloric acid
HERO	Human and Ecological Risk Office
HHW	Household Hazardous Waste
IC	Incident Commander
ICP	Inductively Coupled Plasma
ICS	Incident Command Structure
ID	Identification
IMT	Incident Management Team
IPR	Individual property report
ISO	International Organization for Standardization
L	Liter
L/min	Liters per minute
LMOE	Laboratory margin of error
MCE	Mixed cellulose ester
MCL	Maximum Contaminant Level
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mg/m^3	Milligrams per cubic meter
MHP	Mobile home park
mm	Millimeter
MS	Mass Spectrometry
MS/MSD	Matrix spike/matrix spike duplicates
N/A	Not applicable
NA	Not available
NAM	Negative air machine
ND	Not detected at or above the reporting limit
NIOSH	National Institute for Occupational Safety and Health
NPE	Negative pressure enclosure
NRC	National Response Corporation
OEHHA	California Office of Environmental Health Hazard
OEL	Occupational exposure limit

OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
Pace	Pace Analytical Laboratories
PAH	Polycyclic aromatic hydrocarbons
PBDE	Polybrominated diphenyl ethers
PCB	Polychlorinated biphenyls
PCM	Phase contrast microscopy
PCME	Phase Contrast Microscopy Equivalent
PEL	Permissible exposure limits
PFAS	Per- and polyfluoroalkyl substances
PII	Personal identifiable information
PLM	Polarized light microscopy
PM	Particulate matter
PPE	Personal protective equipment
PUSD	Paradise Unified School District
Q-Q	Quantile-quantile
QA/QC	Quality Assurance/Quality Control
R/S	Restricted/Seasonal
RCRA	Resource Conservation and Recovery Act
ROE	Debris Removal Right-of-Entry Permit
ROW	Rights-of-way
RSL	Regional Screening Levels
s/cc	Structures per cubic centimeter
SA	Site Assessment
SIM	Selected ion monitoring
SOP	Standard Operation Procedure
SOW	Scope of work
SPM	Suspended Particulate Matter
SPSG	SPSG Partners
SQL	Structured query language
SSRS	SQL Server Reporting Services
STLC	Soluble threshold limit concentration
SVOC	Semivolatile organic compound
TBD	To be determined
TCLP	Toxicity characteristic leaching procedure
TDS	Total Dissolved Solids
TEM	Transmission electron microscopy
TestAmerica	Eurofins TestAmerica
Tetra Tech	Tetra Tech, Inc.
TLV	Threshold limit value
TPH	Total petroleum hydrocarbons
TRPH	Total recoverable petroleum hydrocarbons
TTHM	Total Trihalomethanes
TTLC	Total Threshold Limit Concentration

TWA	Time weighted average
USEPA	U.S. Environmental Protection Agency
VOC	Volatile organic compound
Water Board	Regional Water Quality Control Board
WET	Whole Effluent Toxicity
XRF	X-ray fluorescence

1.0 INTRODUCTION

This section discusses the background, scope of work (SOW) and the report content for the Camp Fire Incident in Butte County, California. The California Governor's Office of Emergency Services (CalOES) and the California Department of Resources Recycling and Recovery (CalRecycle), along with contractors executed the SOW in order to remove debris after the Camp Fire Incident.

1.1 BACKGROUND

The Camp Fire Incident in Butte County, California, burned 153,336 acres, destroyed 18,804 structures, and caused three injuries and 85 fatalities. The fire started on November 8, 2018 and was contained on November 25, 2018 (CalFire 2019). The incident boundary is shown on Figure 1-1. The fire burned directly through the Town of Paradise where the majority of structures were lost.

CalRecycle tasked Tetra Tech, Inc. (Tetra Tech), under Contract Number DRR18087, to perform debris monitoring and environmental technical support for residential and commercial properties impacted by the Camp Fire Incident. Tetra Tech staff mobilized on January 8, 2019 in support of the CalOES and CalRecycle Incident Command Structure (ICS) management team. Debris removal was provided by three contractors: ECC Constructors, LLC (ECC) (Contract Number DRR18098), SPSG Partners (SPSG) (Contract Number DRR18099), and Ceres Environmental Services, Inc. (Ceres) (Contract Number DRR18100).

The ash and debris resulting from burned residential structures can contain concentrated amounts of metals, such as antimony, arsenic, cadmium, cobalt, copper, lead, zinc, and other metals. These metals are discussed in Assessment of Burn Debris – 2007 Wildfires San Bernardino and San Diego Counties, California (California Department of Toxic Substances Control [DTSC] 2007) and Assessment of Burned Debris – 2015 Wildfires Lake and Calaveras County, California (DTSC 2015). As a result, these large-scale fire incidents can significantly impact individual properties, local communities, and watersheds if the ash and debris are not removed.

Residual materials such as stucco, roofing, floor tile and mastic, floor sheeting and mastic, fireplaces, furnaces, sheetrock wall systems, cement pipe, exterior home siding, thermal system insulation, concrete and mortar, and other building materials commonly used in homes built before 1984 may also contain other constituents of concern, such as asbestos. In December 2018 and January 2019, DTSC and the U.S. Environmental Protection Agency (USEPA) conducted a preliminary hazardous waste assessment (triage assessment) for suspected asbestos-containing materials (ACM) and other hazardous substances in the area of the Camp Fire Incident. Hazardous materials that were easily handled and managed by the DTSC triage team were removed. Materials that were not immediately dangerous, exceeded the capabilities of the triage team, or required laboratory analysis, were left in place pending further environmental evaluation

1.2 SCOPE OF WORK

Debris removal activities consisted of removing all burned debris, including ACM, building materials, concrete, vegetation, other construction debris, electronic waste, and household hazardous chemicals. The total number of properties addressed in the response consisted of 12,632 individual properties, which includes 1,530 individual spaces within the 31 mobile home parks. These 12,632 properties comprise the 10,968 main assessor parcel numbers (APN) as prescribed on the CalOES database, which does not include mobile home park spaces, but does include withdrawn properties, those addressed in alternate programs, and other properties not addressed within the CalOES debris removal program. Specific counts of site assessments, asbestos surveys, and soil sampling activities are discussed in the sections below.

Tetra Tech and its subcontractors were tasked with all debris management services and reporting as required to manage the debris cleanup services in support of the Incident Commander (IC). Tasks included providing planning, logistics, operations, finance/administrative, and subject matter expert services, as directed by the CalRecycle Contract Manager. All activities conducted in the field and presented in this report were reviewed and approved by the State Incident Management Team (IMT), composed of the entities listed above. All activities were conducted in accordance with the Debris Removal Operations Plan (DROP) for the Camp Debris Removal Incident, Version 5.4, dated June 13, 2019 (CalRecycle 2019) and the following plans:

- Air Monitoring and Sampling Plan –, Camp Fire Incident. Revision 0. (Tetra Tech 2018a)
- Community Air Monitoring and Sampling Plan –, Camp Fire Incident. Revision 0 (Tetra Tech 2018b)
- Health and Safety Plan, Camp Fire Incident, Butte County, California. (Tetra Tech 2019a)
- Soil Sampling Plan, Camp Fire Incident, Butte County, California. Revision 3. (Tetra Tech 2019b)
- Soil Sampling Plan, Camp Fire Incident, Butte County, California. Addendum 1, Revision 1. (Tetra Tech 2019c)
- Abbreviated Sampling Plan for the Camp Fire Incident Site Hydrant Sampling (Tetra Tech 2019d)
- Abbreviated Sampling and Analysis Plan for Ash Sampling. (Tetra Tech 2019e)
- Community Air Monitoring and Sampling Plan –, Camp Fire Incident. Revision 1.0. (Tetra Tech 2019g)
- Soil Sampling Plan, Camp Fire Incident, Butte County, California. Addendum 2, Revision 2. (Tetra Tech 2019h).
- Personal Air Sampling Plan, Camp Fire Incident, Paradise, Butte County, California. Revision 0. (Tetra Tech 2019i)
- Soil Sampling Plan, Camp Fire Incident, Butte County, California. Addendum 3, Revision 1. (Tetra Tech 2019j)
- Soil Sampling Plan, Camp Fire Incident, Butte County, California. Addendum 4, Revision 0. (Tetra Tech 2019k)

1.2.1 Pre-Debris Removal Assessment

Pre-debris removal activities were conducted prior to site assessment, asbestos survey, and debris removal activities. These activities consisted of:

- Verifying installation of address and project signs
- Identifying water and electrical sources
- Identifying equipment and material staging areas
- Identifying underground utilities by alerting Underground Service Alert for public rights-of-way (ROW)
- Identifying underground utilities for private ROWs

Once a Debris Removal Right-of-Entry Permit (ROE) was completed and approved for a property, Tetra Tech performed the following property-specific site assessment activities:

- Identified utilities on property
- Identified septic tank and leach field locations on each property
- Identified water wells on properties not serviced by the local water agency
- Identified and recorded vehicles for removal (i.e., cars, boats, motorcycles, trailers, etc.)
- Measured and recorded foundation and other hardscape footprints
- Measured and recorded ash footprints
- Conducted asbestos surveys

- Conducted mercury and radiological surveys
- Identified hazardous trees
- Identified other property-specific hazards (i.e., swimming pools, large vehicles, hazard trees)
- Identified, removed, or staged hazardous wastes missed during the initial assessment
- Identified potential site access issues that may have required additional work prior to mobilizing equipment and trucking, including hazardous trees, utilities, or bridge repairs

Properties which were identified by Butte County as being damaged and that did not submit an ROE or sign up for the alternative program with an approved work plan by the deadline, were added to the debris removal program following a court order. Once a signed warrant was received by the state, these parcels were complete as high priority sites in order to meet the deadline. These properties were referred to as forced abatements.

1.2.2 Air Monitoring and Surveillance During Debris Removal Operations

Tetra Tech developed a community air monitoring plan for constituents of concern (Tetra Tech 2018b). The plan was approved by the State IMT. The monitoring was to help protect the overall community, sensitive receptors, and receptors on neighboring properties during the debris cleanup operation. Tetra Tech conducted community air monitoring consistent with the approved community air monitoring plan (Tetra Tech 2018b; 2019g) and conducted personal air sampling of task force leaders and others in the area of contamination per the approved Personal Air Sampling Plan (Tetra Tech 2019i).

Tetra Tech developed and implemented its own Health and Safety Plan (Tetra Tech 2019a). All contractor field personnel were required to be 40-hour Hazardous Waste Operator (HAZWOPER) certified and wear Level C Personal Protective Equipment (PPE) when performing on-site field tasks. Level C PPE included the basic Level D PPE with the addition of coveralls (e.g., Tyvek), a half-face respirator (e.g., North/Honeywell) or full-face respirator (e.g., Scott AV3000), nitrile gloves, and foot coverings either attached to coveralls or chemical-resistant rubber boots or latex hazmat booties worn over the standard leather work boot, as outlined in the approved Health and Safety Plan (Tetra Tech 2019a).

1.2.3 Debris Removal Operations Tasks

Tetra Tech was responsible for overseeing the debris removal and operations tasks for the Camp Fire Incident. Debris removal was performed by three CalRecycle contractors: ECC, SPSG, and Ceres. Monitoring and sampling were performed by Tetra Tech. Specific debris removal operation tasks are summarized below.

Storm Water Management

- Observe and verify the deployment of appropriate storm water best management practices at each site such as use of wattles to prevent off-site migration of waste into municipal systems or nearby waters
- Observe and verify the employment of appropriate storm water best management practices around the community to protect storm drain systems or nearby waters (i.e., sedimentation/ash control at storm drain inlets)

Segregate Vehicles for Disposal/Recycling

- Observe and verify the removal of vehicles (i.e., cars, boats, motorcycles, trailers, etc.) for recycling or disposal

- Confirm that motor vehicles have been cleared of their titles before recycling or disposal (completed by California Highway Patrol)

Segregate Ash and Debris for Disposal

- Observe and verify the collection, consolidation, removal, and transportation of ash and debris for disposal
- Observe and verify asbestos abatement and chimney removal activities
- Ensure material requiring special handling and disposal as "designated" or "special" waste is disposed of at a lined landfill and in accordance with California Hazardous Waste disposal regulations

Segregate Metals for Recycling/Disposal

- Observe and verify the collection, consolidation, removal, and transportation of metals for recycling or disposal

Segregate Concrete for Recycling

- Observe and verify the collection, consolidation, removal, and transportation of concrete for recycling unless a registered professional structural engineer determines that the concrete foundation is safe to re-build on

Finish Surface

- Observe and verify the removal and transportation of 3- to 6-inches of soil in the ash impacted areas of the property
- Verify that the ash impacted areas of the property were free of glass, nails, and trip hazards after debris removal
- Observe and verify the finish grading/smoothing ground surface

Hazard Tree Identification and Removal

- Provide a certified or registered arborist to assess trees within the impacted area to evaluate whether they may be a threat to debris removal (i.e., hazard tree) as needed
- Arborists may mark trees as hazardous to be removed; those marked as questionable may be decided to keep or remove by the landowner
- Oversee the collection, consolidation, and removal of hazard trees for recycling (bucked into firewood rounds or chipped as erosion control) or disposal depending on the options provided to the landowner or municipality

Conduct Background Sampling and Establish Cleanup Goals

- Obtain background samples from soils outside of burned areas within Camp Fire Incident to identify background concentrations within the incident area per the DROP (CalRecycle 2019)
- Compare background concentrations to health-based and regulatory screening levels to establish the cleanup goals for the incident

Conduct Environmental Sampling

- Develop a standardized soil sampling approach for each property, dependent on size of ash footprints
- Upon removing all the debris and 3- to 6-inches of soil within the ash impacted areas of the property, sample and analyze the remaining soil surface for the metal constituents identified for the cleanup goals
- If results exceed cleanup goals, recommend additional soil (from 0.5- to 3-inches) be removed for disposal and re-sampling of the new surface soil be performed (i.e. perform a rescrape)

- Repeat rescrape and sampling until the soil meets numeric cleanup goals, the objective of removing all contamination related to the Camp Fire Incident, or as directed by the State IMT
- Once results are less than cleanup goals, erosion control measures were recommended to the State IMT. Once the State IMT determined that all Camp Fire Incident debris and ash was removed, the properties were approved by the State IMT for erosion control
- Complete additional sampling at the direction of the State IMT, including, but not limited to staging area sampling, commercial profiling, ash sampling, and hydrant sampling
- Following State IMT approval the property met the overall cleanup objectives, implemented erosion control measures or erosion control waiver, as authorized by the property owner. Erosion control measures stabilized disturbed soil and reduced potential soil runoff by installing fiber rolls, compost filter socks, silt fences, erosion control blankets, hydraulic mulch and tackifier, soil binders, and other mechanisms to reduce soil erosion

Project Completion Documentation

- Assist CalRecycle staff in completing financial summary information for each property in a manner and level of detail acceptable to CalRecycle
- Document complete project costs
- Prepare a draft and final summary report documenting all SOW activities, including summaries of activities at each individual property, a cost summary, and all associated backup documentation

1.3 REPORT CONTENT

This summary report documents the results from the SOW which includes:

- Section 1 presents the background, scope of work, and the report content
- Section 2 identifies the initial response conducted by DTSC and USEPA
- Section 3 summarizes debris removal activities
- Section 4 summarizes data management activities conducted throughout the response
- Section 5 presents environmental site activities including site assessments, biological monitoring, asbestos assessments sampling, air monitoring and sampling, and soil sampling
- Section 6 summarizes laboratory data validation activities
- Section 7 presents confirmation soil sampling results and statistical evaluations
- Section 8 summarizes additional activities and tasks completed throughout the response
- Section 9 provides the content included within the individual property reports (IPR)
- Section 10 introduces the project costs and overall debris removal and disposal evaluation
- Section 11 presents complete reference

Appendices are as follows:

A Biological Assessment Daily Report Summary
B Biological Assessments Property Status Report and Biology Observation Tracking Summaries
C Bulk Asbestos Data Summary
D Community, Fixed Facility, and Perimeter Particulate Air Monitoring Summary, Telemetry Summary, Meteorological Data and Air Station Checks
E Community, Fixed Facility, and Perimeter Air Sampling Analytical Data Summary
F Personal Air Sampling Analytical Data Summary
G Background Soil Sampling Analytical Data Summary and Statistical Packages
H XRF Calibration Documentation
I Data Validation Summary Reports
J Arsenic and Lead Example CGSs
K Incident Reports

L Staging Area Laboratory Reports and Cleanup Screening Goals Tables
M Hydrant Sampling Laboratory Reports and Screening Tables
N Well Abandonment
O Subslab Soil Sampling Laboratory Reports and Screening Tables
P Individual Property Reports
Q Cost Summary Tables

Attachments are as follows:

1 Debris Removal Operations Plan for the Camp Debris Removal Incident, Environmental Protection Plan Supplement to the Debris Removal Operations Plan for the Camp Debris Removal Incident, Camp Fire Debris Removal Operation Traffic Management Plan, and Emergency Waiver in Support of the Site Cleanup Programs for the Wild Fire Debris Removal Projects in Butte County
2 Analytical Results: Bulk Asbestos Samples
3 Analytical Results: Community, Perimeter, Fixed Facility, and Personal Air Samples
4 Analytical Results: Background Soil Samples
5 Analytical Results: Confirmation Soil Samples
6 Analytical Results: Confirmation Ash Samples
7 Previously Submitted Tetra Tech Plans and Reports

- Air Monitoring and Sampling Plan, Camp Fire Incident. Revision 0
- Community Air Monitoring and Sampling Plan, Camp Fire Incident. Revision 0
- Health and Safety Plan, Camp Fire Incident, Butte County, California
- Soil Sampling Plan, Camp Fire Incident, Butte County, California. Revision 3
- Soil Sampling Plan, Camp Fire Incident, Butte County, California. Addendum 1, Revision 1
- Abbreviated Sampling Plan for the Camp Fire Incident Site Hydrant Sampling.
- Abbreviated Sampling and Analysis Plan for Ash Sampling.
- Background Sampling and Cleanup Goals Report, Revision 2, Camp Fire Incident, Butte County, California.
- Community Air Monitoring and Sampling Plan, Camp Fire Incident. Revision 1.0
- Soil Sampling Plan, Camp Fire Incident, Butte County, California. Addendum 2, Revision 2
- Personal Air Sampling Plan, Camp Fire Incident, Paradise, Butte County, California. Revision 0
- Soil Sampling Plan, Camp Fire Incident, Butte County, California. Addendum 3, Revision 1
- Soil Sampling Plan, Camp Fire Incident, Butte County, California. Addendum 4, Revision 0
- Hydrant Sampling and Employee Industrial Hygiene Exposure Monitoring, Revision 0, Camp Fire Incident, Butte County, California.
- Final Assessment of Ash Sampling, Camp Fire Incident, Butte County, California.
- Commercial Properties Waste Profile Report, Camp Fire Incident, Butte County, California.
- Elevated Arsenic and Lead Patterns, Camp Fire Incident, Butte County, California
- ECC Truck Staging Areas Summary, Camp Fire Incident, Butte County, California
- SPSG Partners Truck Preload Staging Areas Summary, Camp Fire Incident, Butte County, California
- Neal Road Concrete Staging Area Summary, Camp Fire Incident, Butte County, California

- Granite Site Concrete Staging Area Summary, Camp Fire Incident, Butte County, California
- CHP Metal Processing Center Staging Area Summary, Camp Fire Incident, Butte County, California

8 Contractor Air Sampling Summary Tables

The report provides a summary of these actions and provides analytical summaries and documentation for each property within the scope of work. This final report incorporates comments received on July 7 and 10, 2020 from CalRecycle on the draft report, submitted on July 1, 2020. As such, all content, technical approaches, and findings of this final report have been reviewed and approved by CalRecycle.

2.0 TRIAGE ASSESSMENT

California DTSC, with the assistance of USEPA and other local agencies, assessed and removed household hazardous waste and asbestos from fire-damaged properties as part of the initial interagency response to the Camp Fire Incident. Household hazardous waste (HHW) assessed and removed included lead-acid and household batteries, compressed gas cylinders, bulk pesticides, fertilizers, pool chemicals, significant e-wastes paints, thinners, and aerosol cans. ACM was assessed and removed and included transite siding, tiles, and pipes as well as certain types of sub-floor material. DTSC assessed and removed HHW and asbestos from over 13,500 residential, commercial, and public properties. The triage assessment also included hazardous screening including radiological surveys.

Property owners applied for approval in the CalOES debris removal program through completion and submittal of the ROE. State of California and Butte County representatives reviewed and vetted each ROE for determination of applicability and inclusion within the debris removal program. As a part of the vetting process, Butte County provided the final nomenclature for tracking and reporting each real property address within the program. Any discrepancies within addresses provided by property owners or within the Butte County databases were resolved and directed by Butte County.

3.0 DEBRIS REMOVAL ACTIVITES

Debris removal activities were completed at 12,467 individual properties, consisting of removing all burned debris, including ACM, building materials, concrete, vegetation, other construction debris, electronic waste, and household hazardous chemicals. This section provides the methodology, cost tracking measures, disposal summary, traffic controls, storm water management procedures, and a summary of the debris tonnage and disposal.

3.1 METHODOLOGY

The debris removal management portion of the Camp Fire Incident Project encompassed documentation, monitoring, and oversight of removal of burned ash, recyclable metals, concrete, contaminated soil, asbestos, and hazardous trees from burned residential and commercial building footprints and surrounding areas. Tetra Tech tracked material quantities and associated costs from collection to final disposal. Tetra Tech's project work plan and procedures were consistent with the goals of the DROP (CalRecycle 2019) for conducting a rapid cleanup and restoration, minimizing costs, and verifying the safety of those involved in the process.

During the project planning period (immediately post-award to monitor deployment), standardized reports, tracking metrics, customized field documents and specialized training were developed specifically for the challenges of the Camp Fire Incident. As the Camp Fire was the most destructive wildfire in California history, much consideration was paid to responding in an organized, streamlined approach to maximize efficiency and accuracy. From onset of the project, staff members were trained not only in their specific roles but in the program as a whole. This training occurred throughout the duration of the project to reiterate Federal Emergency Management Agency (FEMA) guidance and brief staff on new challenges encountered.

Prior to the commencement of debris removal activities, Tetra Tech conducted a pre-debris removal survey in coordination with the California Highway Patrol (CHP) to identify fire-damaged vehicles and non-vehicles. During this survey, fire-damaged vehicles were identified, photographed, catalogued and ticketed. Data metrics were reported daily and over 18,000 vehicles and non-vehicle equipment were surveyed. Tetra Tech conducted a pre-debris removal video survey to document road conditions before debris removal began. Roads where debris removal would be occurring were recorded using GoPro technology.

As the debris removal portion of the project ramped up, Tetra Tech engaged staff to proceed under the Incident Command System (ICS) management system. Incident Commanders, Operations Section Chiefs (OPS), Deputy OPSs, Branch Directors, Health and Safety Officers and Task Force Leaders were engaged. Firstly, debris contractor task force crews and hauling vehicles were certified and registered with Tetra Tech's proprietary RecoveryTrac Automated Debris Management System (ADMS) application. See Section 4.0 on debris removal data management for an in-depth explanation of data tracking and technology. Tetra Tech also provided teams of inspectors to perform third-party DOT truck inspections of all disposal trucks, low beds, water tenders, tow trucks, street sweepers, and other commercially licensed vehicles used on the project.

Tetra Tech deployed Task Force Leaders to the project site, each with a copy of the site-specific debris removal operations plan. The information provided a baseline understanding of tasks to be performed at each site and what must be documented regarding disposal including:

- Expected material types that must be removed
- Type of equipment being dispatched
- Debris types

- Facilities to dispose of or recycle debris
- Final destination of debris
- Items to be addressed before debris removal is completed
- Estimated quantities of debris removed
- Approved ROE forms

During debris removal, Tetra Tech staff inspected, monitored, tracked, and documented the types of materials being disposed. Additionally, any ancillary crews required were monitored and documented in the field using the RecoveryTrac ticketing system. Debris cleanup crew activities were closely monitored, and Tetra Tech advised the State IMT of any potential issues regarding health and safety, environmental control, or other activity requiring notification or changes to protocols to improve health and safety.

Properties which did not submit ROEs to the State nor conducted debris removal within an alternative program, were added to the debris removal program as forced abatements. These properties had mandated completion dates and were considered high priority by the State IMT.

At the request of CalRecycle, the Mechoopda Indian Tribe and Enterprise Rancheria were subcontracted by Tetra Tech to provide tribal monitoring services for the Camp Fire Project. Tribes deployed tribal monitors to project sites during the debris removal process to ensure no artifacts were disturbed during the debris removal process. The tribes will complete their own final report for the Camp Fire Project, to be submitted independently.

Tetra Tech provided Task Force Leaders at each disposal and recycling facility scheduled for usage each day. These staff members verified the final disposal of debris collected at each property. Responsibilities included the following:

- Identifying trucks coming from debris operations in question by vehicle license plate and truck certification
- Verifying type of materials transported by each truck
- Verifying the tonnage transported by each truck and associated the respective scale ticket received from the landfill for each load

If rescrapes were required, Tetra Tech mobilized back to the property with the debris removal contractor to monitor and document the completion of the property rescrape. Soil generated from the rescrape was tracked separately using the RecoveryTrac ADMS ticketing system. A total of 4,295 properties were rescraped during the Camp Fire Incident project.

Upon approval of confirmation sampling by the State IMT, erosion control was performed, unless specifically waived by the homeowner. Erosion control measures are presented in Section 3.5. Erosion control was the final step in the debris removal process. Task Force Leaders issued tickets for each erosion control property which included associated photographs evidencing the post-debris removal status of the property.

3.2 COST TRACKING

This section provides cost tracking mechanisms and protocols for contractor cost tracking and Tetra Tech and subcontractor cost tracking.

3.2.1 Contractor Cost Tracking

Prior to the start of debris removal operations, Tetra Tech received and reviewed contracts for the three debris contractors and landfill rate specification sheets. After reviewing the contracts, Tetra Tech established the RecoveryTrac database to generate transactions for tickets issued to each debris removal contractor. Tetra Tech met with each primary debris removal contractor and reviewed the proprietary data and reconciliation reports generated automatically through RecoveryTrac. The debris removal contractor reports provided each contractor with sufficient data to reconcile with its subcontractors quickly, as well as generate invoices for payment.

The multifaceted RecoveryTrac Automated Debris Management System (ADMS) mobile device software suite allowed for real-time data collection and analysis, providing visibility and transparency of Camp Fire Incident debris removal operations. RecoveryTrac ADMS was deployed via mobile devices to Tetra Tech field personnel monitoring all facets of the debris removal effort including truck certification, per lot-based debris removal services, and community-based debris removal services. The data inputted by Tetra Tech field personnel were uploaded in real time to the RecoveryTrac database, where data management personnel executed multilayer quality assurance and quality control checks for contract and FEMA compliance.

To maximize FEMA reimbursement and increase project efficiency, Tetra Tech implemented an independent data set for tracking debris by use of FEMA-compliant load tickets to track debris removal from affected properties. The collection portion of each load ticket was completed on site by Tetra Tech staff who documented truck information, debris class, property of origin, time of collection, and location information. Each load ticket also had a unique barcode which followed the load to disposal. This process was supplemented with the physical documentation protocol that included logs for each property which documented contractor labor staff and hours, equipment used, trucks that hauled materials from the property, disposal or recycling sites where materials were transported, and other activities.

The load tickets were then completed at the materials receiving site by Tetra Tech task force leaders. Tetra Tech's ADMS system provided the ability to associate scale tickets and weights determined at a material receiving site with the Tetra Tech load ticket. As a result, load tickets allowed Tetra Tech to document total tonnage of materials removed from each property and totals of materials accepted at the receiving site. Over 300,000 load tickets were issued during the project.

In addition to the data quality control metrics used during the course of day-to-day field operations, Tetra Tech also staffed a robust data management team to perform several quality assurance checks in real time and at each close of business day to ensure FEMA and contract compliance. Multiple RecoveryTrac automated fraud and data monitoring reports were used on the project to detect data anomalies such as correct property assignment using geospatial and APN/address calculations, scale ticket and tonnage congruence, debris class congruence, and truck and debris contractor matches were used for quality checks. Finally, a daily reconciliation was performed on the entire load ticket set to compare to the landfill-reported data. With the rigorous data and cost tracking processes and procedures in place, Tetra Tech was able to respond efficiently to any requests for information relayed by CalRecycle.

During the final step of the cost tracking process, debris contractors submitted invoice data sets for final reconciliation and submission for payment. Tetra Tech staffed several invoice reconcilers devoted to a specific debris removal contractor to expedite the turnaround on invoice production. The application of RecoveryTrac significantly reduced the amount of time needed for a contractor to generate an invoice and for the subsequent invoice reconciliation with Tetra Tech, as contractors were able to access the project data in real time. Tetra Tech reconciled over $950,000,000 of debris removal contractor invoices on the Camp Fire Incident project.

3.2.2 Tetra Tech Cost Tracking

Pursuant to CalRecycle project requirements, ICS 214 Activity Logs were completed by Tetra Tech staff that worked on the Camp Fire project. Completed ICS 214 Activity Logs underwent multiple quality assurance and quality control checks and were also entered into Tetra Tech's 214 database. Quality assurance and quality control checks were completed on billing labor position, labor hours, APN, and other fields required by CalRecycle. Tetra Tech generated labor invoices based on Tetra Tech accounting periods and compared the invoice hours against the supporting ICS 214 Activity Logs. Discrepancies between the supporting backup and the invoice were completed prior to submission to CalRecycle.

For Tetra Tech non-labor invoices, the supporting backup consisted of pass-through vendor invoices, unit rate tickets, and other required supporting backup for non-labor unit based costs. Tetra Tech reviewed the non-labor costs against supporting backup documentation and change orders issued by CalRecycle, where applicable. Discrepancies between the supporting backup and the invoice were completed prior to submission to CalRecycle.

At the request of CalRecycle, the Mechoopda Indian Tribe and Enterprise Rancheria were subcontracted by Tetra Tech to provide tribal monitoring services for the Camp Fire Project. Staff from each Tribe completed ICS 214 Daily Activity Logs to document work activities and record hours worked. CalRecycle has instructed Tetra Tech to only validate time invoiced by the Tribes by comparing the hours invoiced versus the hours reported on the ICS 214 forms.

During the course of the project, CalRecycle issued finance related inquiries and invoice disputes to Tetra Tech. Tetra Tech responded to inquiries and to disputes as required. Where applicable, Tetra Tech developed process improvement procedures to address finance related issues or invoice disputes.

3.3 DISPOSAL

The following exhibit provides the tons of debris received by each landfill or recycling facility and the number of loads to each.

Landfill	Tons	Loads
Crown Metals Recycling Facility	22.38	11
Franklin Neal Road Recycling Facility	256,007.49	20,957
Granite Pacific Heights Recycling Facility	451,096.87	39,133
Butte County Neal Road Landfill	629,829.95	46,817
Odin Metal Processing Facility	51,915.32	32,695
Recology Ostrom Road Landfill	1,552,521.54	113,107
Waste Management Anderson Landfill	718,522.88	56,519

3.4 TRAFFIC MANAGEMENT AND CONTROLS

The California Governor's Office of Emergency Services mission-tasked the California Department of Transportation (Caltrans) with identifying truck haul routes and location-specific improvements that may be required to support the State-operated commercial trucking activity associated with the Camp Fire Incident debris removal operations. Three disposal sites were initially identified to accept fire-related debris, including Anderson Landfill (in Anderson), Recology Ostrom Road Landfill (in Wheatland) and Neal Road Landfill (in Paradise). Two concrete recycling facilities were also selected by Cal OES, one next to the Neal Road Landfill (Franklin Construction Company) in Paradise, and Granite Construction Company in Oroville. Additionally, the Odin Metal Recycling facility in Oroville was constructed at the direction of Cal OES.

Haul route improvements identified by Caltrans included intersection traffic signal timing adjustments, turn bay extensions, implementation of alternative intersection traffic control (such as traffic signal controls and roundabouts) and other temporary and permanent traffic control measures. Caltrans' initial assessment was documented in a brief report titled Camp Fire Debris Removal Operation – Road Access Analyses (CalTrans 2019). To assist Caltrans in this effort, Cal OES mission-tasked CalRecycle and the California Highway Patrol (CHP) to develop a traffic management plan for the State-operated Camp Fire debris removal operations. Tetra Tech was tasked with this mission on February 1, 2019 with the following goals:

1. Limit the traffic impacts of State-operated commercial trucking in neighboring communities
2. Identify capacity and safety constraints along selected routes
3. Monitor and mitigate traffic impacts

The potential trucking impacts associated with the state-operated debris removal effort extended over a vast study area (measuring roughly 110 miles by 50 miles wide) encompassing five counties, between project sites in Butte County and the six remote disposal sites. To develop these goals, area traffic conditions and truck traffic activity associated with the debris removal effort were continually monitored and evaluated from initial operations in February 2019 through the beginning of the final operations phase in August 2019 using a variety of traffic monitoring techniques. Existing traffic congestion data was collected from a variety of sources and included traffic volumes (turning movement count data, automatic traffic recorder data, etc.), peak period traffic congestion monitoring using Google Maps and drone observations, inventory of existing roadway conditions and traffic signage using Google Street View and vehicle dashboard camera observations, and monitoring of debris removal trucks using a global positioning system (GPS) tracking system.

Preliminary truck travel routes were identified for State-operated debris removal trucks traveling between debris removal sites and the disposal facilities aimed at minimizing traffic-related impacts to neighboring communities. These truck travel routes were based on preliminary truck traffic volume projections for peak crew levels based on initial assumptions of anticipated peak operations and truck ticket data for the first few weeks of debris removal operations. As part of this preliminary assessment, CalRecycle's traffic team reviewed real-time impacts at key locations along the truck travel routes to identify mitigation measures. Roadway and traffic control improvements were identified within the following communities:

- Shasta County (Cottonwood)
- Tehama County (Red Bluff)
- Butte County (Chico, Durham, Gridley, Oroville, and Paradise)
- Sutter County (Live Oak and Yuba City)
- Yuba County (Marysville, Olivehurst, and Wheatland)

The preliminary truck travel routes and traffic mitigation measures were documented in several documents throughout the project, including:

- Draft Preliminary Traffic Assessment Memorandum dated February 4, 2019 and updated on February 12, 2019,
- Camp Fire Debris Removal Road Access Analysis dated February 19, 2019,
- Truck Trip Generation and Temporal Distribution Memorandum dated February 21, 2019,
- Camp Fire Debris Removal Road Access Analysis Interim Report Version 1.0 dated February 26, 2019
- Interim Camp Fire Debris Removal Operation Road Access Analyses, Version 2.0 dated April 4, 2019.
- Final Traffic Management Plan Report dated August 27, 2019

Truck travel routes and traffic mitigation measures were refined as traffic monitoring continued through peak operations. To further reduce traffic-related impacts, transportation demand management measures were identified, including:

- Maximize the use of local material disposal sites (Neal Road Landfill) to minimize impacts to the regional highway system
- Develop appropriate local staging areas for coordinating debris removal efforts and storing of equipment to minimize trips to/from Paradise
- Stagger crew work schedules
- Development of long and short haul routes to minimize impacts to any one community
- Install changeable message signs to provide real-time notifications to debris removal truck drivers at key locations along the truck travel routes
- Limit truck exclusions to reduce the impacts to any one roadway or intersection
- Develop asymmetrical traffic loading, when practical

As the debris removal operations progressed toward peak operations, existing traffic conditions and truck activity were monitored to identify additional mitigation or modifications to truck travel routes, when warranted, including "quick response" actions to address unanticipated events. Such events included temporary shutdowns of one or more disposal sites, roadway construction activity, vehicular crashes, and weather-related incidents. Traffic-related impacts caused by activity other than State-operated debris removal operations (such as private-contractor debris removal, utility restoration, roadway repair, etc.) were not accounted for in the traffic evaluation.

Finally, truck traffic volume projections were developed as the crew levels decreased and the project neared completion. The *Final Camp Fire Debris Removal Operation Traffic Management Plan* (dated August 27, 2019) is provided in Attachment 1.

3.5 EROSION CONTROL AND FINAL EROSION CONTROL INSPECTIONS

Erosion control measures as outlined in the DROP (CalRecycle 2019) were implemented at 8,658 properties to stabilize disturbed soil and reduce sediment transport after debris removal activities were completed. Erosion control measures were installed after each property was approved by the State IMT met the site-specific cleanup goals, unless the owner requested not to have erosion control measures installed. In these cases, the owner signed an erosion control waiver form and the site was considered complete.

Standard best management practices (BMP) implemented included the following:

- Level 1: Application of hydraulic virgin wood fiber mulch and tackifier. Hydraulic mulch applied at 2,000 pounds/acre and organic tackifier at 150 pounds/acre.
- Level 2: Application of hydraulic virgin wood fiber mulch and fiber log or compost filter sock. Fiber logs were a minimum of 6- to 8-inches in diameter and were staked and keyed in. Hydraulic mulch was applied at 2,000 pounds/acre.
- Level 3: Application of hydraulic virgin wood fiber mulch, fiber log or silt fence and erosion control blankets or bonded fiber matrix. When bonded fiber matrix was selected, the application rate was 4,000 pounds/acre.

Additional erosion control and mitigation measures were implemented in environmentally sensitive areas and habitat as outlined in the Environmental Protection Plan (Exhibit G of the DROP).

Individual erosion control plans were developed by the State IMT, with input from Tetra Tech's subconsultant (Agnew Environmental Consulting [AEC]), for those sites requiring Level 3 erosion control or those sites that were deemed environmentally sensitive.

AEC's primary role on the Camp Fire Incident was to assist the State IMT, prime contractors, and erosion control contractors on erosion control material product selection, application, and quality control following debris removal. Further, AEC developed a broader list of materials and BMPs for potential use on the project. The function of all erosion control materials was temporary and implemented to stabilize disturbed soils and reduce sediment transport caused by erosion from entering a storm drain system or receiving water body during debris removal. Residential and commercial parcels were evaluated, and a single erosion control strategy selected from the three methods listed above. Level 2 measures were used on 99 percent of the parcels treated. No native seed was used on any of the treated parcels.

AEC worked with erosion control manufacturers and erosion materials applicators to select and use the most appropriate materials for the project, provided erosion control contractor training, and assisted contractors in the field to ensure parcels were addressed according to DROP specifications (CalRecycle 2019). AEC responded to contractors when questions arose from individual parcel applications. In addition to parcel design, installation, and quality control, AEC was responsible for erosion control design, implementation, and inspection of the 31 mobile home parks that were destroyed during the Camp Fire.

Once erosion/sediment control materials were properly installed on individual residential and commercial parcels, AEC inspected and approved individual properties to ensure each was completed in accordance with the specifications. Over a 6-month period (May to October 2019), AEC inspected nearly 4,500 individual parcels to ensure compliance with the specifications. When parcels failed inspection, the erosion control contractor was notified and required to make appropriate repairs. Many sites failed upon first inspection and required additional measures before passing.

Typical causes of initial inspection failures included:

- Missing areas of hydro-mulch
- Light application or improper mixture of hydro-mulch
- Vehicle damage to erosion control measures
- Movement of compost socks or fiber rolls from installation location
- Need for additional compost socks or fiber rolls
- Observed erosion damage
- Logging impacts

Failed parcels were re-inspected and, once passed, the erosion control contractor could receive payment for services completed. Of the final inspections, 27 sites did not pass. Most of these sites had completed erosion control measures that were significantly impacted by logging operations. The following table provides the summary of installations and inspections by debris contractor.

Erosion Control Installations and Inspections by Contractor	
Ceres	
Installed	1,784
Percent Inspected	60%
Fail	6
ECC	
Installed	3,832
Percent Inspected	52%
Fail	7
SPSG	
Installed	3,042
Percent Inspected	46%
Fail	14
Totals	
Installed	8,658
Inspected	4,462
Percent Inspected	52%

3.6 SUMMARY

The following tables summarize the total tonnage of debris removed by type and debris by disposal and recycling receiving facilities.

Debris Type	Tons	Loads
Metals	51,998.81	32,732
Debris/Ash	2,233,944.70	164,022
Soil/Ash	630,063.12	45,459
Soil-Rescrape	36,816.55	6,896
Concrete	707,093.24	60,130
Asbestos (CY)	24,987.00	6,062
Totals	**3,684,903.42**	**315,301.00**

Notes: * Asbestos data not included in total.
N/A – not applicable

Receiving Facility	Tons
Crown Metals Recycling Facility	22.38
Franklin Neal Road Recycling Facility	256,007.49
Granite Pacific Heights Recycling Facility	451,096.87
Butte County Neal Road Landfill	629,829.95
Odin Metal Processing Facility	51,915.32
Recology Ostrom Road Landfill	1,552,521.54
Waste Management Anderson Landfill	718,522.88
Totals	3,659,916.42

4.0 DATA MANAGEMENT

Structured and well-defined data practices provided an important foundation for decision making in the field and maintaining data integrity during all element of reporting. Implementing these data practices ensured that collection and generation of data throughout the project was managed and maintained consistently. With general, consistent, and structured data practices, errors that may have been introduced during field collection and processing of data were minimized.

The major elements of the project data lifecycle implemented during the debris removal process are presented below.

1. **Collection.** Collecting accurate initial relevant data in a manner that minimized opportunities for human/user error and avoided the need for transcription or labor-intensive data handling.
2. **Transmission and Storage.** Passing data from its point of origin during the collection phase to an established data repository. A variety of methods and technologies were used for data transmission, each determined by the type of data being transmitted. The use of secure repositories was critical to ensure data integrity. Data repositories were also selected for their ability to support advanced data analysis and visualization.
3. **Verification.** Multiple QA/QC procedures and steps to ensure data completeness and accuracy.
4. **Analysis, Reporting, and Visualization.** Interpreting data to aid in drawing meaningful conclusions that supported decision-making.
5. **Personal Identifiable Information (PII) Management.** Establishing internal protocols for protecting PII.

Maintaining data integrity and accuracy was a primary driver for all data management efforts. Additional information pertaining to the four major phases of the project data lifecycle are presented below.

4.1 DATA COLLECTION

Data was primarily collected through customized software applications used in the field to capture data and photographs on hand-held devices. Data included assessment field notes, monitoring information, and sampling information. Custom electronic data forms were developed to capture project-specific information. Different functional elements of the forms included the ability to create lists, annotate photos, record GPS, add JavaScript-enabled formulas, and built-in logic to auto-populate certain fields to reduce human error. Analytical data was generated by laboratories and provided to Tetra Tech in the form of electronic data deliverables (EDD) and data packages. Analytical data provided by the laboratories was coupled with sampling data collected by field personnel on the electronic forms. The custom data collection forms created throughout the duration of the project included:

- Structure log
- Asbestos assessment
- Asbestos abatement
- Chimney tip inspection
- Habitat & Water feature observation
- Wildlife & Nesting bird observation
- Soil sampling
- Commercial sampling
- X-ray Fluorescence (XRF) screening
- Air sampling

- Air station check
- Personal Air Sampling
- Pump calibration
- Instrument deployment log
- Dust observation
- Private property debris removal compliance checklist
- Erosion control inspection
- Health & Safety log
- Incident log
- Trailer inspection

4.2 DATA TRANSMISSION AND STORAGE

Data captured in electronic forms was directly uploaded to web servers via a WiFi or cellular data connection. Records submitted to the server would also get delivered to an additional application that produced deliverable Word, PDF, and Excel documents based on a customized template. These automated reports were procedurally uploaded into predetermined server folder locations. The documents were emailed to the necessary parties when applicable. Data stored within the web server was pushed to a Tetra Tech structured query language (SQL) server. A Representational State Transfer Endpoint was set up to make data available from Tetra Tech's SQL server database (data initially captured with the electronic forms) for data visualization. When a new data point or a change to an existing dataset was made within the electronic forms and submitted, the feature class that was created or altered was automatically updated on Tetra Tech's SQL server and web mapping platform.

4.3 DATA VERIFICATION

Field assessment, monitoring, and sampling information was submitted to the database throughout the day, producing a record on a web server as well as an automated report that was uploaded to a predetermined server folder location. Data management personnel performed a multipart QA/QC procedure to assess data completeness and accuracy. Any necessary edits were completed which triggered automated revised report generation.

Tracking sample shipment was implemented in order to keep daily operations moving forward. Receiving timely sampling results allowed prompt evaluation of worker and community safety. Samples collected were compared to the automatically generated chains of custody by on-site personnel prior to samples being shipped to respective laboratories. An off-site team received the laboratory EDDs and data packages, assessed whether turn-around times were met, processed invoices, and requested revisions to data packages when needed. Daily queries provided teams with a detailed list of samples sent to the laboratories, samples with pending results, and samples with results received and in review. Automatically generated audit reports were produced and utilized to assess data completeness and accuracy.

4.4 DATA ANALYSIS, REPORTING, AND VISUALIZATION

Custom data views were developed within SQL server to produce reports that assisted with decision making in the field and the office. A customized mapping application was developed to provide a common operational dashboard for environmental assessment teams to view metrics related to program progress. Planning and operational teams were provided access to the most current metrics concerning environmental assessments, sampling data, biological monitoring, weather forecasts, and debris removal operations. Metrics could be searched, filtered, and sorted, to provide custom reports based on required tasks. Tetra Tech's mapping application also complemented the State dashboard by providing a source for analytical

results. In addition, analytical and monitoring data were presented in data summary tables produced with SQL Server Reporting Services (SSRS) and were frequently used to provide status updates. SSRS was also utilized for audit reporting utilized for QA/QC procedures discussed in Section 4.3.

4.5 PERSONAL IDENTIFIABLE INFORMATION

Tetra Tech implements and uses administrative and technical safeguards that reasonably and appropriately protect the confidentiality, integrity, and availability of PII that it creates, receives, maintains, or transmits. These safeguards include the following:

- Encryption of PII that Tetra Tech stores and transmits
- Implementation of strong access controls, including firewalls, and strong passwords
- Use of updated antivirus software
- Adoption of contingency planning policies and procedures, including data backup and disaster recovery plans
- Conduct of periodic security training

Documentation required and submitted by property owners under the debris removal response program inherently includes PII such as name, address, and phone number information. This information is currently included within Appendix P, Individual Property Reports of this report. Any public requests for information within Appendix P must be redacted to remove PII.

5.0 ENVIRONMENTAL SITE ACTIVITIES

This section provides a summary of environmental activities conducted during the Camp Fire Incident response, including site assessment surveys, biological monitoring, asbestos assessment and sampling, air monitoring and sampling, background soil evaluation, soil cleanup goals, and confirmation sampling.

5.1 SITE ASSESSMENTS

Site assessments (SA) were the initial step in Debris Removal and Property Cleanup, following HHW Removal at properties impacted by the Camp Fire Incident. From January 2019 through March 2020, a total of 12,518 SAs were completed. SAs were not conducted at 114 properties which had empty lots or unburned structures. SAs were completed by environmental unit leaders and managed and reviewed by environmental unit supervisors and an environmental branch director. SAs were used as the baseline for all debris removal and environmental activities.

The purpose of the SA is to identify site hazards and to screen properties for mercury vapors, radiation, and volatile organic compounds (VOC). Additionally, utilities were flagged, and debris documented within the property boundary through a site sketch and photographic documentation. SAs were conducted to provide detailed site information for safe removal and handling of burn debris.

The ROE for each property was provided to assessment teams, granting access, and referenced for site-specific information, including the APN, potential hazards that may be encountered (septic systems, water wells, etc.) and other instructions relevant to debris removal. SA teams donned Level C PPE prior to entering each property. The APN boundary was crosschecked against the ROE; each team confirming it was assessing the correct property. Immediate hazards such as overhead hazards, hazard trees, and holes were identified during the initial walk through. Sites that had structures less than 120 square feet or total debris less than 10 cubic yards were not eligible for the program. Structures that are less than 50 percent destroyed were not considered eligible for the program. If the property was suspected to be ineligible, the information was provided to the State IMT for further evaluation and eligibility determination.

Each parcel was screened for radioactive anomalies and the presence of mercury vapors and various gases. Radiation detection was accomplished with a Ludlum 2241-2, 2241, model 3, or 2221 equipped with either 44-10 or 44-2 probes. Parcels were screened for mercury vapors using a Jerome model 431-X or J405, or Lumex 915 meter. A multi-gas meter was used to detect the presence of explosive gases, carbon monoxide, hydrogen sulfide, and VOCs. If a threshold exceedance was found by the SA team, the team notified supervisors who initiated a more intensive assessment, conducted by an environmental branch director or environmental supervisor.

Radiological readings were recorded at each property during the triage assessment discussed in Section 2. Radiological readings above screening levels during the triage assessment could not be reproduced during SA surveys with the exception of two properties: 054-050-087 and 054-171-131. Elevated radiation was also detected at 054-171-087. Incident reports were provided to the State IMT for each property. A summary of the properties is described below.

> During the SA at 054-050-087 conducted on March 28, 2019, elevated radiation was detected adjacent to the primary structure. Similar levels of radiation were detected during an additional radiological survey on May 31, 2019. A small trench in the affected area was excavated and elevated radiation was detected in the excavated soil and the trench. The trench and excavated soil were left to acclimate to ambient temperatures and resurveyed three times between May 31, 2019 and June 1, 2019, with observed levels of radiation declining during each additional survey. During

the final radiological survey on June 1, 2019, elevated levels of radiation were not detected. Tetra Tech and State IMT deemed the site safe to continue with debris removal operations.

During the SA at 054-171-131 conducted on April 5, 2019, elevated radiation was detected near a burned computer case. Similar levels of radiation were detected during an additional radiological survey on April 8, 2019; however, a specific source could not be identified. During the final survey on April 9, 2019, a rock previously collected and stored in the home by the homeowner was identified as the source of radiation. The rock was containerized and removed from the site by DTSC.

During the SA at 054-171-087 conducted on April 4, 2019, elevated radiation was detected near a burned shed in the southwest corner of the property. The property was resurveyed on April 6, 2019 and elevated levels of radiation were not detected. Tetra Tech and State IMT deemed the site safe to continue with debris removal operations.

Field personnel assessed and documented the pre-debris removal status of individual properties by creating a site sketch of debris footprints and collecting photographic documentation. Property data were captured electronically on tablets through a SA-specific form and Collector mobile applications. Foundation footprints, debris footprints, site hazards (i.e., propane tanks, chimneys, HHW, ordnance, automobiles, recreational vehicles, metal debris, utilities, pools, septic systems, and solar panels) were documented on the site sketch and in the form. Unburned items were not documented in the form but were included in the site sketch as reference points to aid soil sampling teams in finding ash footprint locations. Potentially hazardous conditions (unstable walls, exposed electrical lines, wells, cisterns, burned trees, etc.) were recorded in both the site sketch and the form. Access issues such as creek crossings, culverts, steep grades, 4-wheel drive access, and gate codes were noted on the sketch to assist future debris removal and sampling teams.

Accuracy of the site sketches was critical to the overall success of the project as the site sketches were referenced by asbestos assessors, debris removal crews, soil samplers, and erosion control operations. Asbestos assessors compared their sketches to SA sketches to ensure that both assessments were complete, at the correct property, and that all debris footprints were accounted for. Soil samplers used the sketches to locate former debris and structure footprints and to calculate square footages to establish the number of soil samples to be collected. Debris removal and erosion control teams used the site sketches to ensure that no debris was overlooked.

During the SA, team members used a measuring wheel to accurately document ash footprints and dimensions of structures. The total square footage was calculated and included in the form. Square footages were referenced during debris removal to track ash and debris tonnage that was removed from each property. Accurate classification, dimensions, and photographic documentation of foundations were an essential part of the SAs. Documentation of foundation dimensions helped debris crews avoid potential over-excavation, damage claims, and ultimately maintained program eligibility. Documented structure foundations supported whether a site had been properly excavated, as foundation types influence the amount of soil and debris removed. Structural foundations were separated into three categories: on block/slab, modular, or no foundation.

Utilities were located and flagged with blue tape by the SA team to prevent disruption by removal crews during property cleanup. Hazards such as holes, rebar, wire, etc. were also flagged with orange tape or spray paint to warn future debris removal crews.

After each assessment was completed, the field team reviewed and compared the site sketch and form to ensure all data were accurately captured and documented. The form was then uploaded to a central database where a document deliverable was generated. The document was stored on Box, an online server for secure file sharing, storage and collaboration. Submitted forms were reviewed by an on-site QA/QC team to ensure assessment accuracy. QA/QC items consisted of crosschecking the APN and address with the ROE, CalOES dashboard, and the site sketch. QA/QC teams cross-referred property boundaries and ash footprints from aerial map imagery, ensured hazards found on site were depicted in photos and on the site sketch, and confirmed foundation types were accurately identified and square footages were calculated correctly.

After the completion of the SA, the field team removed their PPE and disposed of it in a plastic bag. Bagged PPE was secured on-site to be retrieved and disposed of during debris removal.

At the conclusion of each field day, the SA teams delivered hard copy site sketches to SA supervisors, checked in SA screening equipment, and disclosed any issues encountered. The site sketches were reviewed by SA supervisors and corrections were made, if necessary, to both site sketches and forms. Completed properties were logged into the SA tracker and crosschecked against the CalOES dashboard to ensure data accuracy. A report of completed SAs and property issues was sent to the State IMT at the conclusion of daily operations.

5.2 BIOLOGICAL MONITORING

Environmentally sensitive areas were identified within the Camp Fire Incident burn area based on the actual or potential presence of endangered, threatened, or special status species and nesting birds. To ensure special status species and habitats were protected throughout the Camp Fire Incident recovery, the State Environmental Unit developed BMPs for debris removal in environmentally sensitive areas, including the use of biological monitors at debris removal sites.

Properties requiring biological assessments for clearance prior to debris removal were identified by State Planning and the State Environmental Unit. In coordination with State Planning and the State Environmental Unit, Tetra Tech performed biological assessments and reassessments, managed data from assessments, facilitated the status assignment process for assessed properties, and provided biological monitoring when requested.

Water features, water crossings, nesting birds, and wildlife were observed and documented during biological assessments. Debris removal at documented environmentally sensitive areas proceeded with the consultation of the State Environmental Unit. Appropriate BMPs were implemented to protect the special status species and their habitats while expediting the debris removal process.

5.2.1 Methodology

To address the environmentally sensitive work within the Camp Fire Debris Removal Operation, the State IMT requested the State Environmental Unit to develop BMPs for animal species, habitat, and watercourses where ash and debris may pose a threat. These BMPs were then submitted in an Environmental Protection Plan (EPP) to the Department of Fish and Wildlife, State Water Resources Control Board, and Central Valley Regional Water Quality Control Board (Water Board) for review and concurrence. The EPP is an attachment to the DROP (CalRecycle 2019). Per the mitigation strategies that included BMPs and other activities in the EPP, the State Environmental Unit reviewed and selected strategies and tactics to remove ash and debris from environmentally sensitive areas, including biologically sensitive areas with special status species and nesting birds.

The EPP was submitted to the California Natural Resources Agency for approval, and received an Emergency Waiver on May 24, 2019, provided in Attachment 1. The Emergency Waiver allowed debris removal operations to proceed without delay on properties potentially under jurisdiction of the Department of Fish and Wildlife, while preserving the intent of the waived laws and protecting the environment.

As described in the DROP (CalRecycle 2019), the State IMT consulted multiple assessments, databases, and maps to evaluate the Biological Assessment Area and produced a scoping list of 15 special status species that are listed in California or federally as threatened, endangered, species of special concern, or candidates for listing. These species were included if they occurred downstream of the project, were located within the Biological Assessment Area, or had the potential to travel into the project boundary.

For the Camp Fire Incident, when the ash and debris field was more than 50 feet from environmentally sensitive areas, the removal process proceeded per the DROP (CalRecycle 2019). When the ash and debris field was less than 50 feet from environmentally sensitive areas, then the debris removal contractor incorporated the BMPs listed in the EPP as it conducted debris removal under the Emergency Waiver.

The State Environmental Unit and Tetra Tech biologists were tasked to perform biological assessments, including nesting bird surveys and visual encounter surveys on properties within 100 feet of a water feature, perform biological reassessments to determine movement of water and protected species as the season changed, recommend BMPs for each property biologically assessed, and perform biological monitoring for properties when necessary.

The State Environmental Unit used ArcGIS to identify properties with water features within 100 feet of the property boundary that were listed for upcoming debris removal. The State IMT identified priority properties for biological assessments and scheduling.

Based on requirements provided by the State Environmental Unit, Tetra Tech developed a biological assessment form. Tetra Tech biologists assessed and documented observations for each individual property into iForms via a tablet. All data collected with iForms are included in Appendix B. The tasks completed for biological assessments included the following.

Located water features within 100 feet of the ash footprint and documented additional water feature details including:

- Number of water features
- Type of water features
- Distance to water features
- Wet or dry
- Locations
- Photographs
- Notes

Completed visual encounter surveys near the water feature to find special status species and documented additional wildlife details including:

- Number of species of wildlife
- Species found
- Locations
- Photographs
- Notes

Completed nesting bird surveys over the whole property to find nesting bird and special status species, flagging nested trees with red and black striped flagging, and documented additional nesting bird details including:

- Number of nesting birds
- Species found
- Nesting stage
- Locations
- Photographs
- Notes

Located damaged water crossings as requested by the State Environmental Unit for debris removal access and documented additional water crossing details including:

- Number of water crossings
- Type of water crossings
- Locations
- Photographs
- Notes

Located suitable habitat. Suitable habitat was optional on the SA form; the water feature was evaluated as a suitable habitat and additional information in this category was supplemental. The details included:

- Land or water
- Species suitable for the habitat
- Locations
- Photographs
- Notes

Biological assessments were completed by Tetra Tech Subject Matter Experts and the State Environmental Unit. The data were managed and reviewed by the State Environmental Unit, Tetra Tech biologist Environmental Unit Supervisors, and an Environmental Branch Director. Upon completion, the field form underwent QA/QC checks for accuracy and completeness. Following approval of QA/QC checks, the biological assessments were submitted to the State Environmental Unit for evaluation and status assignment under the EPP.

Based on the field observations documented in the form, the State Environmental Unit assigned a status to each property that was biologically assessed. The status was based on the level of threat to special status species and appropriate level of BMP under the EPP. The BMP Level 2 status was removed as an option for properties shortly after the BMP list was made due to redundancy with the BMP Level 3 status. No properties were given this status. A complete list of property statuses and definitions is provided below.

Property Status	Definition	Scheduling Requirements
Clear	Cleared for debris removal	Can be scheduled for debris removal, no biological monitoring or environmental crew required
BMP Level 1	Required a wattle or other erosion/sediment control	Follow Level 1 BMPs; environmental crew required for debris removal.
BMP Level 2	Required a biological monitor (Removed from status list because it was redundant to BMP Level 3)	Follow Level 2 BMPs; biological monitor required for debris removal and environmental crew required for debris removal

Property Status	Definition	Scheduling Requirements
BMP Level 3	Required a wattle or other erosion/sediment control plus a biological monitor	Follow Level 3 BMPs; biological monitor required for debris removal and environmental crew required for debris removal
Short Term R/S	Required a seasonal hold for a nesting bird or special status species	Feature needs to be reassessed for seasonal change; not eligible for scheduling
ELZ	Required a designated hand removal crew within 50 feet of a water feature	Follow ELZs; clearance sweep by biological monitor and environmental crew required for debris removal
TBD or No Status	Required a status to be assigned	Status must be assigned prior to debris removal

Notes:
BMP - Best Management Practice
R/S - Restricted/Seasonal
ELZ - Equipment Limitation Zone
TBD - To Be Determined

Upon receiving a property status, the biological assessment forms were then reviewed and approved by the Environmental Unit Supervisors and an Environmental Branch Director.

Data collected in the project form database were linked to the Camp Fire Biology Tracking Geographic Information System (GIS) Map, which was merged into the Camp Fire Dashboard. The Camp Fire Biology Tracking GIS Map team mapped and coordinated each biologically assessed property, the property status, any targeted features that were identified, and targeted feature buffer zones.

Targeted feature buffer zones were identified in compliance with the EPP. The Biology Buffer Key (Table 5-1) includes the targeted nesting birds, special status species, water features, and their corresponding buffers. All properties located within a buffer zone were evaluated for consideration under the EPP and Emergency Waiver as the associated significant feature was considered on a case-by-case basis by the State Environmental Unit.

The State Environmental Unit identified properties for biological reassessment to check on significant features that changed seasonally. Properties requiring reassessment were assigned Tetra Tech biologists and the State Environmental Unit who completed additional field observations of significant features identified during the initial assessment. Reassessments included updating additional assessments of one or more specific features identified in the original assessment. Reassessments required additional assessment of only the specific features originally identified during a biological assessment, not the whole property. Some properties required multiple reassessments prior to receiving a new status and scheduling for debris removal. Not all properties requiring reassessments were assigned a short-term Restricted/Seasonal (R/S), status. Reassessments were completed on some properties after debris removal was complete.

Based on the property status assigned by the State Environmental Unit, biologically assessed properties were scheduled for debris removal. All properties biologically assessed and cleared proceeded per the DROP (CalRecycle 2019). Any properties assigned a BMP Status 1, BMP Status 3, or Equipment Limitation Zone (ELZ) qualified as environmentally sensitive areas covered under the EPP and Emergency Waiver, requiring an environmental debris crew. Some ELZ properties and BMP Status 3 properties also required biological monitoring. Biological monitoring was required within 25 feet of a water feature and as otherwise determined by the State Environmental Unit.

Biological monitoring was completed immediately prior to and during debris removal by the State Environmental Unit or Tetra Tech Biologists. The biological monitoring activities required for each property were selected on a case-by-case basis by the State Environmental Unit. Activities included clearance sweeps and debris removal monitoring.

A clearance sweep was conducted to evaluate the area for special status species with a visual encounter survey to assess whether any were present prior to initiating debris removal. If no special status species were observed during the clearance sweep, the debris removal crew could move forward without a biological monitor if the State Environmental Unit determined that the clearance sweep was satisfactory.

Debris removal monitoring included the following:

1. Monitoring debris removal near a bird nest. Permission to hold debris removal was possible if the nest showed major disturbance.
2. Monitoring water features for special status species presence. If special status species were present, debris removal stopped if species moved into the work area or were in a dangerous situation.
3. Visually monitoring water turbidity and embankment structure for debris removal in and near water features. Monitoring to ensure the embankment was not destroyed and the water did not have too much disturbance.

Data were collected on tablets using specific forms for biological assessment. Tetra Tech developed a biological assessment form, and coordinated the assessment observation, review, and status assignment process with the State IMT, specifically State Planning and the State Environmental Unit. Approximately 150 biological assessments were completed using hard copies, prior to the development of a biological assessment form. These assessments were redone with the developed forms to include the data in the Biology Tracking GIS Map. Forms were voided if multiple original assessment forms were made for the same property, when data were entered incorrectly, or could not be verified during the review process. Records to be voided were identified by Environmental Unit Supervisors and an Environmental Branch Director, then confirmed by the State Environmental Unit before they were voided.

5.2.2 Results

Individual biological assessments were completed from February 20 to October 22, 2019 at a total of 1,626 properties enrolled in the State debris removal program. The Daily Summary Report in Appendix A summarizes the biological assessment tasks that were completed each day. The Property Status Report in Appendix B summarizes the final status of each biologically assessed property.

Environmentally sensitive areas with significant features at properties with water features within 100 feet were identified at 946 properties (58 percent) of the 1,626 properties with biological assessment. No significant features were identified at 680 properties (42 percent) of the properties.

At the 946 properties identified as having significant features, a total of 1,576 features were identified. Water features were the most identified feature during biological assessments at 1,119 (71 percent), followed by water crossings at 362 (23 percent) of the identified significant features. Nesting birds accounted for 63 (4 percent) of the significant features and wildlife were 32 (2 percent) of the significant features identified during biological assessments.

Of the water features identified, 362 (32 percent) were intermittent drainages, 239 (21 percent) were perennial drainages, 195 (17 percent) were ephemeral drainages, 128 (11 percent) were ditches (Class IV drainage), 83 (7 percent) were other water features, 83 (7 percent) were ponds, 39 (3 percent) were swales, and 26 (2 percent) were meadows. Ephemeral drainages are streams that flow only during times of precipitation, intermittent drainages are streams that flow seasonally, and perennial drainages are streams that flow all year round. Water Class IV drainages are man-made water features used for agricultural, domestic, or hydroelectric supply. These ditches have little to no established riparian habitat (CalFire 2020).

Other water features included springs, seeps, creeks, and man-made features including residential above-ground and in-ground swimming pools, ponds, and canals. All water features and pictures can be found in Appendix B.

Types of Water Features	Amount	Percent
Ditch (Class IV Drainage)	128	11%
Ephemeral Drainage	195	17%
Intermittent Drainage	362	32%
Meadow	26	2%
Others	83	7%
Perennial Drainage	239	21%
Pond	83	7%
Swale	39	3%
Total	**1,155**	**100%**

Of the targeted special status species wildlife found, 70 percent were Foothill Yellow-legged Frogs (*Rana boylii*), 22 percent were Western Pond Turtles (*Actinemys marmorata*), 5 percent were non-targeted species, and 3 percent were Chinook Salmon - Central Valley Spring-Run Esu (*Oncorhynchus tshawytscha*). The following exhibit provides the targeted special status species of wildlife found. The State Environmental Unit captured multiple Foothill Yellow-legged Frogs to identify them and included photo documentation in one of the forms. In another, the State Environmental Unit mentioned attempt at capture. To capture an endangered species is deviating from the Environmental Protection Plan but is covered under the Environmental Waiver.

Species of Wildlife	Amount	Percent
Chinook Salmon - Central Valley Spring-Run Esu (*Oncorhynchus tshawytscha*)	1	3%
Foothill Yellow-legged Frog (*Rana boylii*)	26	70%
Western Pond Turtle (*Actinemys marmorata*)	8	22%
Non-targeted species	2	5%
Total	**37**	**100%**

Note: Esu - Evolutionary significant unit

Of the nesting birds observed within the Camp Fire Incident, 19 percent were Red-shouldered Hawks (*Buteo lineatus*), 16 percent were Oak Titmice (*Baeolophus inornatus*), 12 percent were Acorn Woodpeckers (*Melanerpes formicivorus*), and 7 percent were Black Phoebes (*Sayornis nigricans*).

Species of Nesting Birds	Amount	Percent
Acorn Woodpecker (*Melanerpes formicivorusI)*	7	12%
American Crow (*Corvus brachyrhynchos*)	3	5%
American Robin (*Turdus migratorius*)	3	5%
Bald Eagle (*Haliaeetus leucocephalus*)	1	2%
Black Phoebe (*Sayornis nigricans*)	4	7%
Bullock's Oriole (*Icterus bullockii*)	1	2%
House Wren (*Troglodytes aedon)*	2	3%
Hummingbird unknown species	1	2%

Species of Nesting Birds	Amount	Percent
Inactive Owl Nest	1	2%
Common Raven (*Corvus corax*)	1	2%
Oak Titmouse (*Baeolophus inornatus*)	9	16%
Osprey (*Pandion haliaetus*)	1	2%
Pine Siskin (*Spinus pinus*), California Towhee (*Melozone crissalis*), Dove, Pigeon	1	2%
Red-shouldered Hawk (*Buteo lineatus*)	11	19%
California Scrub Jay(*Aphelocoma californica*)	3	5%
Steller's Jay (*Cyanocitta stelleri*)	2	3%
Undetermined	2	3%
Undetermined Hawk	3	5%
White-breasted Nuthatch (*Sitta carolinensis*)	2	3%
Total	**58**	**100%**

Of the water crossings identified, 70 percent were culverts, 18 percent were bridges, 8 percent were low-water, 3 percent were other water crossings, and 1 percent were undetermined. The 3 percent of other water crossings included rocked fords, broken temporary bridges, and drainages across roads (erosion). Photographs of all water crossings are included in Appendix B.

Types of Water Crossings	Amount	Percent
Bridge	67	18%
Culvert	260	70%
Low-Water	29	8%
Other	10	3%
Undetermined	2	1%
Total	**368**	**100%**

A goal of the EPP, with leniencies from the Environmental Waiver, is to protect all species of nesting birds in the environmentally sensitive areas of the Camp Fire Incident. Of the documented nests, 74 percent were successful, and 19 percent were inactive/invalid documented nests. Only 7 percent (four bird nests) of documented nests failed. Inactive/invalid nests were nests that were from previous years and not occupied for the 2019 season or reports of potential nesting birds where a nest was never located for that bird. Of the four nests that failed, the first nest at APN 054-220-057, was noted to be damaged by weather and failed on June 6, 2019. The second nest at APN 053-330-020, was abandoned for no apparent cause and failed on May 30, 2019. The third nest failed at APN 066-380-025. Initially located on private property in a damaged shed, the nest's presence was threatened following a property owner's resistance to the biological assessment/reassessment process and debris removal scheduling considerations for environmentally sensitive areas. To protect the nest from destruction, it was relocated to the edge of the property by a member of the State Environmental Unit. The nest failed after being relocated, possibly caused by predation. The fourth nest failed at APN 051-083-004. On April 30, 2019, debris removal was active within 100 feet of the nest with the female adult in the nest with the fledgling. On May 28, 2019, the Red-shouldered Hawk fledgling was found dead beneath the nest with no adult birds nearby. The nest was checked two additional times to confirm there were no additional fledglings. No additional details or observations were provided in the reassessment. Because of the length of time between reassessments, the exact cause of death and contributing factors are unknown. The following exhibit provides a summary of nesting bird success.

Nesting Bird Success	Amount	Percent
Number of Successful Bird Nests	43	74%
Number of Failed Bird Nests	4	7%
Number of Inactive/Invalid Bird Nests	11	19%
Total	**58**	**100%**

5.2.3 Reassessments

Reassessments were completed at properties with significant features identified during the assessment. Reassessments were completed as directed by the State Environmental Unit to evaluate movement of water and special status species with seasonal change. The reassessment was completed on the previously identified feature only, as opposed to a reassessment of the entire property. Not all properties with significant features were reassessed. Properties with nests were reassessed frequently to assess nesting stage. Verbal reports of tadpole/special status species sightings by other members of the debris removal incident team warranted a reassessment. On May 14, 2019, the State Environmental Unit determined that all properties with water features must be reassessed at least once to evaluate whether the water feature dried out. Reassessments were occasionally repeated if water features were still wet on the first reassessment. Reassessments were usually completed prior to debris removal, but properties with water features were not put on hold for debris removal if a reassessment had not been completed. Reassessments were completed as directed by the State Environmental Unit and State Planning, regardless of debris removal status.

Of the 513 properties that were reassessed, 87 percent contained significant features. The absence of significant features observed during reassessment of 13 percent of the properties may be caused, in part, by the seasonal flow of water features and seasonal movement of wildlife.

Water features were the most reassessed features with 79 percent of properties, nesting birds were the second most revisited at 20 percent, and because wildlife comprised only 2 percent of features in the original assessments, only 1 percent of features observed during reassessments were wildlife. Water crossings were not reassessed. A total of 527 features were reassessed on 513 properties.

A total of 2,289 biological assessments were completed at 1,626 properties, including 513 properties that were reassessed, 150 properties that were assessed twice, and 50 voided forms. Forms were voided if multiple original assessment forms were made for the same property, when data were entered incorrectly, or could not be verified during the review process. Some properties had multiple parent forms made by mistake, leaving multiple forms with minor deviations from each other. Data from these forms were deemed valuable, therefore, forms were voided instead of deleted. For properties with multiple forms and the same status, the form with more information was kept and the others were voided. For properties with multiple forms with different statuses, the property that had the most recent forms were kept and all other forms were voided as instructed by the State Environmental Unit.

Of all properties biologically assessed, 1,341 (82 percent) were cleared. The other 285 properties (18 percent) were covered by BMPs. Of the properties covered by BMPs, 186 (11 percent) required erosion control and/or a biological monitor, 41 properties (3 percent) required an equipment limitation zone (ELZ), 14 properties (1 percent) required erosion control, 24 properties (1 percent) required a seasonal hold, and 20 properties (1 percent) were TBD because of access and scheduling issues related to forced abatement properties. While four nest failures were documented, 74 percent of nesting birds were successful. A summary of the final status is provided in the following exhibit.

Status	Number of Properties	Percent
Clear	1,341	82%
ELZ	41	3%
BMP Level 1	14	1%
BMP Level 3	186	11%
Short Term R/S	24	1%
No Status	0	0%
TBD	20	1%
Total	**1,626**	**100%**

Notes:
ELZ - Equipment Limitation Zone
BMP - Best Management Practice
R/S - Restricted/Seasonal
TBD - To Be Determined

There was a total of eight incidences of potentially harmed wildlife or abandoned pets that were reported to Animal Control during the Camp Fire Incident debris removal activities from April 30, 2019 to June 18, 2019. The Tetra Tech deployed biologists to the scene to evaluate the situation then contact Animal Control. The details were documented, including whether animal control responded. Most involved local wildlife hiding in chimneys that were scheduled for demolition.

5.2.4 Deviations

There were no deviations from the EPP as finalized through the Emergency Waiver.

5.3 ASBESTOS ASSESSMENTS AND SAMPLING

Asbestos site assessments were a primary step in Debris Removal and Property Cleanup, conducted concurrent or following site assessments at properties impacted by the Camp Fire Incident. The purpose of the asbestos site assessment was to identify and sample suspect ACM present in wildfire damaged or destroyed structures and other features on properties in the debris removal program. The results of the assessment provided information used for waste removal and disposal (abatement) and chimney structure evaluation and demolition prior to general debris removal. The goal of the wildfire asbestos program is to identify and remove gross ACM from the debris footprints which reduce risks from ACM to the debris removal workers; incident management personnel; nearby residents and neighbors in the community; and others handling, transporting, and disposing of the debris. The asbestos site assessment process followed the Wildfire–Damaged Structures Asbestos Site Assessment Standard Operating Procedure (SOP) "California Wildfire Asbestos Survey."

California requires certification for consultants and technicians conducting asbestos sampling or planning and overseeing asbestos removal projects of 100 square feet or more of surface area of ACM from construction in accordance with California Code of Regulations (CCR) Section 341.15 1529(q) and the California Business and Professions Code Sections 7180-7189.7. Only a Certified Asbestos Consultant (CAC) can provide asbestos consulting and sign asbestos survey reports, while both CACs and Certified Site Surveillance Technicians (CSST) may conduct surveys and collect samples. Both CACs and CSSTs must meet training and experience requirements to obtain their respective certifications.

5.3.1 Assessment Approach

For the Camp Fire Incident, asbestos assessments were conducted by a CAC or CSST staff under their direction. A CAC or CSST inspected fire-related debris at each property for the presence of suspected ACM and collected samples of suspect materials. Asbestos surveys of properties included:

- Completing a field data sheet including a property survey sketch and information regarding structures and suspected ACM identified.
- Recording the estimated quantity, location, and distribution of suspected ACM.
- Photographing all suspected ACM.
- Identifying assumed or confirmed ACM for removal by the abatement contractor.

Based on the potential hazards associated with the properties and sampling of ACM, asbestos survey field personnel donned Level C PPE while performing all asbestos assessments.

Samples of suspected ACM were collected from damaged or destroyed structures, their associated features, and debris piles within each property boundary for bulk asbestos analysis as part of the asbestos survey. Materials sampled included typical suspect asbestos-containing construction materials (stucco, roofing, vinyl floor tile and mastic, caulking, grouts and mortars, vinyl sheet flooring, vapor barrier, insulating materials, sheetrock and joint compound, plaster, cementitious panels and pipe, exterior home siding, thermal system insulation, and other building materials) and non-construction related suspect materials, such as automotive brake pads, mid-century electronics, camp stoves, salvaged materials, kilns, cementitious irrigation piping, or other stored materials.

If no suspect ACM was identified to sample or materials were confirmed not to contain ACM, the property was approved for debris removal or chimney demolition, if required. Suspect ACM on chimney exteriors was sampled; however, the interior chimney components required demolition to access the suspect materials. Therefore, chimney interior materials were visually inspected during chimney demolition, and additional abatement or sampling was conducted of suspected ACM.

More than 100,000 bulk asbestos samples were collected from December 15, 2018 to March 11, 2020. Out of the total 12,632 properties, 12,413 properties were sampled for ACM: 6,207 (50%) properties contained ACM and required asbestos abatement; 6,206 (50%) properties did not require abatement. The sampling results are summarized in Appendix C. Copies of the analytical results for the bulk asbestos samples are included in Attachment 2.

After collection, bulk samples of suspected ACM were placed into plastic bags, labeled, packaged, and shipped with a chain-of-custody form to one of eight analytical laboratories:

- EMLab (U.S. Locations)
- EMSL Analytical, Inc. (U.S. Locations)
- Eurofins CEI (Cary, NC and Folsom, CA)
- J3 Resources, Inc. (Houston, TX)
- LA Testing (Los Angeles, CA)
- Microtest Analytical (Rancho Cordova, CA)
- Patriot Environmental Lab (San Jose, CA)
- Quantem Environmental Testing (Oklahoma City, OK)

The laboratories analyzed all bulk samples of suspected ACM by two methods:

- USEPA Method 600/R-93/116, Method for Determination of Asbestos in Bulk Building Materials (USEPA 2008), was used for all samples (except vermiculite) and employs polarized light microscopy (PLM) to determine the percentage of asbestos by volume in the sample. For PLM results near 1 percent and for material with multiple components, the analytical method includes further, more precise evaluation using the "point count method" involving visual analysis under magnification. Because of higher accuracy, point count results superseded the PLM results in determining ACM content and consequent abatement. In some cases, the point count results were provided in a separate report, while in others point count results were integrated into a single report.

- California Air Resources Board (CARB) Method 435 was used for samples suspected to contain vermiculite because the physical structure of vermiculite makes PLM/point count analysis difficult. Results are reported in percent asbestos by volume.

PLM results were requested for 2-day, 24-hour, or same day turnaround time, per direction of the State IMT. CARB Method 435 results were provided on a 5-day turnaround time. Laboratory result turnaround times were dictated by State IMT requests regarding priority properties. Following laboratory analyses and data interpretation and before general debris removal activities, California-certified abatement contractors performed abatement on properties with confirmed ACM Abatement contractors completely wrap or encase ACM for approved off-site disposal following all required procedures to prevent migration or escape of asbestos fibers. Tetra Tech staff, or subcontractors with a CAC or CSST, monitored abatement contractors to verify completion of abatement. Verification included review of ACM identified and site drawings, inspection of removal areas for completeness of ACM removal, and verification of forms documenting the ACM removed. Once abatement was verified as complete, the property was released for general debris removal.

5.3.2 Data Collection and Documentation

Data collection and documentation of asbestos assessment and abatement is included for each property at which ACM was identified. Four documents are generated in sequence at each property with each building on its predecessor and supported with analytical data. The four documents are presented below.

1. Asbestos Survey Form (ASF): Completed by the CAC/CSST to document the initial site inspection. The ASF documents the features of the property based on the inspector's observations including number, condition, and construction of structures; number of chimneys; suspect material identification and collection; site drawing with sample locations; and photographs. Suspect ACM identified on the ASF are sampled for laboratory analysis. If no suspect ACM are identified, the property is approved for debris removal or chimney demolition if needed.
2. Asbestos Survey Results (ASR): Prepared by the analytical laboratory to report results of samples collected. The ASR documents the percent by volume of asbestos in each sample by a combination of analytical techniques. Occasionally, more than one ASR was prepared for a property because of the analyses requested or follow-on sampling events. If the ASR does not confirm ACM in the samples collected, the property is approved for debris removal or chimney demolition if needed.
3. Asbestos Abatement Clearance (AAC): Completed by the CAC/CSST to document the removal of ACM identified in the ASR. The abatement contractor completes the work and a CAC/CSST verifies materials in the ASR are removed from locations identified in the ASF.

4. Asbestos Chimney Form (ACF): Completed by the CAC/CSST to document the visual inspection of a chimney interior during demolition. Exterior suspect ACM are sampled during initial site assessment; however, interior materials cannot be viewed without demolition. The CAC/CSST documents any suspect ACM identified on the ACF and the property is scheduled for abatement or samples are collected of the newly identified material. If suspect ACM is sampled, the CAC/CSST generates another ASR. If suspect materials are removed, the CAC/CSST generates a corresponding AAC.

5.3.3 Deviations from the Work Plan

Strict health and safety, dust, and air monitoring protocols were implemented throughout the debris response activities with the specific understanding and anticipation that, due to the magnitude of the Camp Fire Incident, the physical and logistical challenges involved with assessing, sampling, and abating bulk asbestos materials may result in asbestos abatement outside of the Wildfire–Damaged Structures Asbestos Site Assessment SOP. Specifically, health and safety protocols were designed to ensure that hazardous materials exposure, both community and worker, were minimized regardless of the status of asbestos survey or sampling results. In some instances, because of scheduling challenges, parcel identification challenges, miscommunication, or data entry error, debris removal occurred before asbestos program phases were completed including assessment, abatement, or chimney demolition. In some cases, asbestos abatement was conducted on trace asbestos material when not required.

Fire and heat affected suspect ACM construction materials are not easily identified in ash, debris or rubble. Additionally, suspect ACM may be buried under ash or debris, or encased in concrete and not identified during the initial assessment. Any new suspect ACM not identified during assessment but later identified during abatement, chimney tip, or debris removal were visually evaluated when discovered. These suspect ACM were either assumed to be ACM and abated or if the newly identified suspect ACM was a substantial quantity the material was sampled to confirm abatement requirement.

Laboratory analysis by PLM is limited to the refractory resolution and method requirements. Asbestos fibers in heat affected ACM are sometimes altered where the refractive indices are outside the parameters of the method. This altered refraction can provide false negatives for some ACM materials on a sample by sample basis. Field observations of suspect ACMs discovered on properties with negative laboratory results for those materials were either assumed to be ACM and abated or sampled and sent to a lab separate from the initial analytical provider to confirm ACM abatement requirement. Table 5-2 provides the properties that were resampled and deviations from the work plan.

5.4 AIR MONITORING AND SAMPLING

This section provides a summary of all air monitoring and sampling activities conducted as presented in the Air Monitoring and Sampling Plan (AMSP) (Tetra Tech 2018a) and Community Air Monitoring and Sampling Plan (CAMSP), Revision 0 (Tetra Tech 2018b), consistent with the DROP (CalRecycle 2019), and approved by the State IMT. Specific activities include background monitoring and sampling, perimeter air monitoring, fixed facility air monitoring, particulate monitoring results, community air sampling, fixed facility air sampling, negative air machine sampling, personal air sampling, and any deviations from the work plans. Air sample laboratory results were requested on 3-day turnaround time with the exception of NIOSH Method 7402 which was directed at 24-hour turnaround time, per direction of the State IMT.

5.4.1 Background Air Monitoring and Sampling

Tetra Tech collected background air monitoring data and air sampling data prior to initiation of debris removal from January 22 to February 1, 2019. Background air monitoring data and air sampling data were collected consistent with the work plans to assess baseline ambient air conditions within the Camp Fire burn area prior to debris removal. Background air data were collected during working hours from a total of 43 locations, as shown on Figure 5-1.

To assess background air conditions, Tetra Tech identified potential background air locations throughout and around the residential community. Of the 43 locations, 33 representative locations were chosen from ROEs available at the time, to provide a geographic spread of the burn area, and 10 were identified as preliminary community locations as discussed further in Section 4.4.3. Prior to debris removal, background air data were collected during working hours from 15 to 25 locations each day. Locations were monitored and sampled one or more times, based on available equipment, available ROEs, and locations of other background samples each day.

Air monitoring was conducted using TSI DustTrak II Aerosol Monitor 8530s (DustTraks) to assess real-time particulate concentrations at all background locations. DustTraks continuously logged concentrations of particulate matter (PM) with a diameter less than 2.5-micrometers (µm) ($PM_{2.5}$) at each background location. Ambient air samples were collected at each background sampling location with one high-flow air pump (QuickTake 30) for an asbestos sample and two low-flow air pumps (Gillian GilAir Plus) – one for a metals sample and one for a low-flow asbestos sample. High-flow air pumps were calibrated at a flow rate of approximately 10 liters per minute (L/min) and low-flow air pumps were calibrated at a flow rate of approximately 3 L/min. The flow rate of each air pump was measured before and after sample collection using a Bios DryCal Defender 510 primary flow calibrator, Bios DryCal DC-Lite primary flow calibrator, or site-calibrated rotameters.

The average daily air monitoring and sampling duration was approximately 6 hours per day at background locations. During this sampling time, approximately 3,600-liters (L) of air was collected for high-flow asbestos samples, and approximately 1,080 L of air was collected for low-flow samples. DustTraks logged a particulate concentration at 1-minute intervals for the duration of monitoring.

Attached to each air pump was either a Phase Contrast Microscopy (PCM) 25-millimeter (mm) diameter, 0.8-µm mixed cellulose ester (MCE) membrane filter cassette for asbestos samples or a 37-mm diameter, 0.8-µm MCE filter cassette for metals samples. Sampling pumps were co-located with particulate monitoring equipment and mounted on a 4- to 5-foot-tall tripod stand to ensure media remained fixed in the breathing zone. The inlet cap of the asbestos filter cassettes was removed during sampling, so that the cassettes were open-faced, and all cassettes were positioned downward at a 45-degree angle and perpendicular to the prevailing wind direction.

Air samples were shipped to LA Testing in Huntington Beach, California for analysis. Samples were analyzed for metals using National Institute for Occupational Safety and Health (NIOSH) Method 7300/7303 (NIOSH 2003). Each asbestos sample was analyzed using NIOSH Method 7400 by PCM (NIOSH 1989). Initially, if any of the high-flow asbestos air samples were overloaded and could not be analyzed through direct preparation, the low-flow asbestos sample from the same location was sent to the laboratory for analysis. Following implementation of the CAMSP Revision 1 (Tetra Tech 2019g), all low-flow asbestos samples held under chain-of-custody were analyzed for evaluation. PCM samples with results greater than 0.005 fiber per cubic centimeter (f/cc) were analyzed using NIOSH Method 7402 by transmission electron microscopy (TEM) (NIOSH 1994).

A total of 156 particulate monitoring data files were collected and processed from background locations. A total of 152 metals samples, 153 low-flow asbestos samples, and 152 high-flow asbestos samples from

background locations were also collected and submitted for analysis. Background air sampling locations are shown on Figure 5-1. Background particulate monitoring data are presented in Appendix D. Background air sample data for asbestos and metals are presented in Appendix F.

Chromium was detected in one sample at a community background location at a concentration of 0.41 microgram per cubic meter ($\mu g/m^3$). Zinc was detected in two background samples (one community location) up to 1.3 $\mu g/m^3$. No background samples detected asbestos above the screening level of 0.1 f/cc. Fibers were detected during PCM analysis in one sample at a concentration of 0.003 f/cc. No background samples had asbestos detections in TEM analysis.

5.4.2 Perimeter Air Monitoring

Perimeter air monitoring began on February 7, 2019 and concluded on November 5, 2019, with additional perimeter monitoring from March 10 to 13, 2020. Perimeter air monitoring was conducted to assess the effectiveness of dust mitigation controls implemented by the debris removal crews. Perimeter air monitoring was conducted as described in the approved AMSP (Tetra Tech 2018a) and CAMSP, Revision 0 (Tetra Tech 2018b) from February 7 to March 15, 2019, and then Revision 1 of the CAMSP (Tetra Tech 2019g) from March 16, 2019 to March 13, 2020. Revision 1 of the CAMSP updated and replaced both the AMSP and original CAMSP. Air monitoring station locations were selected based on work areas, wind direction, and potential sensitive receptors around the removal properties. Perimeter air monitoring consisted of up to three air monitoring stations triangulated around the work area of an active debris removal or asbestos abatement property, outside of the exclusion zone. Environmental Unit Leaders/Air Quality and Environmental Unit Leaders conducted perimeter air monitoring at approximately 25 to 30 percent of active properties each day, up to a maximum of 45 properties. The Environmental Unit Leaders/Air Quality and staff were responsible to oversee the monitoring and that the approved plans were carried out appropriately. Perimeter locations were selected by Tetra Tech personnel, unless otherwise directed by State Operations, State Planning, or the State IMT. Each perimeter location was chosen based on locations where crews would be working on the same property for the entire day, property access, nearby sensitive receptors, and identified occupied structures. Up to 5 percent of perimeter locations were selected by the Tetra Tech based on environmentally sensitive conditions, including adjacent sensitive receptors and evident repopulation in and around the work areas.

DustTraks were used to assess particulate concentrations for an average of 8 hours per day during working hours at perimeter locations. DustTraks continuously logged concentrations of $PM_{2.5}$ at perimeter locations from February 7 to February 13, 2019, as described in the AMSP and CAMSP (Tetra Tech 2018a, 2018b).

Following verbal direction by the State Air Monitoring Liaison, Tetra Tech began logging concentrations of particulate matter that have a diameter of less than 10 µm (PM_{10}) at perimeter locations on February 14, 2019. This change was later captured in the CAMSP Revision 1 (Tetra Tech 2019g).

Perimeter air monitoring concluded on November 5, 2019, at the direction of the Tetra Tech IC, with coordination from the State IMT. The basis and justification for the demobilization of air monitoring and sampling activities is described in the Camp Fire Air Monitoring and Sampling Demobilization Plan (CalEPA 2019). Tetra Tech conducted perimeter air monitoring at one additional debris removal site from March 10 to 13, 2020.

5.4.3 Community Air Monitoring

Community air monitoring began on February 7, 2019 and concluded on October 17, 2019. Community air monitoring started after debris removal activities had begun. Community air monitoring and sampling was

constructed to verify that debris removal was not exposing the community to elevated air particulate contamination. Community monitoring data were initially collected during working hours at 12 preliminary community locations identified in accordance with CAMSP Revision 0 (Tetra Tech 2018b) from February 7 to March 15, 2019. Air monitoring data collected at preliminary community locations from January 24 to February 1, 2019 are included in Section 4.4.1. As described under the CAMSP Revision 1 (Tetra Tech 2019g), from March 16 to October 17, 2019 community air monitoring data were collected 24 hours each day at up to nine community locations.

Locations eligible for daily community air monitoring in CAMSP (Tetra Tech 2018b) included sensitive receptors near the work areas (i.e., schools) located inside of the Camp Fire Incident burn area or within 1,000 feet of the burn area, with the option to include schools up to and beyond 3,500 feet from the burn area as determined by the State IMT. The AMSP (Tetra Tech 2018a) and CAMSP Revision 0 (Tetra Tech 2018b) are provided in Attachment 6. Twelve preliminary locations granted Tetra Tech access to conduct air monitoring and sampling during debris removal. Nine of the preliminary community locations selected for background sampling were identified based on sensitive receptors and places of interest in the community. Three of the preliminary community locations were identified by the State IMT based on high-traffic transportation corridors.

To more accurately assess ambient air quality for potential receptors in and around the community, CAMSP (Tetra Tech 2018b) was reassessed by the State IMT and Butte County Air Quality Management District (BCAQMD). The recommended public health screening levels for particulate matter in ambient air were lower than those used for background testing and community monitoring and sampling in the CAMSP Revision 0 (Tetra Tech 2018b). To accurately compare community monitoring data to public health screening levels, such as the USEPA Air Quality Index (USEPA 2018), BCAQMD, and the State IMT required 24-hour monitoring methods at community locations. TSI DustTrak II Aerosol Monitor 8530s continued to be used to assess particulate concentrations at community locations. DustTraks continuously logged $PM_{2.5}$ concentrations 24 hours per day and had a screening level of 35 $\mu g/m^3$ for a 1-hour time-weighted average (TWA), corresponding to "good" air quality as defined by the Air Quality Index (USEPA 2018). Community air monitoring under CAMSP Revision 1 (Tetra Tech 2019g) began on March 16, 2019.

All community monitoring locations in the revised CAMSP were identified and approved by the State Air Monitoring Liaison in coordination with the State IMT and BCAQMD. Changes to the community monitoring locations were provided by the Air Monitoring Liaison for inclusion in the revised CAMSP (Tetra Tech 2019g). Initial community monitoring procedures under Revision 0 were phased out on March 16, 2019. Particulate monitoring under Revision 1 occurred between March 16, 2019 and October 17, 2019. BCAQMD and the State IMT coordinated access at each community location. In coordination with the BCAQMD and at the recommendation of the State Air Monitoring Liaison, the State IMT directed the demobilization of air monitoring and sampling activities in the Camp Fire Air Monitoring and Sampling Demobilization Plan (Revision 1, October 4, 2019). Dates of particulate monitoring at each community location are provided on Table 5-3. Community particulate air monitoring locations are shown on Figure 5-2.

5.4.4 Fixed Facility Air Monitoring

Fixed facility air monitoring began on March 15, 2019 and concluded on October 14, 2019. Fixed facility air monitoring started with implementation of the CAMSP, Revision 1 (Tetra Tech 2019g), after debris removal activities had begun. Fixed facility air monitoring was conducted to provide additional oversight of potential air quality impacts of waste management facilities associated with Camp Fire Incident debris removal program and disposal operations. These facilities were designated by the State IMT for metal and concrete recycling and disposal. The Air Monitoring Liaison and BCAQMD selected two fixed facilities for perimeter air monitoring: Odin Construction Metal Recycling and Franklin Construction Concrete

Recycling. Fixed facility air monitoring consisted of three air monitoring stations triangulated around the work area of each facility and operated during working hours. Fixed facility monitoring concluded on October 14, 2019, as directed by the State IMT in the Camp Fire Air Monitoring and Sampling Demobilization Plan (Revision 1, October 4, 2019). Equipment fixed facility locations and station placement are shown in Figure 5-3 and Figure 5-4.

5.4.5 Particulate Air Monitoring System Checks, Meteorological Data, and Reporting

At all perimeter, community, and fixed location types, field personnel conducted periodic system checks on the air monitoring stations throughout the day to ensure equipment was functional and particulate concentrations were not approaching action levels. System checks included recording the physical condition of the equipment and data collection capability. System checks are included in Appendix D. Monitoring data collected with DustTraks was reviewed during system checks for maximum particulate concentration. Data files from each location were downloaded and reviewed at the end of each day to identify data exceedances, irregularities, or concerns requiring further investigation or correction. DustTraks units are factory calibrated annually and do not require field calibration. DustTraks units were zero calibrated with a manufacturer-provided zero filter prior to each use and as needed throughout the day.

Meteorological data, including temperature, wind direction, wind speed, and current weather conditions were monitored and logged for the Butte County area throughout air monitoring activities. Tetra Tech used a Met One Instruments AIO 2 Sonic Weather Sensor with a Met One Model 370 rain gauge or accessed the National Weather Service website that provides current weather conditions and the Weather Underground website for current and historical weather conditions. The Met One weather station was equipped with telemetry to transmit data in real time and operated between April 17, 2019 and November 12, 2019. The weather station was located on the roof of Thomas Ace Hardware at 5720 Clark Road, Paradise, California. The location of the weather station is displayed in Figure 5-2. A summary of meteorological data is included in Appendix D.

A summary of the particulate monitoring dataset collected during the duration of removal activities is also included in Appendix D. Monitoring duration, maximum 1-hour TWA, maximum 15-minute TWA, and particulate concentrations are provided for each location. There are no laboratory analytical results for the particulate monitoring. Real-time air monitoring data and weather data were captured digitally throughout the monitoring period. Particulate concentrations at community and fixed facility locations were monitored throughout the day via real-time data transmission. Elevated particulate concentrations were communicated directly to the task force leaders and crew foremen during system checks throughout the day, and to the State IMT via the Environmental Branch Director as necessary. For perimeter locations, maximum concentrations were checked periodically throughout the day. At all locations, the dataset was reviewed at the end of the day and evaluated. Particulate monitoring occurred at community locations 24 hours per day and at perimeter locations and fixed facility locations each working day, unless otherwise directed by the State IMT.

Perimeter data files were identified by location, including property APN. Community and fixed location data files were identified by their respective assigned acronym (e.g., PUSD for Paradise Unified School District). Community and fixed facility monitoring included collection and real-time data transmission of particulate monitoring data to public and private web-based user interfaces via telemetry. Community locations transmitted current particulate monitoring concentrations 24 hours per day. Fixed facility locations transmitted particulate monitoring data during active data collection. Hourly and daily TWAs for particulates were calculated at community locations and hourly TWAs were calculated at the fixed facility locations. The TWAs were converted to the Air Quality Index (AQI), and the corresponding AQI range for each community and fixed facility location was reported on a public website (USEPA 2018a). The public viewer also displayed real-time air monitoring data from up to four California Air Resources Board (CARB)

particulate monitoring stations. The CARB stations recorded 24-hour average $PM_{2.5}$ concentrations, and the current AQI range for each location was included on the public viewer at the request of the State Air Monitoring Liaison. The public viewer was accessible to anyone with an internet connection. The public website was accessible via a Uniform Resource Locator linked to the BCAQMD website. Access to the private user interface was limited to the Tetra Tech Environmental Unit Leader/Air Quality or Environmental Unit Leaders and required login credentials for access. The private interface displayed the current particulate concentrations measured at each location, with the option to download the previous 24-hour data for all locations, at all times. Appendix D contains a summary of real-time monitoring data displayed via telemetry and on the public website, including monitoring locations and date ranges.

Particulate monitoring data for all locations were reviewed daily and any exceedances were communicated to the State IMT via the State Air Monitoring Liaison. In addition to being posted on the public website, air monitoring results for community and fixed facility locations were summarized in tables. Particulate monitoring data for each community and fixed location were summarized in letter form, by week. Particulate monitoring results from community and fixed facility locations were also provided to BCAQMD on a twice-monthly basis in a detailed report. A total of ten Consolidated Air Quality Reports were submitted to the State IMT for review by the Air Monitoring Liaison; the completed reports were subsequently submitted to BCAQMD for release to the public. A summary of findings, including sample data and monitoring exceedances for all community and fixed facility locations from March 18 to November 5, 2019 was posted on the BCAQMD website.

5.4.6 Particulate Air Monitoring Results

The particulate air monitoring levels at perimeter locations exceeded the project action level at 129 different equipment stations located on 124 total properties, collected on 65 different dates from February 11 to October 24, 2019 during debris removal. The project screening level for particulate matter was greater than 50 µg/m^3 based on a 1-hour TWA. Perimeter monitors logged data in real time and recorded an alarm log if a 15-minute TWA particulate concentration exceeded 600 µg/m^3, as specified by the State IMT with consultation from BCAQMD. Equipment error at two sampling events resulted in alarm level exceedances, as summarized below.

Date	Site Identification	Duration (D:HH:MM)	Maximum 15 Minute TWA Alarm (µg/m^3)	Duration > 600 µg/m^3 (minutes)	Comment
4/24/2019	054-040-039	0:06:48	142569.2	15	Equipment fell over
6/15/2019	051-162-048	0:07:29	815.72	5	Equipment malfunction

Notes:
TWA - time weighted average
µg/m^3 - micrograms per cubic meter

Thirty-four perimeter exceedances that occurred between September 12, 2019 and September 14, 2019 are attributed to poor air quality in Butte County caused by the Walker Fire and are unrelated to the debris removal program for the Camp Fire Incident. The Walker Fire burned in Plumas County from September 4, 2019 through September 25, 2019. It is likely the Walker Fire impacted air quality during the Camp Fire Incident debris removal program and the particulate exceedances during this period were not related to debris removal activities associated with the Camp Fire Incident.

On May 31, six exceedances encompassing every equipment station at two properties were attributed to burn piles at a neighboring property and were not attributed to the debris removal program.

Four exceedances were attributed to user error or equipment malfunction, including one screening level exceedance and alarm limit exceedance on April 24, 2019 that occurred when a DustTrak fell to the ground.

The only other alarm limit exceedance occurred on June 15, 2019 and was attributed to equipment malfunction. During system checks, the field team noted no visible dust at the site, and artificially high particulate readings relative to the two other equipment stations at this perimeter location. Following additional examination and troubleshooting by the Environmental Unit Supervisor/Air Quality, the DustTrak unit that recorded the alarm limit exceedance had not previously been field-deployed on the project at any location. The exceedance was determined to be caused by equipment malfunction, and the DustTrak unit was removed from use on the project and returned to the vendor for repair.

Eight total exceedances on six different dates included notes on nearby equipment, trucks, or other debris removal activities impacting dust levels on site.

All other occurrences with perimeter particulate levels greater than the action level, as well as those discussed above, were investigated and are summarized in Table 5-4. Locations of perimeter particulate exceedances are shown on Figure 5-5.

The particulate air monitoring concentrations at community locations exceeded the project action level under CAMSP Revision 1 (Tetra Tech 2019g) on 12 different dates, along with 20 exceedances during debris removal. The project screening level under CAMSP Revision 1 for particulate matter was 35 $\mu g/m^3$ based on a 1-hour TWA.

It is likely that the 11 community particulate exceedances during the period between September 11, 2019 and September 13, 2019 were caused by the Walker Fire and were not related to debris removal activities associated with the Camp Fire Incident.

Butte County issues burn permits in select months. Five exceedances from April 3 to May 30, 2019 were caused by wood burning on a nearby property. All occurrences at community locations with particulate levels greater than the action level were investigated and are summarized in Table 5-5. Community monitoring locations are shown on Figure 5-2.

The particulate air monitoring levels at fixed facility locations exceeded the project action level on 12 different dates, with 12 total monitoring exceedances during debris removal. The project action level for particulate matter was greater than 50 $\mu g/m^3$ based on a 1-hour TWA. All occurrences at fixed facility locations with particulate levels greater than the action level were investigated and are summarized in Table 5-6. Fixed facility monitoring locations are shown on Figure 5-3 and Figure 5-4.

5.4.7 Perimeter Air Sampling

Perimeter air samples were collected between February 2, 2019 and November 5, 2019, with additional samples collected between March 10 and 13, 2020. A total of 27,786 perimeter air samples were collected and analyzed, excluding any field or laboratory blanks.

Perimeter air samples were collected to ensure the safety of nearby residents, any non-occupational bystanders, and other transient members of the general public. Air sampling was suspended during inclement weather at the direction of the State IMT. Perimeter air sampling locations were co-located with air monitoring locations.

During the removal activities conducted under the AMSP and CAMSP Revision 0 (Tetra Tech 2018a, 2018b), each air sampling location consisted of one high-flow air pump (QuickTake 30) for a high-flow

asbestos sample and two low-flow air pumps (Gillian GilAir Plus) for a metals sample and a low-flow asbestos sample. High-flow air pumps were calibrated at a flow rate of approximately 10 L/min and low-flow air pumps were calibrated at a flow rate of approximately 3 L/min. Following implementation of the CAMSP Revision 1 (Tetra Tech 2019g), only the two low-flow air pumps were used for a metals sample and low-flow asbestos sample. The flow rate of each air pump was measured before and after sample collection using a Bios DryCal Defender 510 primary flow calibrator, Bios DryCal DC-Lite primary flow calibrator, or site-calibrated rotameters.

Attached to each air pump was either a 25-mm diameter, 0.8-µm MCE membrane filter cassette for asbestos samples; or a 37-mm diameter, 0.8-µm MCE filter cassette for metals samples. All cassettes were mounted on a 4-to 5-foot-tall tripod stand. The asbestos filter cassettes were made open-faced by removing their inlet caps during sampling. The cassettes were positioned downward at a 45-degree angle and perpendicular to the prevailing wind direction.

The total daily air sampling time was approximately 7 to 8 hours. During this sampling time, approximately 4,200 L of air was collected for a high-flow asbestos sample where applicable. Approximately 1,260 L of air was collected for the low-flow samples.

Air samples were shipped to EMSL/LA Testing, in Huntington Beach, California, for analysis. Metals samples were analyzed using NIOSH Method 7300/7303 (NIOSH 2003). Asbestos samples were analyzed by PCM using NIOSH Method 7400 (NIOSH 1989). Asbestos samples with PCM results greater than 0.005 f/cc were further analyzed by TEM using NIOSH Method 7402 (NIOSH 1994). Appendix D provides the following information for each perimeter sample: sample identification (ID), collection date, sample location, metals sampling results in $\mu g/m^3$, and asbestos sampling results in f/cc for both PCM and TEM analyses, if applicable.

Consistent with the AMSP and CAMSP Revision 0 (Tetra Tech 2018a, 2018b), all metals samples and high-flow asbestos samples were submitted to the laboratory for analysis and low-flow asbestos samples were archived on site under chain-of-custody. If any of the high-flow asbestos air samples were overloaded and could not be analyzed by the laboratory through direct preparation, the low-flow asbestos sample from the same location was sent to the laboratory for analysis. High-flow asbestos samples were eliminated in the CAMSP Revision 1 (Tetra Tech 2019g) and only low-flow asbestos samples were collected and analyzed. Following implementation of the revised CAMSP, all low-flow asbestos samples previously collected and held under chain-of-custody were analyzed for asbestos for comparison to CAMSP Revision 1 perimeter asbestos samples.

A total of 14,145 perimeter asbestos samples were analyzed by the laboratory and evaluated under the CAMSP (Tetra Tech 2018b, 2019g) screening levels. During the project, 209 perimeter asbestos air samples were analyzed using TEM in addition to PCM analysis.

Asbestos fibers were confirmed in 14 of the TEM samples, ranging from 0.0019 - 0.0121 fibers. Asbestos samples collected from perimeter locations contained higher concentrations of fibers compared to background samples. No asbestos fibers were detected above the action level in any of the high-flow or low-flow asbestos air samples analyzed via PCM or TEM throughout the removal activities for perimeter locations.

For metals samples with a TWA-based screening value and a run time less than 8 hours, an adjusted result was calculated and compared to the original screening level. For metals samples with a run time greater than 8 hours and a TWA-based screening value, the daily occupational exposure limit (OEL) was calculated and used in comparison with the original laboratory result.

Of the 13,641 perimeter metals samples collected, at least one metal analyte was detected in 5,784 samples (42 percent), including antimony, arsenic, chromium, copper, lead, nickel, selenium, and zinc. Low levels of chromium are commonly detected in new, unused filters used for collecting air samples. Therefore, low-level chromium detections in air samples may be caused by the filter media in part. Because the chromium levels found in the filter media are well below the air occupational screening level of 500 µg/m^3, it is still possible to identify whether exposure to airborne chromium has occurred near or above the screening level. Of the detections, there were a total of three sample concentrations during debris removal that exceeded the perimeter screening level provided in the CAMSP Revision 1 (Tetra Tech 2019g). Zinc was the only analyte found to exceed its screening level. All three perimeter samples with zinc exceedances were collected on July 9, 2019 from two different sites. One site contained two perimeter locations with zinc exceedances. The other site contained one zinc exceedance and one perimeter particulate exceedance (contained in Table 5-4). Metals exceedances for perimeter samples are summarized below.

Date Collected	Site Identification	Location Type	Analyte	Screening Level (µg/m^3)	Analytical Result (µg/m^3)	Calculated Result (µg/m^3)	Daily OEL (µg/m^3)
7/9/2019	055-270-083	Perimeter 001	Zinc	50	81	70	--
		Perimeter 002	Zinc	50	150	130	--
	051-104-041	Perimeter 001	Zinc	50	80	--	40

Notes:
The screening level is provided in CAMSP Revision 1, Table 2 (Tetra Tech 2019g).
µg/m^3 - micrograms per cubic meter
OEL - occupational exposure limit

5.4.8 Community Air Sampling

Air sampling at community locations started on February 7, 2019, after debris removal had begun, and concluded on October 1, 2019. Ambient air samples at community locations were collected to assess whether airborne metals and asbestos fibers generated from debris removal activities were migrating beyond site work areas and impacting the air quality of the nearby community. Samples were collected daily during debris removal working hours at predetermined sensitive receptor locations around the community, as established in the CAMSP (Tetra Tech 2018b, 2019g). Air sampling was suspended during inclement weather at the direction of the State IMT. Sampling equipment was co-located with equipment to monitor ambient particulate matter concentration. The community procedures provided in the original CAMSP (Tetra Tech 2018b) consisted of personal sampling methods, evaluating data relative to occupational health standards. Public health screening levels were lower than those used for background sampling and initial community sampling. At the direction of the Air Monitoring Liaison and BCAQMD, Tetra Tech revised the CAMSP to incorporate ambient 24-hour sampling methods, revised analytical methods, and public health screening levels for community locations. Under the direction of the Tetra Tech certified industrial hygienist, and in coordination with the State IMT and BCAQMD, Tetra Tech identified and acquired new sampling equipment, sampling methodologies, and analytical methods with lower detection limits to reach community screening levels and appropriate for the project objectives. In addition, community sampling locations required approval and identification by the State IMT and BCAQMD. Tetra Tech coordinated with the Air Monitoring Liaison, BCAQMD, and designated facility representatives to establish ambient air monitoring and sampling locations consistent with siting criteria contained in USEPA 40 Code of Federal Regulations (CFR) Part 58, Appendix E: Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring.

Preliminary community air sampling methods were phased out on March 16, 2019 as amended equipment, procedures, and sampling methods were implemented. Community air sampling locations, along with their start and end dates are listed in Table 5-7. Community air sampling locations are shown on Figure 5-2.

Samples were collected at preliminary community locations from February 7 to March 16, 2019 during debris removal working hours, using the same sampling procedures as described above for perimeter sampling in Section 4.4.7.

From February 7 to March 16, 2019, a total of 140 metals air samples and 286 asbestos air samples were collected from preliminary community locations and analyzed by the laboratory. During this phase of sampling, no asbestos air samples were analyzed using TEM. No asbestos fibers were detected above the action limit of 0.01 f/cc in any of the high-flow or low-flow asbestos air samples analyzed via PCM or TEM throughout the removal activities. Metal results showed there were no detected analytes above the action levels for any samples during this time.

During the initial sampling period, metals were detected below the action levels in 16 samples at nine preliminary community locations. Zinc was detected in one sample at the intersection of Skyway and Highway 99 on February 7, 2019 at a level of 0.97 µg/m^3 (action level 3,000 µg/m^3) and lead was detected in one sample at Magalia Adventist School on February 8, 2019, at a level of 0.57 µg/m^3 (action level 50 µg/m^3). Chromium was detected in 14 samples at eight different locations from February 22, 2019 to March 16, 2019 at levels ranging from 0.36 to 0.55 µg/m^3 (action level 500 µg/m^3). Analytical summary tables are contained in Appendix E.

The majority of metals samples analyzed via NIOSH 7300/7303 failed to achieve the analytical sensitivity required to report beryllium results below project screening levels. The beryllium detection limit was reported above the Threshold Limit Value of 0.05 µg/m^3 but below the Permissible Exposure Limit (PEL) of 0.2 µg/m^3 in 140 preliminary community metals samples. These sample data are reported as not detected and no further analysis of these data was performed.

During debris removal activities, preliminary community air sampling results were slightly higher than background levels. Chromium was detected more frequently during debris removal operations; however, it was also detected in a background sample at a community location. Zinc was detected during debris removal but at a higher concentration in a background sample at a preliminary community location. Lead was detected below the screening level during debris removal but was not observed in community background samples. Community asbestos samples contained higher concentrations of fibers compared to background samples, but no samples were above the action limit and no asbestos fibers were confirmed via TEM analysis.

Appendix E provides the following information on each preliminary community air sample collected under CAMSP (Revision 0, December 18, 2018): sample ID, collection date, sample location, metal sampling results in µg/m^3, and asbestos sampling results in f/cc for PCM analyses.

Community sampling under the CAMSP Revision 1 (Tetra Tech 2019g) was initiated in late April when additional equipment became available. Tetra Tech crews deployed sampling equipment throughout Butte County during the month of May, depending on availability of electricity. Updated equipment, sampling methods, and analytical methods were used for metal and asbestos sampling at approved locations. Criteria for designating updated locations and sampling methods included the potential presence of sensitive populations such as schools, health care facilities, and public facilities. Designated locations were identified and approved by the State Air Monitoring Liaison and BCAQMD. Screening levels were also updated to reflect more stringent Public Health Action Levels in the Community Screening Levels located in Table 3 of the CAMSP Revision (Tetra Tech 2019g).

As a result of the CAMSP Revision 1 (Tetra Tech 2019g), air sampling for elemental metals at community locations employed the following methods:

- USEPA Compendium Method IO-2.1, Sampling of Ambient Air for Total Suspended Particulate Matter (SPM) and PM_{10} Using High Volume Sampler.
- USEPA IO Compendium Method IO-3.5: Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air: Determination of Metals in Ambient Particulate Matter Using Inductively Coupled Plasma/Mass Spectrometry (ICP/MS).
- 40 CFR Part 50, Method for the Determination of Lead in Total Suspended Particulate Matter.
- 40 CFR Part 58, Appendix E: Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring.
- Standard Operating Procedures for Lead Monitoring using a Total Suspended Particulate High Volume Sampler (Tetra Tech 2019g).

For the air sampling under CAMSP Revision 1 (Tetra Tech 2019g), the State IMT worked with the State Air Monitoring Liaison in coordination with BCAQMD to implement ambient sampling techniques at approved locations for daily community air monitoring and air sampling. Considerations for community locations included the siting criteria included in USEPA 40 CFR Part 58, Appendix E: Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring, as well as a power supply. Community air sampling was eventually approved for a total of seven locations and was initiated on varying dates as sampling equipment and access to electricity became available. The first ambient air sample collection from an approved community location was collected on April 27, 2019 and sampling at all community locations concluded on October 1, 2019. Community sampling locations are provided on Figure 5-2 and sampling date ranges are included in Table 5-7.

Metals Air Sampling Results

Air samples were analyzed for California Administrative Manual 17 metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc), excluding mercury, at community locations. Community metals samples ran for 24 hours and approximately 21 to 25 m^3 of air was drawn through the filter media. Samples were collected using a TISCH High Volume TE-5170V Sampler and Total Suspended Particulate filters in accordance with USEPA Compendium Methods IO-3.4 or IO-3.5 (USEPA 1999a, 1999b). Equipment was calibrated at installation and every 15 days or 360 hours of use. Tetra Tech staff collected the samples, inspected the equipment, and recorded field notes daily. Performance checks were completed on-site daily to ensure equipment was within calibration. If sampling equipment could not pass equipment was sent to the vendor for maintenance when needed.

All community samples for metals were labeled, packaged, and shipped in accordance with approved sampling methods to Eastern Research Group, Inc. in Morrisville, North Carolina for analysis under a 72-hour turn-around time. Tetra Tech held all samples for the week under chain-of-custody on-site and shipped community metals samples on Saturday for Monday receipt. Analysis for lead and arsenic was performed following EPA Method EQL-0512-201 and Modified Compendium Method IO-3.5 and particulate mass measurements were performed following EPA Compendium Method IO-3.1 (USEPA 1999a, 1999b).

From May 7 to October 1, 2019, a total of 722 metals air samples were collected from community locations and analyzed by the laboratory as required by the CAMSP Revision 1 (Tetra Tech 2019g).

Analysis revealed elemental metals were detected at low concentrations in the ambient air at community locations. All detections were below the public health action levels except for one sample. Barium was detected at a level of 0.0631 µg/m^3 at Paradise Town Hall on August 20, 2019. This detection exceeded the community screening level of 0.05 µg/m^3.

The Air Monitoring Liaison investigated potential sources of barium in ambient air to determine whether elevated barium concentrations observed on the project were emanating from disturbed soil containing high background levels of barium, ash and debris with elevated metals concentrations, and/or specific activities associated with the debris removal program. Environmental Branch Directors performed a data review and identified the following:

- Laboratory data for all ambient air samples with barium concentrations above 0.02 µg/m^3
- Active properties (i.e., those with debris removal, vehicle removal, asbestos removal, soil sampling and/or rescrapes taking place during the air sample collection period) within 0.5 miles of the community sampling location where ambient barium was detected
- Barium concentrations from background soil samples, clearance soil samples, and ash samples collected from each active property and/or community sampling location described above

Review of activities during August 19 to 21, 2019 showed that one asbestos abatement, five debris removal sites, and 11 soil sampling events were occurring within a 0.5-mile radius of Paradise Town Hall. Soil data from 16 of the non-abatement properties revealed barium levels of 110- to 420-milligrams per kilogram (mg/kg). Two of these properties had soil samples with barium concentrations greater than the background level of 360 mg/kg. Ash data collected from two of the properties revealed elevated barium levels up to a maximum of 4,980 mg/kg. While barium is not observed at elevated concentrations in all ash samples, the elevated ash samples could contribute to the elevated air sample result at Paradise Town Hall. A map of the location of the elevated barium air sample result, the properties and their soil and ash sample results are provided in Figure 5-6.

The Air Monitoring Liaison summarized and presented these findings to the BCAQMD Governing Board. The barium exceedance was also documented and discussed in the twice-monthly report that was submitted to BCAQMD for date range August 16 to September 8, 2019, and posted publicly on the BCAQMD website. Following the barium exceedance at Paradise Town Hall, Environmental Branch Directors continued to monitor for and investigate ambient barium concentrations above 0.02 µg/m^3 by identifying properties active during air sample collection and reviewing barium concentrations in associated soil and ash samples. No other ambient metals samples exceeded the community screening levels for barium or any other analyte during the project. Community analytical data is provided in Appendix E.

Asbestos Air Sampling Results

Sampling for asbestos at community locations ran for 24 hours per day, 7 days per week. Each ambient air sampling location consisted of one high-flow QuickTake 30 air pump. Air pumps were calibrated at a flow rate of approximately 4.5 L/min. The flow rate of each air pump was measured before and after sample collection using a Bios DryCal Defender 510 primary flow calibrator, Bios DryCal DC-Lite primary flow calibrator, or site-calibrated rotameters. Attached to each air pump was a 25 mm diameter, 0.8 µm MCE filter cassette mounted on a 4- to 5-foot high cassette stand to approximate average breathing height. The inlet cap of the filter cassettes was removed during sampling so that the cassettes were open-faced; and the cassettes were positioned downward at a 45-degree angle and perpendicular to the prevailing wind direction. Approximately 6,300 L of air was drawn through the filter media and collected for an asbestos sample.

Community asbestos samples collected for asbestos analysis were shipped to multiple EMSL locations and analyzed in accordance with the International Organization for Standardization (ISO) Method 10312, "Ambient Air – Determination of Asbestos Fiber – Direct Transfer Transmission Electron Microscopy Method." Samples were analyzed by Phase Contrast Microscopy Equivalent (PCME) and results were reported in structures per cubic centimeter (s/cc).

The community screening level for asbestos provided by the State IMT and BCAQMD was 0.01 f/cc (Tetra Tech 2019g), based on human health screening levels developed with PCM sample results. Tetra Tech evaluated community asbestos air samples via ambient sampling method ISO 10312. Although ISO 10312 is a modern TEM analytical method, results were reported using PCME asbestos fiber size classification. As described in the revised CAMSP (Tetra Tech 2019g), PCME fibers are defined as fibers greater than 5 µm in length, and 0.25 to 3 µm in width, with a 3:1 aspect ratio.

Based on the Framework for Investigating Asbestos-Contaminated Superfund Sites (USEPA 2008), PCME results via ISO 10312 are appropriate for use in comparison to the 0.01 f/cc community screening level specified for the Camp Fire Incident.

From April 27 to October 1, 2019, a total of 813 ambient asbestos air samples were collected from community locations and submitted for laboratory analysis. Asbestos fibers were detected in 143 samples, ranging from 0.00032 to 0.0022 s/cc. No asbestos fibers were detected above the action limit of 0.01 f/cc in any of the community asbestos air samples.

Because they employed different sampling procedures, equipment, and analytical methodologies, ambient community samples collected from April 27 to October 1, 2019 under the revised CAMSP (Tetra Tech 2019g) were not compared to background samples collected under the original CAMSP (Tetra Tech 2018b). However, samples for community were run 24 hours per day, including Sundays, when debris removal was not active.

Analytical results from community locations for asbestos and metals were provided in a detailed report to BCAQMD on a twice-monthly basis and a summary of findings was posted on the BCAQMD website. Sample data and monitoring exceedances for all community and fixed facility locations were posted publicly on the BCAQMD website, from March 18 to November 5, 2019. A total of ten Consolidated Air Quality Reports were submitted to the State IMT for review by the State Air Monitoring Liaison and the completed reports were subsequently submitted to BCAQMD for release to the public. Analytical data were reviewed daily and any sample exceedances were communicated to the State IMT. Community air sampling results were also displayed on the public viewer with air monitoring data. The most currently available sample results for asbestos samples and six target heavy metals were provided for each location. A summary of sampling data displayed on the public viewer is included in the Telemetry Summary in Appendix D.

Appendix E provides the following information on each community air sample collected under CAMSP Revision 1 (Tetra Tech 2019g): Sample ID, collection date, sample location, metal sampling results in $\mu g/m^3$, and total asbestos sampling results in s/cc for PCME analyses.

In coordination with BCAQMD and at the recommendation of the State Air Monitoring Liaison, the State IMT directed the demobilization of air sampling activities in the Camp Fire Air Monitoring and Sampling Demobilization Plan (Revision 1, October 4, 2019). All asbestos and metals sampling at community locations concluded on October 1, 2019 for the remainder of the project.

5.4.9 Fixed Facility Air Sampling

Fixed facility air sampling was conducted concurrently with air particulate monitoring from March 15, 2019 to October 1, 2019. Fixed facility air stations included equipment to enable real-time monitoring for airborne particulate matter concentrations down to 10 microns (PM_{10}), and air sampling for asbestos and metals. Air monitoring and sampling activities occurred only during working hours. Fixed facilities were located as follows: Odin Construction Metal Recycling at 3000 7th Ave, Oroville, and Franklin Construction Concrete Recycling at 1023 Neal Road, Paradise. Fixed facility sampling locations at Odin Construction are shown on Figure 5-3 and Franklin Construction locations are shown on Figure 5-4. Ambient air samples were collected from fixed positions to assess whether airborne asbestos and metals fibers were generated from debris removal disposal at the recycling facilities and any resulting migration.

From March 15, 2019 to October 1, 2019, a total of 800 metals air samples and 811 asbestos air samples were collected at fixed facility locations and analyzed by the laboratory. Sampling equipment was co-located with equipment to monitor ambient particulate matter concentration. Air sampling was suspended during inclement weather at the direction of the State IMT.

During the facility working hours, each air station was set up with two low-flow air pumps (Gillian GilAir Plus) for a metals sample and a low-flow asbestos sample. The low-flow air pumps were calibrated at a flow rate of approximately 3 L/min. The flow rate of each air pump was measured before and after sample collection using a Bios DryCal Defender 510 primary flow calibrator, Bios DryCal DC-Lite primary flow calibrator, or site-calibrated rotameters.

Attached to each air pump was either a 25 mm diameter open-face, 0.8 µm MCE filter cassette for asbestos samples; or a 37 mm diameter closed-face, 0.8 µm MCE filter cassette for metals samples. All cassettes were mounted on a 4- to 5-foot-tall tripod stand. The filter cassettes inlet caps were removed during sampling. The cassettes were positioned downward at a 45-degree angle and perpendicular to the prevailing wind direction.

The total daily air sampling time was approximately 480- to 600-minutes per day reflecting working hours. During this sampling time, approximately 1,440 to 1,800 L of air was collected for the low flow samples.

Air samples were shipped to EMSL/LA Testing, in Huntington Beach, California, for analysis. Target metals samples were analyzed with NIOSH 7300/7303 (NIOSH 2003), as well as with USEPA Environmental Response Team SOP No. 2008, "General Air Sampling Guidelines" (USEPA ERT 1994). Asbestos samples were analyzed concurrently in consideration of timeliness and clarity of public data reporting. Asbestos samples were analyzed using NIOSH Method 7400 by PCM (NIOSH 1989) and NIOSH 7402 by TEM (NIOSH 1989).

Appendix E provides the following information for each fixed facility air sample: sample ID, collection date, sample location, metals sampling results in micrograms per cubic meter (µg/m^3), and asbestos sampling results in f/cc for both PCM and TEM analyses (if applicable).

Analytical data were reviewed daily and Tetra Tech prepared summary tables of air sampling results for fixed facility air samples. Fixed facility sampling data and monitoring data were posted and updated daily on the public viewer. A summary of telemetry and public viewer locations and date ranges is provided in Appendix D.

During the sampling period of March 15, 2019 to October 1, 2019, there were no metal exceedances of the project action levels defined in the CAMSP Revision 1 (Tetra Tech 2019g). No PCM asbestos samples indicated detections greater than the screening level of 0.1 f/cc. Twelve asbestos samples had TEM detections; none exceeded the screening level.

5.4.10 Negative Air Machine Sampling

Two Class 1 Regulated ACM abatements were conducted as part of the debris removal program at APNs 052-201-031 and 053-101-029. Class 1 abatement requires a negative pressure enclosure (NPE), which once work begins must remain on and intact until clearance is achieved in accordance with California Occupational Safety and Health Administration (Cal OSHA) regulations at 8 CCR 1529(g)(4)(F)(5)(A)(1)(d) and federal OSHA regulations at 29 CFR 1926.1101(g)(5)(i)(A)(4).

Negative Air Monitoring During Full Containment Asbestos Removal

In an additional measure to ensure the safety of the public, supplemental air monitoring was performed at high-concern asbestos abatement properties where an NPE was constructed for asbestos removal. Air sampling equipment was set up outside areas of the negative air pressure system where air was released, either through a high-efficiency particulate air filter or through the decontamination chamber where workers were exiting. The negative air machine (NAM) samples were collected in addition to three air monitoring stations that were erected on the boundaries of the property, monitoring for particulate matter, as well as sampling for target metals and asbestos.

The NAM asbestos samples were analyzed for fiber count via PCM using procedures from NIOSH 7400 (NIOSH 1989). If detected at or above 0.005 f/cc, the samples were analyzed additionally via TEM using procedures from NIOSH 7402 (NIOSH 1994).

A total of 22 NAM asbestos air samples were collected from the two separate parcels that had NPE containment during asbestos abatement activities. NAM sampling was directed by the Tetra Tech Environmental Branch Director/Certified Asbestos Consultant in charge of asbestos sampling. Twelve samples were collected at APN 052-201-031 from September 9 to 14, 2019 and ten samples were collected at APN 053-101-029 from October 10 to 15, 2019. Fourteen of the samples had PCM fiber detections ranging from 0.002 to 0.008 f/cc. Six of the samples had PCM fiber detections at or above 0.005 f/cc and were further analyzed for asbestos via TEM. One sample from September 14, 2019 had confirmed detection of asbestos fibers via TEM at a concentration of 0.006 f/cc. No samples contained fibers detected above the screening level. Analytical results for NAM samples are summarized below.

APN	Date	Sample Number	Fiber Count (f/cc)	Confirmed Asbestos (Y/N)	Screening Level
052-201-031	9/09/2019	1	ND (<0.002)	NA	0.1 f/cc
		2	ND (<0.002)	NA	
	9/10/2019	1	ND (<0.002)	NA	
		2	ND (<0.002)	NA	
	9/11/2019	1	0.003	NA	
		2	0.002	NA	
	9/12/2019	1	0.002	NA	
		2	0.002	NA	
	9/13/2019	1	0.003	NA	
		2	0.003	NA	
	9/14/2019	1	0.006	Y	
		2	0.008	N	

APN	Date	Sample Number	Fiber Count (f/cc)	Confirmed Asbestos (Y/N)	Screening Level
053-101-029	10/10/2019	1	0.008	N	
		2	0.004	NA	
	10/11/2019	1	ND (<0.002)	NA	
		2	0.005	N	
	10/12/2019	1	ND (<0.002)	NA	
		2	ND (<0.002)	NA	
	10/14/2019	1	ND (<0.002)	NA	
		2	0.005	N	
	10/15/2019	1	0.002	NA	
		2	0.007	N	

Notes:
f/cc - fibers per cubic centimeter
Y/N - Yes/No
NA - Not Available
ND - Not detected at or above the reporting limit, listed in parentheses

OSHA Consultation at APN 053-101-029

The Class 1 abatement at APN 053-101-029 required additional consultation with Cal OSHA to comply with applicable regulations. The Class I Regulated ACM NPE containment at APN 053-101-029 was not maintained as required by applicable regulations. Maintaining the NPE containment during non-working hours proved not feasible at this site because of site-specific conditions. Cal OSHA approved an alternative to NPE during non-working hours for APN 053-101-029.

A generator was used to maintain the NPE during working hours because there was no on-site power source. Citing fire hazards caused by dry conditions and noise issues associated with generator use overnight and during the weekend, the debris removal contractor shut down the NPE during non-working hours over the weekend from 1730 on Friday, October 11, 2019 to 0700 on Monday, October 14, 2019. The Paradise Police Department subsequently prohibited the use of an unsecured generator during the night from Monday, October 14, 2019 to Tuesday, October 15, 2019 at this site.

The primary CAC working on the project notified applicable parties of the regulatory non-compliance, including Cal OSHA's Enforcement Division in Redding, California. Tetra Tech consulted with the Northern California District Manager for Cal OSHA to discuss project details, engineering controls, waste management, schedule, and challenges for maintaining the NPE at the APN 053-101-029 site. Cal OSHA approved the implementation of an alternative to the NPE overnight at this site. The contractor's work plan for asbestos abatement was revised to include the NPE alternative, specifying that the containment must be completed sealed and secured from intrusion without allowing any air flow in/out and no gross asbestos waste may be present within the containment. The contractor operated NAM equipment maintaining the NPE at this site until 1730, after which the alternative plan was put into place and approved secure and air-tight by one of the project CACs. Because the project CAC reached out to the Cal OSHA Enforcement Division for consultation and resolution of the issue, the alternative plan was successfully implemented until the air clearance criterion was met for the site on Wednesday, October 16, 2019. No enforcement actions were taken, and site work practices complied with safety practices and regulations.

5.4.11 Personal Air Sampling

CalRecycle contractors, including Tetra Tech, were responsible for collecting personal exposure samples during activities associated with debris removal. Debris removal contractors used subcontractors to collect

personal exposure samples. The contractors were responsible for collecting personal air samples for their employees and uploading sample results to the project files. Tetra Tech reviewed the contractor sampling data at the request of the State IMT. All personal air sampling results are summarized below.

Tetra Tech Personal Samples

Tetra Tech performed personal exposure assessments for field staff during field activities. Assessments were performed in compliance with 29 CFR Part 1910.1001(d)(2)(i) regarding PELs. These efforts are described in the Personal Air Sampling Plan (Tetra Tech 2019i). Table 5-8 contains a summary of air samples collected by Tetra Tech. Personal air sample data and results collected by Tetra Tech are provided in Appendix F.

During all site assessments, asbestos surveys, and soil sampling events, Tetra Tech personnel donned Level C or modified Level C PPE with appropriate respirators and cartridges. During air sampling and debris monitoring, Tetra Tech personnel donned Level C PPE when entering a site exclusion zone/work area. Site assessments, asbestos surveys, soil sampling, air sampling, and debris removal oversight tasks required Level C PPE based on potential employee exposure to airborne asbestos and silica or fire-related metals above the prescribed PELs. The potential for exposure required conducting an exposure assessment regulated under the OSHA method described at 29 CFR Part 1910.1001. The exposure samples were collected using breathing-zone air samples representative of the 8-hour TWA for each employee work category. For all samples with an 8-hour or greater run time, the 8-hour OEL was adjusted appropriately. For conservative measures, both a daily and a weekly adjusted 8-hour OEL were calculated, and the smaller of the two values was used for comparison with the laboratory result. Some workdays were shorter than 8 hours for various reasons. In these cases, the result was adjusted to a TWA based on the run time, to be compared to the 8-hour OEL.

Personal exposure monitoring samples were collected from January 12, 2019 to March 13, 2020 to assess worker exposure to asbestos, metals (including mercury and hexavalent chromium), and silica during site activities. On January 12, 2019, metals and asbestos sampling began. Silica sampling started on February 19, 2019. Mercury and hexavalent chromium sampling started on May 13, 2019.

Samples were collected daily from at least 25 percent of personnel involved in each work activity to represent a typical full-shift employee exposure for the duration of the field event. Sampling personnel included Environmental Unit Leaders and CACs/CSSTs performing site assessments, asbestos surveys, air sampling, and soil sampling and Task Force Leaders performing oversight on debris removal crews. For most of the samples, the workday averaged from 7- to 10-hours. Silica samples were only collected from Task Force Leaders.

Sample collection procedures were reviewed and directed by a Tetra Tech certified industrial hygienist. Selected personnel were fitted with a Gillian GilAir Plus low-volume air sampling pump consisting of polyvinyl tubing with the appropriate sample media (sampling train). The sample media were attached to the clothing or to PPE in the worker's breathing zone located in a hemisphere of 6- to 9-inches around the individual's face. The tubing was attached to the worker's clothing or PPE in such a manner as not to restrict their motion during site activities or present an entanglement hazard.

Each personal sampling pump was pre- and post-calibrated using a primary standard such as a Bios DryCal Defender 510 primary flow calibrator, Bios DryCal DC-Lite primary flow calibrator, or site-calibrated rotameters. Pre- and post-calibration flow rates were documented on the chain-of-custody form and the average flow rate was be used to calculate the sample volume. Air sampling pumps were pre-calibrated to 2 L/min for the following analyses: asbestos and metals (including hexavalent chromium and mercury). Silica samples were pre-calibrated to 2.5 L/min and equipped with an aluminum cyclone.

Asbestos air samples were collected using an air pump equipped with a 25 mm diameter, 0.8 µm MCE filter cassette. Metals and mercury samples were collected using an air pump with a 37 mm diameter, 0.8 µm MCE filter media. Silica and hexavalent chromium samples were collected using 37 mm, 5.0 µm polyvinyl chloride cassettes.

Samples were submitted to LA Testing, in Huntington Beach, California, for analyses. Metals samples were analyzed using NIOSH Method 7300/7303 (NIOSH 2003). Each asbestos sample was analyzed using NIOSH Method 7400 via PCM (NIOSH 1989). If PCM results were greater than 0.005 f/cc or in the event of any PCM detection for Task Force Leaders, asbestos samples were analyzed via NIOSH Method 7402 via TEM (NIOSH 1994). Silica samples were analyzed using NIOSH Method 7500 for respirable crystalline silica. Mercury samples were analyzed using the OSHA-ID 145 Modified method. Hexavalent chromium samples were analyzed using OSHA-ID 215M.

Samples were collected from Tetra Tech employees and subcontractors for analyses and include the following totals:

- Tetra Tech collected a total of 12,237 valid personal samples from 671 employees
- Tetra Tech collected a total of 3,896 personal metals samples from 455 employees. Metals were detected in 1,419 samples, including barium, beryllium, cadmium, chromium, copper, lead, vanadium, and zinc. There were 514 non-detections where the reporting limit was equal to or greater than the adjusted OEL for beryllium. There was one metals exceedance of the PEL for beryllium on July 25, 2019 from an Environmental Unit Leader performing soil sampling

Date Collected	Sample Identification	Personnel Task	Analyte	PEL (µg/m^3)	Analytical Result (µg/m^3)	Sample Duration (min)	Weekly OEL (µg/m^3)
7/25/2019	O133533	Soil	Beryllium	0.2	0.120	600	0.1

Notes:
µg/m^3 - micrograms per cubic meter
PEL - permissible exposure limit
OEL - occupational exposure limit

Tetra Tech collected 4,183 personal asbestos samples from 462 employees. Based on the initial PCM analysis, fibers were detected at or above the action level of 0.1 f/cc in 18 personal asbestos samples. The samples were analyzed using TEM. The TEM analysis did not confirm any elevated detections for asbestos, and the adjusted fiber counts were below the project action level for all personal asbestos samples.

Date Collected	Sample Identification	Personnel Task	Analyte	PEL (f/cc)	PCM Result (f/cc)	Adjusted TEM Result (f/cc)
1/30/2019	B273471	Personal	Asbestos	0.1	0.1	<0.0024
3/19/2019	E228384	Personal	Asbestos	0.1	0.1	<0.0028
3/22/2019	O173616	Personal	Asbestos	0.1	0.298	<0.0182
3/26/2019	E233559	Personal	Asbestos	0.1	0.111	<0.0029
3/28/2019	B273745	Personal	Asbestos	0.1	0.139	<0.0031
3/28/2019	E233559	Personal	Asbestos	0.1	0.116	<0.0026
3/30/2019	E233490	Personal	Asbestos	0.1	0.21	<0.0072
4/9/2019	E228381	Personal	Asbestos	0.1	0.242	<0.0025
4/13/2019	O127469	Personal	Asbestos	0.1	0.125	<0.0023

Date Collected	Sample Identification	Personnel Task	Analyte	PEL (f/cc)	PCM Result (f/cc)	Adjusted TEM Result (f/cc)
4/17/2019	E228384	Personal	Asbestos	0.1	0.14	<0.0029
4/24/2019	O173737	Personal	Asbestos	0.1	0.109	<0.0056
4/25/2019	E228381	Personal	Asbestos	0.1	0.209	<0.005
4/25/2019	E229713	Personal	Asbestos	0.1	0.203	<0.0025
4/26/2019	E228384	Personal	Asbestos	0.1	0.106	<0.0027
4/30/2019	O173584	Personal	Asbestos	0.1	0.306	<0.0025
6/20/2019	E228381	Personal	Asbestos	0.1	0.177	<0.0027
6/24/2019	E228381	Personal	Asbestos	0.1	0.168	<0.0042
7/9/2019	E228384	Personal	Asbestos	0.1	0.108	<0.0026

Notes:
f/cc - Fibers per cubic meter
PCM - Phase Contrast Microscopy
PEL - Permissible exposure limit
TEM - Transmission Electron Microscopy

Tetra Tech collected 1,166 personal silica samples from 263 employees. There were 51 detections of respirable crystalline silica. A total of four of the samples exceeded the OSHA PEL of 0.05 mg/m^3, but three of the samples were contaminated during laboratory sample preparation and are not representative of the samplers' exposures.

Date Collected	Sample Identification	Personnel Task	Analyte	PEL (µg/m^3)	Analytical Result (µg/m^3)	Sample Duration (minutes)
7/2/2019	B274431	Task Force Leader	Respirable Crystalline Silica	50	80	346
7/27/2019	A174097	Task Force Leader	Respirable Crystalline Silica	50	120	332
7/27/2019	E274585	Task Force Leader	Respirable Crystalline Silica	50	72	287
7/27/2019	B233045	Task Force Leader	Respirable Crystalline Silica	50	67	378

Note: Lab reported all above samples from July 27, 2019 as having been contaminated with environmental silica during sample preparation.
µg/m^3 - micrograms per cubic meter
PEL - Permissible exposure limit

Tetra Tech collected 1,407 personal mercury samples from 372 employees. There were no mercury detections or exceedances of the PEL of 0.025 mg/m^3.

Tetra Tech collected 1,585 personal hexavalent chromium samples from 385 employees. Hexavalent chromium was detected in 59 samples, with no exceedances of the PEL of 0.005 mg/m^3.

Contractor Personal Samples

Contractor sampling was conducted by three contractors: ECC, Ceres, and SPSG. Each contractor conducted daily personal air sampling on contactor debris removal teams and asbestos abatement crew employees throughout the duration of their time on site. ECC sampled January 30, 2019 through November 5, 2019. Ceres began sampling March 19, 2019 and continued through November 6, 2019. SPSG sampled February 4, 2019 through September 25, 2019.

To comply with OSHA regulations, air sampling was conducted on employees from each contractor with the highest potential exposure, including the following tasks: operator, laborer, foreman, ACM abatement, operator-laborer, task force monitor, and air monitoring technician.

In response to the potential hazards, personal air samples were collected and analyzed for the following analytes by each contractor: asbestos, respirable dust, crystalline silica, hexavalent chromium, and metals. Target metals were antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc. ECC, Ceres, and SPSG submitted analytical laboratory reports to the State IMT throughout the project.

- Ceres collected 944 asbestos samples, 907 respirable dust samples, 931 crystalline silica samples, 884 hexavalent chromium samples, and 932 metals samples
- ECC collected 1,164 asbestos samples, 1,188 respirable crystalline silica/respirable dust samples, 283 hexavalent chromium samples, 259 mercury samples and 1,238 metals samples
- SPSG collected 2,242 asbestos samples, 2,257 respirable crystalline silica/respirable dust samples, 1,125 hexavalent chromium samples, and 2,254 metals samples

ECC and Ceres provided air sample result summary tables containing personal sampling data, analytical results, and screening levels, which are described below. SPSG provide air sample result summary tables; however, the submittal date of July 23 did not enable Tetra Tech to provide a review or summary table of the results. The number of samples collected by SPSG provided above is estimated based on cursory review of raw analytical reports submitted to the IMT. Tables provided by the three contractors are included in Attachment 8.

Ceres collected 5,425 personal air samples on 150 working days from March 19 to November 6, 2019. Personnel position titles that were sampled include excavator operators, laborers, and skid steer operators. Ceres reported 48 personal samples that exceeded the relevant OELs selected by their certified industrial hygienist.

The OELs provided by Ceres were identified as Cal OSHA/OSHA PEL TWAs. Sample results were reported as the sample concentration. Sample run time in minutes was also provided for each sample. The tables did not indicate whether the provided sample concentration is a raw value or a calculated value, or if the Cal OSHA/OSHA PEL TWAs were adjusted for extended work shifts. Table 5-9 contains an overview of the results reported in Ceres Camp Fire Air Sampling Result tables. Sampling data and laboratory results for the samples identified as exceedances are provided in Table 5-10. All information in Table 5-9 and in Table 5-10 is based on the data provided in the Ceres Camp Fire Air Sampling Result tables. Laboratory reports were not evaluated and sample analytes, counts, concentrations, and/or exceedances were not confirmed with raw analytical data.

ECC collected 4,232 personal air samples on 186 working days from January 30 to November 5, 2019. Personnel sampled were those tasked with asbestos removal, debris removal, and chimney tipping. Personnel position titles included laborers, excavator operators, skid steer operators, and supervisors. ECC reported eight personal samples that exceeded the relevant OELs selected by their certified industrial hygienist.

The OELs provided by ECC were identified as 8-hour PELs/Threshold Limit Value (TLV). The PELs/TLVs were not adjusted for extended work shifts. Sample results were defined and reported as the average sample concentration for the sample duration, not the worker's TWA. Table 5-11 contains an overview of the results included in ECC Air Monitoring Report tables. Sampling data and laboratory results for the samples reported as exceedances are provided in Table 5-12. All information in Table 5-11 and in Table 5-12 is a selection of data provided in ECC Air Monitoring Report tables. Laboratory reports were not evaluated and sample analytes, counts, concentrations and/or exceedances were not confirmed with raw analytical data.

5.4.12 Deviations from the Work Plan

The CAMSP Revision 1 (Tetra Tech 2019g) stated that perimeter air monitoring and sampling was to be conducted at three fixed facility locations. The third identified location was Granite Construction. Air monitoring and sampling was not conducted at Granite Construction. The facility was not active in March 2019 when Odin and Franklin locations were confirmed, and access to the facility by field sampling teams for reconnaissance was not confirmed. On July 17, 2019, the Air Monitoring Liaison, in coordination with BCAQMD, decided not to pursue stationary monitoring at Granite Construction.

Tetra Tech collected air samples at perimeter, fixed facility, and personal samples during working hours. Air samples were collected from community locations 24 hours a day, 7 days a week. Air samples were not collected when operation were suspended, as directed by State IMT, or equipment failures. Occurrences of these non-sampling events are presented in Table 5-13.

Typically, asbestos samples are analyzed by TEM if they have PCM sample results greater than 0.005 f/cc. However, PCM results alone provide a fiber count, but do not differentiate between asbestos fibers and non-asbestiform fibers. Because TEM is a separate analysis with a separate turnaround time following PCM analysis, and to eliminate any confusion in asbestos sample results posted publicly, fixed facility samples were analyzed via NIOSH Methods 7400 and 7402 concurrently. Asbestos PCM results were presented in f/cc alongside either positive or negative confirmation of asbestos, as determined by the TEM results. TEM analysis confirmed the presence of asbestos fibers below 0.1 f/cc in four more personal samples. The adjusted fiber counts were below the project action level for all personal asbestos samples.

The State IMT directed TEM analysis for all PCM detections from Task Force Leader samples on May 6, 2019. A total of 85 previously-analyzed samples from Task Force Leaders with PCM detections on the project had already been disposed of by the lab and could not be analyzed further.

The DROP (CalRecycle 2019) states that "All air samples will be verified by Level 2 Verification. All Fixed Facility and Community locations will be Level 4 validation." Tetra Tech performed Level 4 validation on all ambient air samples yielding results that can be used to make risk-based conclusions. Samples from fixed facility locations were collected using personal sampling methods while debris cleanup activities were ongoing, yielding results that can be compared to occupational health limits (as described in CAMSP Revision 1 and Section 4.4.3 above). Tetra Tech performed Level 4 validation on community air samples and Level 2 validation on perimeter and fixed facility samples.

In accordance with the CAMSP Revision 1 (Tetra Tech 2019g), air monitoring and air sampling data were to be summarized and communicated to each location within two weeks of sample collection. The deliverables reporting schedule described in the revised CAMSP (Tetra Tech 2019g) was modified based on the actual sampling and analysis schedule. Community location metals samples shipments were scheduled by the laboratory to be weekly rather than daily. The analytical method for these samples requires mass determinations prior to sample analysis, and the laboratory policy is that the 72-hour turnaround time was based on determination of mass rather than sample receipt. Community location sampling data required

Level 4 validation prior to reporting. While preliminary sample results are reported within the turnaround time, the final data packages required to complete data validation are required within 30 days, though an accelerated reporting schedule for Level 4 packages was requested and implemented. While weekly result letters, which require data validation, were unable to be completed and submitted within two weeks of sample collection, the preliminary community and fixed facility monitoring and sampling results contained in the weekly letters were summarized for each location and made publicly available on the BCAQMD website in the twice-monthly reports submitted by the Air Monitoring Liaison, and on the public viewer linked on the BCAQMD website.

The CAMSP states, "Each perimeter location will consist of three equipment stations containing co-located monitoring and sampling equipment. These locations will be selected and established to be equally-spaced so that results can be representative of air quality conditions, recognizing that wind speeds and directions can frequently change throughout the course of a workday. Perimeter location selection will also consider aspects such as nearby homes, businesses, or schools that appear to have been repopulated. Actual equipment locations at these work sites will be selected based on observed meteorological conditions, the location of the work area relative to potential receptors, and the security of monitoring equipment."

Perimeter locations consisted of three equipment stations whenever possible. When the layout, size, or activities at a property with debris removal prohibited safe access to portions of the property, alternate debris removal locations were considered for perimeter monitoring and sampling. If a property with partially restricted access was determined to be the best available option to collect usable data, the site perimeter was occasionally deployed with only two equipment stations. A total of 46 perimeter air monitoring sites were deployed with less than three equipment stations on the Camp Fire Incident.

At the direction of the Air Monitoring Liaison, select perimeter locations consisted of six equipment stations rather than three. The six-station setups were typically used during asbestos abatement and debris removal at schools or at similarly sized sites. These properties used personnel and equipment from two or more debris crews simultaneously; the number of perimeter stations triangulated around the work area were similarly increased at these properties when directed to do so by the State IMT. At all perimeter sites with six stations, the placement of specific equipment stations was selected by the Air Monitoring Liaison and Environmental Unit Supervisor/Air Quality prior to abatement or debris removal activities. Perimeter locations were deployed with six stations at one property a total of 37 times from May 30 to August 27, 2019.

The CAMSP states that "Tetra Tech personnel will conduct periodic system checks of air monitoring equipment at a frequency of at least three times per day to ensure equipment is functional." Some 147 perimeter locations had zero to two station checks logged. System checks were not completed at the designated frequency when distance between multiple sites in different divisions or number of staff in the field prohibited field teams from accessing all deployed equipment multiple times throughout the day. Occasionally, site access was blocked for portions of the day, and all required checks were attempted but not completed. Staff were instructed to contact alternate field personnel or the Environmental Unit Supervisor in charge of field teams if they were unable to complete all three system checks at a location. System checks were completed as required to the extent possible under field conditions.

The majority of metals samples analyzed via NIOSH 7300/7303 failed to achieve analytical sensitivity required to report beryllium results below project screening levels. The beryllium detection limit was reported above the Threshold Limit Value of 0.05 $\mu g/m^3$ but below the PEL of 0.2 $\mu g/m^3$ in 164 background samples, 140 preliminary community samples, 808 fixed facility samples, and 13,603 perimeter samples. The laboratory reporting limits for all of these samples were higher than the Threshold Limit Value action level for beryllium but were below the PEL. Laboratory analytical challenges resulting in difficulty achieving appropriate method sensitivity for beryllium analysis are widely observed. Analytical challenges

include method sensitivity, variable sample collection time and sample mass, and the low occupational exposure limits for beryllium. The elevated laboratory reporting limits were likely caused by insufficient sample volumes. The levels in these samples were not detected greater than the reporting limits, but it is unknown if the results are greater than the site-specific air monitoring action levels. Data for these samples are reported as not detected. No further analysis of these data was performed.

During the removal activities, conducted under the original CAMSP (Tetra Tech 2018b), each air sampling location consisted of one high-flow air pump (QuickTake 30) for a high-flow asbestos sample and two low-flow air pumps (Gillian GilAir Plus) for a metals sample and a low-flow asbestos sample. High-flow air pumps were calibrated at a flow rate of approximately 10 L/min; low-flow air pumps were calibrated at a flow rate of approximately 3 L/min. Following implementation of the revised CAMSP (Tetra Tech 2019g), only the two low-flow air pumps were used for a metals sample and low-flow asbestos sample and the high-flow sample was eliminated.

Initially, if any of the high-flow asbestos air samples were overloaded and could not be analyzed through direct preparation, the low-flow asbestos sample from the same location was sent to the laboratory for analysis. Following implementation of the CAMSP Revision 1, all low-flow asbestos samples held under chain-of-custody were analyzed for evaluation with asbestos results collected under the revised CAMSP (Tetra Tech 2019g). If the laboratory reports containing high-flow asbestos samples had not already been validated, they were removed from the queue as long as alternate data from low-flow samples would become available for that location.

5.5 BACKGROUND SOIL EVALUATION

Tetra Tech conducted a background investigation to establish naturally occurring or anthropogenic (originating from human activities) metals concentrations in soil at the Camp Fire Incident. The sampling was conducted consistent with the approved Soil Sampling Plan, Camp Fire Incident, Butte County, California, Revision 3, dated February 6, 2019 (Tetra Tech 2019b). The background soil evaluation was submitted to the State IMT as Background Sampling and Cleanup Goals Report, Revision 2 (Tetra Tech 2019f).

5.5.1 Methodology

Background sampling was conducted in accordance with the objectives and measures in the DROP (CalRecycle 2019) and the approved soil sampling plan (Tetra Tech 2019b). The methodology is consistent with background sampling at all previous fire incidents evaluated by Tetra Tech, including Erskine, Clayton, Detwiler, Helena, Thomas, Mendocino Complex, and Carr Fire Incidents.

Samples were collected from 13 geologic units identified within the incident area as shown on Figure 5-7. The number of samples collected is correlated to the number of affected properties associated with each geologic unit, as presented in the soil sampling plan (Tetra Tech 2019b). The following exhibit presents the geologic units within the Camp Fire Incident boundary, the number of sampling locations with each unit, and the total number of samples collected per unit. Geologic units are listed in order of geologic age, with youngest geologic unit at the top.

Geologic Unit	Description	Locations	Samples
Q	Pleistocene-Holocene, nonmarine and some marine sedimentary, alluvium, terrace deposits	3	9
Tc	Tertiary, nonmarine sedimentary, sandstones, conglomerates, lake deposits	3	9
Tv	Tertiary volcanics	3	9
Tvp	Tertiary volcanics, pyroclastics, andesite	106	318
m	Pre-Cenozoic, metasedimentary and metavolcanic rocks, slate, quartzite, chert, schist, gneiss	3	9
Ku	Upper Cretaceous, marine sedimentary, metasedimentary, sandstone, shale, conglomerate	9	27
gb	Mesozoic, plutonic, gabbro, dark dioritic	7	21
grMz	Mesozoic, plutonic, granite, granodiorite, quartz diorite	12	36
Mzv	Mesozoic, mafic volcanic, andesite, rhyolite flows, greenstone, some Franciscan Formation	9	27
um	Mesozoic, plutonic ultramafic, serpentine, gabbro, peridotite	9	27
Pm	Permian, marine sedimentary and metasedimentary, shale, limestone, quartzite, some pyroclastics	3	9
Pz	Paleozoic, marine and metasedimentary, slate, sandstone, shale, chert, limestone, quartzite	19	57
Pzv	Paleozoic, metavolcanics, breccia, tuff, greenstone, interbedded sedimentary	6	18
	Totals:	**192**	**576**

5.5.2 Sample Collection Protocols

The SOW consisted of collecting soil samples from across the fire-impacted area and was conducted per the approved sampling plan (Tetra Tech 2019b). Soil sets consist of one surface and two borehole (subsurface) samples. A single surface soil sample was collected from each location identified. The top 3 inches of soil were removed by gloved hand or disposable plastic trowel. The surface soil sample, from the 3- to 6-inch below ground surface (bgs) interval, was collected with a disposable plastic trowel.

Subsurface (or borehole) samples were collected to identify metals concentrations potentially related to historical conditions or activities which have since been graded over or covered by current structures or landscaping. The subsurface samples were collected at the same location as each surface soil sample. The soil from the 6- to 9-inches bgs interval and the 9- to 12-inches bgs interval were collected with a stainless-steel bit hand auger. All samples were placed in 8-ounce jars, labeled, and stored in a cooler for shipment to the laboratory for analysis.

5.5.3 Analytical Methods

All samples were analyzed for CCR Title 22 metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc) by USEPA Method 6020 by BC Lab, a California-certified laboratory based in Bakersfield, California. Some samples were analyzed for mercury by USEPA Method 7471A because the start of background

sampling and analysis occurred before the laboratory could be notified that USEPA Method 6020 could be used for mercury. USEPA Methods 6020 and 7471A provide comparable results for mercury and the change in method did not affect the usability of the data or overall data quality, as both methods have been used at previous fire incidents. Consistent with previous fire incident reporting, soil data results were not dry-weight corrected by the laboratory.

Background soil sampling results were requested for 48-hour turnaround time, per direction from the State IMT and approved soil sampling plans. The background soil data underwent Stage 3 data validation. No data quality issues were identified during validation.

5.5.4 Background Soil Review and Statistical Evaluations

The background data were evaluated qualitatively and quantitatively following receipt of the analytical data. The following items were reviewed qualitatively: overall data distribution, distribution between surface and borehole samples, distribution within each geologic unit, distribution of data at margins of adjacent geologic units, and potential outliers. The qualitative evaluation did not indicate significant or measurable differences regarding the distributions of surface versus subsurface samples, distributions within geologic units, comparable geologic units, or geographic distributions, such as dividing units into eastern or western portions of the incident. The qualitative review of outliers is discussed below as a part of the quantitative evaluation.

The analysis of the distribution within each geologic unit, including complete statistical analysis and outlier identification, was conducted quantitatively using USEPA ProUCL Version 5.1, Statistical Software for Environmental Applications for Data Sets with and without Non-detect Observations (USEPA 2016).

The Tvp geologic unit represents 56 percent of the total samples collected. Because of the large area within the Tvp geologic unit affected by the Camp Fire Incident, population tests were conducted to evaluate whether multiple populations exist for key indicator metals arsenic and cobalt.

The first step for evaluating multiple populations was to create a quantile-quantile (Q-Q) plot of the data to evaluate whether any breaks or inflection points exist in the data. For arsenic, the Q-Q plot was created both with and without the non-detected results. The plotted data do not appear to indicate more than one population; thus, it was decided that there were not multiple populations within the Tvp data set and the statistical evaluation for Tvp was conducted on the full data set.

The statistical evaluation also included an identification of statistical outliers, defined as samples results which are larger or smaller than most of the data values within a sample distribution, and thus are not representative of the population from which they were drawn. The inclusion of outliers in the computation of the various decision statistics may yield inflated values of those decision statistics. Statistics which include outliers may represent those outliers disproportionately versus the main dominant population of interest (i.e., the background concentrations). The outliers cannot systematically be removed, however, because they could be appropriately within the sample population. Outliers can (1) represent actual soil background conditions, based on inherent natural soil variability, or (2) represent concentrations which are not naturally occurring, such as chemical spills or non-native imported soil, or laboratory errors.

A qualitative evaluation was conducted for each statistical outlier to evaluate whether the outlier should be removed or retained. The qualitative evaluation included graphing the results of the metal in consideration, change in the 95 percent Upper Tolerance Limit (95UTL) based on retaining or removing the outlier, comparison of the outlier concentration to concentrations within other geologic units, and the location of the outliers in relation to boundaries of the geologic units. The summary of the outlier evaluation is presented below.

Geologic Unit	Outlier Sample Location	Metal and Concentrations	Removed or Retained	Rationale
Tv	112	*Arsenic, 8.9 mg/kg*	Retained	Small number of samples and outlier within the expected background values for the area.
Tvp	013	*Cadmium, 6 mg/kg*	Removed	This cadmium result is a statistical outlier and is anomalous for the area, which is primarily non-detect for cadmium (312 non-detects out of 315 samples) with two very low detections.
	063	Arsenic, 46, 42, 15 mg/kg Nickel, 1,100 mg/kg	Removed	Three highest arsenic and the highest nickel results are in sample 063. These results are anomalous compared to other results when graphed and are also statistical outliers.
	191	Not applicable	Removed	Sample 191 is located on the border of Tvp and m units, and therefore its designation is ambiguous. There were no elevated concentrations associated with sample 191.
Ku	010	*Arsenic, 14 mg/kg*	Retained	Statistical distribution including sample is normal.
	022	Lead, 140 mg/kg	Removed	Lead result appears anomalous as compared to distribution in graphs and is a statistical outlier.
Gb	117	Arsenic, 51 mg/kg	Removed	This arsenic result is anomalous compared to other results when graphed and is also a statistical outlier.
grMz	046	*Cobalt, 22 mg/kg*	Retained	Statistical distribution including sample is normal.
um	174	Cobalt, 120, 110, 100 mg/kg Nickel, 1,100, 1,100, 1,100 mg/kg	Removed	Three highest cobalt and nickel results are in sample 174. These results are anomalous compared to other results when graphed and are also statistical outliers.
Pz	142	Cobalt, 120 mg/kg	Removed	This cobalt result is anomalous compared to other results when graphed and is also a statistical outlier.

Note:
Italicized sample results identified through qualitative review; all others identified by statistical tests.
mg/kg - milligrams per kilogram

The statistical evaluation for each geologic unit includes the frequency of detection, minimum detected concentration, maximum detected concentration, mean concentration, distribution, and 95UTL with 95 percent coverage. The sample result tables by geological unit and the output tables and graphs from ProUCL are included in Appendix G.

Background levels were calculated based on 95UTL, except in cases where all the results are not detected, or the metal was detected in fewer than four samples in a geologic unit. Statistical methods are not appropriate when fewer than four detected values are in a data set. When a metal was not detected in the background soil samples for the geologic unit, the selected background value is the highest reported laboratory detection limit for the metal. When a metal was detected fewer than four times in the background soil samples for the geologic unit, the maximum detected concentration was selected as the background concentration for the metal.

The statistical evaluations were completed twice, once with outliers and once without outliers. In addition, classical outlier test procedures, such as the Dixon test and the Rosner test were used to identify possible outliers and the data sets with suspected outliers were graphed using Q-Q plots, histograms, and box plots. This exercise enabled the computation of reliable and defensible background threshold values for project-related decisions.

5.5.5 Results

The results of the qualitative and quantitative analysis indicate that background concentrations should be applied to each geologic unit, based on all sample results, as modified by the outlier discussion presented above. There was no statistical justification to merge geologic units, subdivide geologic units, group geographically, or subdivide by sample depths for the determination of background units based on the background soil data set. The following table provides the background threshold value for each metal by geologic unit.

	Geologic Unit												
Metal	**Q**	**Tc**	**Tv**	**Tvp**	**m**	**Ku**	**gb**	**grMz**	**Mzv**	**um**	**Pm**	**Pz**	**Pzv**
Antimony	0.4 [1]	0.4 [1]	0.4 [1]	0.46 [2]	0.8 [2]	0.46 [2]	0.4 [1]	0.43 [2]	0.4 [1]	2 [1]	0.4 [1]	3.3	2 [1]
Arsenic	4.7	2.3	8.9	7.7	4.13	18	12	12	6.8	7.8	7.4	27	2.6
Barium	350	165	317	360	580	141	170	210	185	400	470	180	170
Beryllium	0.65	0.52	0.64	1.0	0.76	0.56	0.57	0.42	1.1	0.75	1.4	0.92	0.56
Cadmium	0.24 [1]	0.24 [1]	0.24 [1]	0.32 [2]	0.48 [2]	0.24 [1]	0.24 [1]	0.24 [1]	0.24 [1]	0.44 [2]	0.24 [1]	0.24 [1]	1.2 [1]
Chromium	77	81	116	200	266	82	790	240	233	403	280	293	282
Cobalt	23	28	27	36	56	28	53	22	32	49	43	37	45
Copper	50	37	110	77	108	60	76	84	97	119	77	130	141
Lead	63	21	12	54	22	50	11	17	14	11	9.3	23	51
Mercury	0.019 [2]	0.026 [2]	0.019	0.18 [2]	0.044 [2]	0.18 [2]	0.03 [2]	0.22 [2]	0.10 [2]	0.034 [2]	0.019 [2]	0.11	0.061 [2]
Molybdenum	0.36	0.25 [2]	0.65	1.1	0.704	0.49	0.72	1.5	1.3	1.8	0.64	4.2	1.1
Nickel	90	63	56	130	137	64	522	190	75	300	320	330	213
Selenium	0.55 [1]	1.8	0.55 [1]	4.5	1.1	1.2	0.55 [1]	0.55 [1]	1.3	0.96	0.55 [1]	2.1	2.8 [1]
Silver	0.26 [1]	0.26 [1]	0.26 [1]	0.28 [2]	0.51 [2]	0.26 [1]	0.26 [1]	0.26 [1]	1.2 [2]	1.3 [2]	0.27 [2]	0.26 [1]	1.3 [1]
Thallium	0.24 [1]	0.24 [1]	0.24 [1]	1.2 [1]	0.49 [1]	0.24 [1]	0.24 [1]	0.24 [1]	0.24 [1]	1.2 [1]	0.35 [1]	0.26 [1]	1.2 [1]
Vanadium	139	164	150	220	274	138	190	150	200	210	94	140	191
Zinc	70	68	63	120	94	230	69	55	106	118	113	131	208

Notes:
All units milligrams per kilogram.
Background levels calculated based on 95th upper tolerance level with 95 percent coverage of data, except as noted.
1 The metal was not detected in the background soil samples for the geologic unit. The value presented is the highest reported laboratory detection limit for the metal.
2 The metal was detected fewer than four times in the background soil samples for the geologic unit; thus, calculation of a statistical background level was not possible. The value presented is the maximum detected concentration for the metal.

5.6 CONFIRMATION SAMPLING

Confirmation sampling was conducted at individual properties following the completion of debris removal activities to confirm that no fire-related contaminants remained in soils beneath or adjacent to impacted structures. From February 7, 2019 through March 14, 2020, Tetra Tech collected more than 103,000 confirmation soil samples, including samples collected after rescrapes. The sampling was conducted consistent with the approved Soil Sampling Plan, Camp Fire Incident, Butte County, California, Revision 3, dated February 6, 2019 (Tetra Tech 2019b). All confirmation soil sampling data and associated records are provided in Attachment 5.

Confirmation sampling was conducted after debris removal at residential, commercial, school, and mobile home park properties. All properties were sampled following the sampling methodology as described in Section 5.5.1. Commercial properties were designated by the State as exempt or non-exempt from commercial waste profiling. Additional analysis was required for commercial non-exempt properties based on the results from waste profiling as described in Section 8.3 Commercial Waste Profiling.

The State IMT requested specific support from California DTSC in response to elevated mercury samples detected at five properties. DTSC provided all rescrape and sampling activities at these properties; neither the State IMT nor Tetra Tech were on-site to oversee or direct DTSC activities. Following removal activities, DTSC provided maps and sampling results to the State IMT and Tetra Tech, and final recommendations were provided consistent with the approved soil sampling plan (Tetra Tech 2019b). The five properties consisted of APN 017-230-056, APN 050-040-077, APN 052-181-001, APN 054-191-066, and APN 055-290-052_02B.

5.6.1 Soil Sampling Methodology

Confirmation sampling was based on USEPA Superfund Lead-Contaminated Residential Sites Handbook and conducted in accordance with the objectives and measures in the approved sampling plan (Tetra Tech 2019b), and the DROP (CalRecycle 2019). The methodology is consistent with confirmation sampling at all previous fire incidents evaluated by Tetra Tech, including Erskine, Clayton, Detwiler, Helena, Thomas, Mendocino Complex, and Carr Fire Incidents.

5.6.1.1 Frequency

Confirmation samples were collected from the former ash footprints of damaged structures and vehicles on each property where debris removal occurred. Structures were divided into sampling decision units (DU) based on the square footage of the ash and debris footprint for each structure as recorded during the site assessment survey and updated as appropriate during the soil sampling. A five-point composite soil sample was collected from every DU at 12,487 properties. The sampling frequency is presented in exhibit below and was based on the guidelines presented in the DROP (CalRecycle 2019) and soil sampling plan (Tetra Tech 2019b).

Estimated Square Footage of Structure Footprint	Number of 5-Point Aliquots
0 to 100 square feet	1
101 to 1,000 square feet	2
1,001 to 1,500 square feet	3
1,501 to 2,000 square feet	4
2,001 to 5,000 square feet	5
Greater than 5,000 square feet	Determined case-by-case

For structure footprints greater than 5,000 square feet, sampling strategies were designed such that no DU exceeded 1,000 square feet in accordance with the DROP (CalRecycle 2019). The case-by-case sampling summary for structures with structure footprints estimated as greater than 5,000 square feet is presented in Table 5-15. All sampling strategies at footprints greater than 5,000 square feet were approved by the State IMT.

There were 145 properties which did not include soil sampling for a variety of reasons, including the second level of duplexes, vacant lots, unburned structures, or other property-specific reasons. Properties with no soil sampling are presented in in Table 5-14. All determinations to not collect soil samples were confirmed or directed by the State IMT.

5.6.1.2 Collection

Confirmation samples were collected from surface soils (0- to 3-inches bgs) in each DU with 4-ounce dedicated plastic scoops. Each sample was a composite of five aliquots within the DU. Each aliquot was marked with a pin flag or spray paint and each DU was marked with a labeled pin flag at the north boundary. Soil from the five aliquots was combined in a zip-tight plastic bag and homogenized before being transferred into sample jars. Sample information, including sample date and time was recorded on a property-specific electronic data capture form. Structures sampled, structure square footage, and number of DUs were also recorded on the property-specific electronic data capture forms and confirmation soil maps.

If a confirmation soil sample result was greater than the cleanup goal and laboratory margin of error, an additional 2- to 3-inches of soil was removed by the cleanup contractor as directed by the State from the DU represented by the soil sample. This procedure was called a rescrape. Following the soil rescrape, new confirmation samples were collected from the DU following the same confirmation sample collection methodology. At DUs requiring multiple rescrapes, new confirmation samples would be collected after each rescrape. Sample information, including sample date and time was recorded on a property-specific electronic data capture form. DUs sampled and rescrape number were recorded on the property-specific electronic data capture forms and confirmation soil maps.

If soil sample results indicated that metal concentrations above the cleanup goals were likely from local background or ambient pre-fire conditions, then site-specific soil borings would be collected from below the surface and away from the burned structure ash footprints, per direction from the State IMT. At each soil boring location, a stainless-steel auger was used to collect samples from three separate depth intervals (usually 3- to 6inches, 6- to 9-inches, 9- to 12-inches, and occasionally 12- to 15-inches bgs) and placed directly into sample jars. Sample collection procedures for the site-specific borings were the same as for the background soil samples which are described in Section 5.5. Sample information, including sample date, time, and depth, was recorded on a property-specific electronic data capture form. Soil boring locations were recorded on the property-specific confirmation soil maps.

Based on rescrape sample results, some properties were recommended for X-ray fluorescence (XRF) screening by Tetra Tech and approved by the State IMT. XRF field screening allowed for focused removal of localized soil with metal concentrations exceeding the cleanup goals; this approach occasionally resulted in sampling areas being divided into smaller units. Sample methodology for XRF field screening samples is described in Section 5.6.2.

Some sample areas were not sampled based on obstructions left in the sampling area at homeowner request such as retaining walls, concrete pathways, patios, etc. If confirmation samples could not be collected because of an obstruction, Tetra Tech received written approval from the State IMT not to sample the area and a note was made on the site-specific sampling map. Homeowner requests approved by CalRecycle were typically documented in the site-specific Butte County Camp Fire Site Activity Form.

5.6.1.3 Sample Identification

All soil samples were assigned a unique sample identification number. The identifier was composed of the following information:

- Site Name – Camp Fire Incident – BFI
- APN
- Sample Location
- Sample Number
- Sample Depth, when applicable

Confirmation sample names used BFI, then APNs followed by the structures sampled (A, B, C, etc.), and the number of samples per structure based on the structure footprint (A1, A2, A3, B1, C1, C2, etc.).

	APN		Structure/Sample Number
Example Confirmation Sample Name:	123-456-789	–	A2

Rescrape sample names were the same as confirmation samples but added a suffix (R1, R2, R3, etc.) identifying the number of rescrapes within the DU.

	APN		Structure/Sample Number		Rescrape
Example Rescrape Sample Name:	123-456-789	–	A2	–	R1

Soil boring sample names were noted by the APN, soil boring number (SB01, SB02, etc.), and followed by the depths sampled (0306, 0609, 0912, 1215, where 0306 represents 3 to 6 inches bgs, etc.).

	APN		Soil Boring		Depth
Example Soil Boring Sample Name:	123-456-789	–	SB02	–	0306

XRF sample names were the same as rescrape samples but added a suffix (S1, S2, S3, etc.) for the section unit within the DU.

	APN		Structure/Sample Number		Rescrape		XRF Unit
Example XRF Sample Name:	123-456-789	–	B1	–	R2	–	S1

5.6.1.4 Handling

Sampling locations from all soil sampling events were noted in the property-specific confirmation soil maps and as documented in this summary report. The samples were labeled, packaged, and shipped in accordance with USEPA-approved sampling procedures and under appropriate chain-of-custody protocols and consistent with the soil sampling plan (Tetra Tech 2019b). Completed chain-of-custody forms are included with analytical records provided in Attachment 5.

Samples were analyzed by Alpha Analytical Laboratories (Alpha), American Environmental Testing Laboratory (AETL), ALS Environmental (ALS), BC Laboratories, Inc. (BCL), BSK Associates Laboratory (BSK), EMAX Laboratories, Inc. (EMAX), Enthalpy Analytical (Enthalpy), Eurofins CalScience (CalScience), Eurofins TestAmerica (TestAmerica), and Pace Analytical Services (Pace). All soil samples from a property were sent to the same laboratory for analysis. When laboratory capacity allowed, rescrape and soil boring samples from each property were sent to the same laboratory for analysis as the original confirmation samples from that property.

All confirmation, rescrape, and soil boring samples were analyzed for CCR Title 22 metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver thallium, vanadium, and zinc) using USEPA Method 6020. Some samples were analyzed for mercury by USEPA Method 7471A because the start of confirmation sampling and analysis occurred before laboratories could be notified that USEPA Method 6020 could be used for mercury. USEPA Methods 6020 and 7471A provide comparable results for mercury and the change in method does not affect the usability of the data or overall data quality, as both methods have been used at previous fire incidents. Consistent with previous fire incident reporting, soil data results were not dry-weight corrected by the laboratory.

Confirmation samples from three commercial non-exempt properties (APNs 053-012-023, 053-131-090, and 054-040-138) were also analyzed for volatile organic compounds (VOC) by ALS Environmental based on the results of the commercial waste profiling. Commercial waste profiling is discussed in Section 8.3.

Confirmation samples were analyzed on a 72-hour turnaround time. Confirmation samples from high-priority properties were analyzed on a 48-hour turnaround time per direction of the State IMT. All mobile home park spaces, rescrape, and soil boring samples were analyzed on a 48-hour turnaround time per direction of the State IMT.

5.6.1.5 Quality Assurance/Quality Control

Prior to conducting confirmation sampling at a property, site assessment forms and aerial imagery of the property were reviewed to ensure all structures to be sampled were included on the soil sampling map. Soil sampling maps and sample information for each property were recorded in a property-specific electronic data capture form by field sampling teams and reviewed by on-site senior staff for accuracy.

Matrix spikes and matrix spike duplicates (MS/MSD) were analyzed for the confirmation and rescrape soil samples to assist in evaluation of field and laboratory precision and accuracy. Confirmation soil samples were selected by the laboratories for MS/MSD analysis, at a frequency of no less than 1 in 20 samples. The laboratory injected ("spiked") a known concentration of each metal into the extra volume for the soil sample, and percent recoveries and relative percent differences were calculated for the precision and accuracy evaluations. MS/MSD evaluations are presented in the data validation reports in Appendix I.

5.6.1.6 Deviations from the Work Plan

The following were deviations from the soil sampling plan (Tetra Tech 2019b):

- The soil sampling plan notes that aliquot locations would be physically marked with spray paint. During rain or snow conditions, aliquot locations within DUs were marked with pin flags.
- The soil sampling plan notes that sampling locations would be recorded in the site logbook and using a GPS device. Sampling locations were recorded in the site-specific data capture form and on the site-specific sampling map. GPS coordinates were not critical or important to soil approval decisions.
- The soil sampling plan notes that rescrape samples would be collected as three discrete samples per sample area at properties with less than 1,000 square feet of burned area and properties with over 1,000 square feet of burned area but less than 50 percent of confirmation samples with results above cleanup levels. Collection of rescrape samples followed a confirmation sample methodology consistent with the DROP (CalRecycle 2019), as confirmed by the State IMT.

- Eleven properties had one fewer confirmation sample collected than per the frequency identified in the plan. In five cases the square footage difference was less than 100 square feet. In all cases, the spacing of the aliquots and number of confirmation samples collected provided complete aerial coverage of the burned structure areas and are considered useable for characterizing the areas sampled. The properties are listed below.

APN	Structure: Square Footage	Plan Samples Required	Samples Collected
050-190-039_FT6343	A: 1,680	4	3
050-440-009	C: 112	2	1
051-260-002	A: 2,100	5	4
052-090-055	A: 2,250	5	4
052-122-029	B: 2,100	5	4
053-070-033	A: 1,800	4	3
053-150-147	A: 1,525	4	3
055-500-008	C: 1,050	3	2
055-500-037	A: 2,200	5	4
058-420-005	A: 1,660	4	3
066-450-003	H: 180	2	1

5.6.2 XRF Screening

The XRF device was used as a field screening tool for preliminary identification and quantification of metal concentrations in the soil, either naturally occurring or from anthropogenic contamination, within the property footprint. From July 2019 to February 2020, XRF was used at 313 properties during the Camp Fire Incident. Table 5-16 provides the XRF-related property activities. XRF screening values were evaluated against established cleanup goals to guide real-time decisions by the State IMT for further excavation before collection of final confirmation soil samples.

Use of XRF allowed for focused removal of metal contaminants with concentrations exceeding field screening thresholds established by the State IMT and Tetra Tech, with review and approval by the State IMT. The goal of this procedure was to minimize the amount of soil excavated while reducing the need for additional rescrapes, which required the mobilization of heavy construction equipment to a property.

Tetra Tech field team Environmental Unit Leaders received specialized training using the Olympus Delta and Niton model XL3t handheld XRF analyzers, in compliance with manufacturer guidelines and safety protocols. XRF calibration was confirmed using manufacturer protocols and standards to ensure optimal instrument performance. Calibration checks were documented and can be found in Appendix H. All XRF screening values were recorded on field sheets. Samples that passed the XRF screen were shipped under chain-of-custody to an off-site laboratory for metals analyses by USEPA Methods 6020 and 7471 for final determination of property status.

XRF was initially used on properties with difficult access, properties that required a temporary bridge, and forced abatement properties, to expedite the cleanup process. After debris removal was completed, composite samples were collected and screened with the XRF for analyte identification and quantification. If an exceedance was identified, an immediate rescrape was performed before heavy equipment was demobilized from the property.

Additionally, properties that had previously undergone one or more unsuccessful rescrapes were recommended for XRF evaluation by Tetra Tech and approved by the State IMT. XRF rescrapes were part of a two-step process: an initial property assessment and a rescrape assessment. Field screening data were

collected using an XRF in situ analysis procedure created by the State IMT and Tetra Tech (Tetra Tech 2020b). Following an XRF evaluation recommendation, a preliminary evaluation of contaminated DU(s) was completed. DUs with an area greater than 100 square feet were divided into smaller sub-units and labeled Split 1 (S1), Split 2 (S2), etc. to identify a source area of contamination. If a source area could not be identified after the first division, additional divisions, labeled S1-A, S1-B, etc. were made. If contamination within a divided DU was identified, the contaminated sub-unit required additional excavation. The sub-units that did not exceed the screening threshold required no further excavation, but a confirmation sample was needed to analytically verify contamination was not present. DUs, sub-units, and sample aliquot locations were marked on the property sketch.

Five-point composite samples were collected from the surface of each DU and homogenized before XRF screening. If screening data from a surface soil sample indicated contaminant concentrations above the field screening threshold, subsurface samples were collected within the DU using a hand auger to identify the depth of contamination. If field screening of subsequent subsurface samples continued to indicate soil contamination at depth, subsurface samples were collected from outside of the debris footprint and screened to evaluate whether soil contamination was related to residual burned debris or representative of background or ambient soil contaminant concentrations. The subsurface samples were often sent to an off-site laboratory for further analysis by direction of the State IMT. Both surface and subsurface samples were collected during the initial assessment to examine the depth of contamination, which determined the amount of soil to be removed.

Field screening data, property sketches, and notes were recorded in the field and reviewed and digitized by on-site senior staff. Tetra Tech provided a summary package to the State IMT with a recommendation of excavation depth review. Following approval to proceed, the Tetra Tech XRF staff accompanied the rescrape crew to the scheduled site. Composite samples were collected following the soil rescrape and screened with the XRF analyzer to provide confidence that the collected sample would achieve laboratory analytical cleanup goals. If XRF screening results were less than the screening threshold, the collected sample was sent to an off-site laboratory for analytical confirmation. If the sample screened above the screening threshold, a further investigation of contaminant depth was made. The contractors were permitted to remove up to 6-inches of soil, including the recommended rescrape depth, based on the XRF results. If contamination exceeded 6-inches, the XRF team contacted the State IMT to discuss property conditions and further action.

In 16 cases, the State IMT requested incident reports to be submitted to document specific XRF findings. Incident reports were prepared for properties that were excavated to bedrock, had the presence of mine tailings, had discovery of foreign objects, or had contaminated fill material. The objects and conditions were photographed, XRF screened, documented, and reviewed by the State IMT who determined whether to continue with area remediation or to cease excavation activities based on circumstances unrelated to the Camp Fire Incident. Incident reports are discussed in Section 8.1.

Property Activities	Number of Properties
Total number of properties where XRF was used	313
XRF used to perform preliminary evaluation and XRF-guided rescrape per state recommendation	282
Properties with split decision unit samples	154
XRF used to screen confirmation soil samples by state request	3
XRF used to screen rescrape soil samples by state request, but where no preliminary XRF evaluation occurred	2

Property Activities	Number of Properties
Preliminary XRF evaluation occurred, but no XRF-guided rescrape occurred	19
XRF used because of property access issue	4
XRF used at Forced Abatement property	3
XRF incident reports	16

6.0 DATA VALIDATION

Tetra Tech performed data validation on air, background and confirmation soil, ash, staging soil, and hydrant samples as discussed in the following subsections. The "stages" of validation performed for each set of samples discussed were performed as defined in the USEPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (USEPA 2009). The data validation reports produced following the "stages" validation process are provided in Appendix I.

6.1 DATA QUALIFIERS

Assignment of data qualification flags for analytical data from the laboratories used for air, soil, and miscellaneous samples collected from the Camp Fire Incident site conformed to the USEPA National Functional Guidelines for Inorganic Superfund Data Review (USEPA 2017b) and the USEPA National Functional Guidelines for Organic Superfund Data Review (USEPA 2017c). Data review specifications require that various data qualifiers be assigned when a deficiency is detected. If no qualifier is assigned to a result that has been reviewed, the data user is assured that no technical deficiencies were identified during validation. The qualification flags used are defined as follows:

- J – The analyte was positively identified; the associated value is the approximate concentration of the analyte in the sample.
- J+ – The analyte was positively identified; the associated value is the approximate concentration of the analyte in the sample and may be biased high.
- J- – The analyte was positively identified; the associated value is the approximate concentration of the analyte in the sample and may be biased low.
- U – The analyte was not detected at or above the associated value (reporting limit).
- UJ – The analyte was not detected at or above the associated value (reporting limit), which is considered approximate because of deficiencies in one or more quality control criteria.

Rejection of data was not required for the data set reviewed. The reviewed data are considered suitable for decision-making purposes with the qualifications deemed necessary through the validation process. A "U" qualifier does not indicate that a data deficiency exists because all non-detect values are flagged with the "U" qualifier regardless of whether a quality deficiency has been detected.

6.2 AIR SAMPLES

Of the air samples discussed previously in Section 4.4, the community, background, fixed facility, and perimeter air samples underwent validation. These samples were analyzed for metals and asbestos, as discussed in the following sections. Additionally, one personal sample data package for silica was validated as discussed below.

6.2.1 Community Air Samples

Community air samples were collected according to the DROP (CalRecycle 2019) and CAMSP (Tetra Tech 2018b, 2019g). These air samples were analyzed for asbestos by ISO Method 10312, Ambient Air – Determination of Asbestos Fibers – Direct Transfer Transmission Electron Microscopy Method and metals by USEPA Inorganic Compendium Method IO-3.5, Determination of Metals in Ambient Particulate Matter Using ICP/MS.

Stage 4 validation was performed on over 1,000 samples in 108 asbestos data packages provided by LA Testing and on over 700 samples in 22 metals data packages provided by Eastern Resource Group. A discussion of the QC deficiencies resulting in data qualification and the data validation reports summarizing the validation of each data package are presented in Appendix I.

6.2.2 Background, Fixed Facility, and Perimeter Air Samples

Background, fixed facility, and perimeter air samples were collected according to the DROP (CalRecycle 2019) and CAMSP (Tetra Tech 2018b, 2019g). These air samples were analyzed for asbestos by NIOSH Method 7400 (via PCM) and/or NIOSH Method 74702 (via TEM), as well as for metals by NIOSH Method 7300/7303 (using inductively coupled plasma/atomic emission spectroscopy). Additionally, one personal air data package containing samples analyzed for silica in accordance with 29 CFR 1910.1053(c) and as specified in the Personal Air Sampling Plan (Tetra Tech 2019i) was validated based on a laboratory note stating that several samples included in the package were contaminated with environmental silica during sample preparation.

Stage 2A validation was performed on the follow air data sets provided by LAT:

- Ten personal air samples located in the single data package discussed above for silica
- Over 180 background air samples located in eleven data packages for metals
- Over 100 background air samples located in eleven asbestos by PCM data packages
- Over 1,000 fixed facility air samples located in 135 data packages for metals
- Over 1,000 fixed facility air samples located in 136 asbestos by PCM data packages, with a subset of 1,000 samples located in 131 asbestos by TEM data packages
- Over 16,000 perimeter air samples located in 203 data packages for metals
- Over 16,000 perimeter air samples located in 222 asbestos by PCM data packages, with a subset of almost 200 samples located in 81 asbestos by TEM data packages

A discussion of the QC deficiencies resulting in data qualification and the data validation reports summarizing the validation of each data package are presented in Appendix I.

6.3 SOIL SAMPLES

Background and confirmation soil samples were collected according to the DROP (CalRecycle 2019) and the Soil Sampling Plan (Tetra Tech 2019b). Background and confirmation soil samples were analyzed for metals by USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA publication SW-846, Third Edition, Final Updates I, II, IIA, IIB, III, IIIA, IIIB, IV, and V (USEPA 2015) Method 6020B. Additionally, AETL, BCL, EMAX, Enthalpy, CalScience, ExcelChem, and Pace performed the mercury analyses by SW-846 Method 7471B because these laboratories did not have the capacity or certification required to perform the analyses by SW-846 Method 6020A. This deviation to the DROP was approved in advance by the State IMT.

Stage 3 validation was performed on almost 600 metals background soil samples located in 39 data packages. Stage 2A validation was performed on the following metals confirmation soil data sets:

- Over 33,000 samples located in 5,940 data packages analyzed by Alpha
- Over 11,000 samples located in 1,995 data packages analyzed by AETL
- Almost 4,500 samples located in 787 data packages analyzed by ALS
- Over 18,000 samples located in 3,166 data packages analyzed by BCL

- Over 18,000 samples located in 3,152 data packages analyzed by BSK
- Over 300 samples located in 60 data packages analyzed by CalScience
- Over 1,500 samples located in 268 data packages analyzed by EMAX
- Almost 2,400 samples located in 437 data packages analyzed by Enthalpy
- 67 samples located in 13 data packages analyzed by ExcelChem (mercury only)
- Over 7,300 samples located in 1,350 data packages analyzed by Pace
- Almost 6,000 samples located in 1,023 data packages analyzed by TestAmerica

A discussion of the QC deficiencies resulting in data qualification and the data validation reports summarizing the validation of each data package are presented in Appendix I.

6.4 MISCELLANEOUS SAMPLES

Validation was performed on several samples collected to support activities not discussed in the previous sections. These validation efforts are discussed in the following sections.

6.4.1 Waterway Ash Samples

The State IMT requested Tetra Tech collect ash samples at burned residential areas bordering waterways according to the Soil Sampling Plan, Revision 3 (Tetra Tech 2019b) and the Abbreviated Sampling and Analysis Plan for Ash Sampling (Tetra Tech 2019e). These samples were analyzed for the following parameters:

- Polycyclic aromatic hydrocarbons (PAH) by SW-846 Method 8270D-selected ion monitoring (SIM)
- Cyanide by SW-846 Method 9012
- Anions by EPA Method 300.0
- pH by SW-846 Method 9045D
- Total dissolved solids (TDS) by USEPA Method 160.1
- Wet extraction test (WET) lead by SW-846 Method 6010B
- Metals by SW-846 Methods 6010B and 6020A
- Sulfide by SW-846 Method 9034
- Perfluorinated alkyl substances (PFAS) by USEPA Method 537 modified
- Polybrominated diphenyl ethers (PBDE) by USEPA Method 1614

A total of 150 ash samples located in 41 data packages provided by BCL underwent Stage 2A validation. A discussion of the QC deficiencies resulting in data qualification and the data validation reports summarizing the validation of each data package are presented in Appendix I.

6.4.2 Waste Profiling Ash Samples

Ash samples were collected as part of the commercial waste profiling effort. These ash samples were collected according to the Soil Sampling Plan, Addendum 2, Revision 2 (Tetra Tech 2019h) and the Background Sampling and Cleanup Goals Report (Tetra Tech. 2019f). These samples were analyzed for the following parameters:

- Benzene, toluene, ethylbenzene, and xylenes (BTEX) by SW-846 method 8260B

- Semi-volatile organic compounds (SVOC) by SW-846 method 8270D
- Pesticides by SW-846 method 8081B
- Herbicides by SW-846 method 8151A
- Polychlorinated biphenyls (PCB) by SW-846 method 8082A
- Total petroleum hydrocarbons (TPH) by SW-846 method 8015C
- Metals by SW-846 method 6020A
- Mercury by SW-846 method 7471B
- Toxicity characteristic leaching procedure (TCLP) metals by SW-846 methods 1311/6010B
- WET metals by SW-846 method 6010B

Over 1,300 ash samples located in 282 data packages provided by ALS underwent Stage 2A validation. A discussion of the QC deficiencies resulting in data qualification and the data validation reports summarizing the validation of each data package are presented in Appendix I.

6.4.3 Staging Soil Samples

The staging soil samples were collected according to the Soil Sampling Plan, Addendum 4, Revision 0 (Tetra Tech. 2019j) and the Debris Removal Operations Plan (CalRecycle. 2019). These samples were analyzed for various combinations of the following parameters:

- VOCs by SW-846 method 8260B
- SVOCs by SW-846 method 8270D
- Pesticides by SW-846 method 8081B
- PCBs by SW-846 method 8082A
- TPH by SW-846 method 8015C
- Dioxins/Furans by SW-846 method 8290
- Metals by SW-846 Method 6020A
- Mercury by SW-846 Method 7471B
- Cyanide by SW-846 method 9012
- Sulfide by SW-846 method 9034
- Reactive cyanide and sulfide by SW-846 Chapter 7
- TCLP metals by SW-846 Methods 1311/6010B
- WET metals by SW-846 Method 6010B

Almost 200 staging soil samples located in nine BCL data packages, one ALS data package, one Enthalpy data package, and one Pace data package underwent Stage 2A validation. Stage 2A validation was a deviation from the plans referenced above, which stipulated Stage 3 validation. However, Tetra Tech did not receive data packages of an appropriate level to perform Stage 3 validation for the staging area samples. This deviation is considered acceptable because the data usage for the staging area samples is comparable to property rescrape soil data, which underwent Stage 2A validation as discussed previously. A discussion of the QC deficiencies resulting in data qualification and the data validation reports summarizing the validation of each data package are presented in Appendix I.

6.4.4 Hydrant Samples

The hydrant samples were collected according to the Hydrant Sampling Plan (Tetra Tech 2019d) and the Hydrant Sampling and Employee Industrial Hygiene Exposure Monitoring plan (Tetra Tech 2019l). A total

of 21 water samples were analyzed for VOCs using USEPA method 524.2 by BSK and for SVOCs using USEPA method 625 by Alpha in one combined data package. Additionally, 48 air samples in one data package were analyzed for BTEX by method IH-BTEX by LAT. These two data packages underwent Stage 2A validation. A discussion of the QC deficiencies resulting in data qualification and the data validation reports summarizing the validation of each data package are presented in Appendix I.

6.4.5 Truck Spill Soil Samples

Soil samples were collected at two truck spill incidents. Seven soil samples each were collected from the areas of the truck spill in Concow and the truck spill at the intersection of Clark Road and Meadow Song Drive in Paradise in general accordance with the Soil Sampling Plan, Revision 3 (Tetra Tech 2019b). These 14 samples were submitted to BSK for metals analyses by SW-846 method 6020A, and the two data packages underwent Stage 2A validation. A discussion of the QC deficiencies resulting in data qualification and the data validation reports summarizing the validation of each data package are presented in Appendix I.

7.0 CONFIRMATION SOIL SAMPLE RESULTS

This section provides a summary of the cleanup goals approved by the State IMT, the review, recommendations, and approval process for incoming confirmation sample results, the methodology and summary of properties cleared through soil boring results, a discussion of elevated arsenic and lead identified in groups of properties, deviations from the work plan, and statistical evaluations of all confirmation results program wide, and by residential, commercial, mobile home, and school properties.

7.1 CLEANUP GOALS

California and federal health-based and hazardous waste standards were compiled by the State IMT to evaluate cleanup goals for the Camp Fire Incident. Background levels are also considered when establishing cleanup goals to ensure that resources are not allocated to removing soil concentrations which may be above the health-based standards but are not related to the debris from the incident. As discussed in Section 4.5, the 95UTL statistic is used to identify the background concentration for each metal within each geologic unit.

All risk-based screening levels presented in this report represent residential and unrestricted use scenarios. Separate screening levels applicable to commercial properties were also developed and are discussed in Section 8.3. The regulatory goals evaluated consist of:

1. California DTSC, Office of Human Health and Ecological Risk Assessment, Note 3, June 2018 (Human and Ecological Risk Office [HERO] Note 3) (DTSC 2018)
2. California Hazardous Waste Total Threshold Limits Concentration (TTLC), CCR, Title 22, Chapter 11, Article 3
3. USEPA Regional Screening Levels (RSL) (USEPA 2018)

Except for thallium, the cleanup goal is the lower of the DTSC HERO, TTLC, and EPA RSL levels unless the background concentration is greater than the screening level. If the background concentration is higher than the screening level, the background concentration is selected as the cleanup goal to avoid removing soil concentrations which may be above the health-based standards but are not related to the Camp Fire Incident. The State IMT selected the California Human Health Screening Level (CHHSL) value of 5.0 mg/kg for thallium (California Office of Environmental Health and Hazard [OEHHA] 2010) as a result of laboratory technical limitations and based on past fire incident experience. CHHSLs for other chemicals have been superseded by the updated DTSC HERO or USEPA RSL values and were not considered.

Health-based standards were applied as the cleanup goal for all metals except arsenic, cobalt, nickel, and thallium. The 95UTL was used as the screening value for arsenic for all geological units. The 95UTLs were used as the screening values for cobalt except for the Q and grMz geological units, which use the health-based screening value for cobalt. The 95UTL for nickel was selected as the cleanup value for the gb geological unit because the background level was greater than the health-based screening level. Finally, as indicated previously, the cleanup goal for thallium is the CHHSL value (OEHHA 2010) because of laboratory technical limitations in meeting the current health-based screening levels.

The comparison tables which include the calculated background threshold values compared to the appropriate health-based screening level for each geologic unit are provided as Tables 7-1a through 7-1m. If the cleanup goals were based on the DTSC Screening Levels, CHSSL, USEPA RSL, or the background threshold value, a 20 percent laboratory margin of error was added to the value, except for lead. Samples above the health-based screening goal but within the laboratory margin of error are considered by the State IMT to meet the overall cleanup objectives of the debris removal action. See California Residential Wildfire

Soil Cleanup Goals Work Sheet 2019 for further information in Attachment 1. The summary of selected cleanup goals for each geologic unit based on health-based standards and background concentration is presented below.

Metal	Geologic Unit												
	Q	**Tc**	**Tv**	**Tvp**	**m**	**Ku**	**gb**	**grMz**	**Mzv**	**Um**	**Pm**	**Pz**	**Pzv**
Antimony	37	37	37	37	37	37	37	37	37	37	37	37	37
Arsenic	***5.6***	***2.7***	***11***	***9.2***	***5.0***	***21***	***14***	***14***	***8.1***	***9.4***	***8.9***	***32***	***3.2***
Barium [1]	9,999	9,999	9,999	9,999	9,999	9,999	9,999	9,999	9,999	9,999	9,999	9,999	9,999
Beryllium	18	18	18	18	18	18	18	18	18	18	18	18	18
Cadmium	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Chromium [1]	2,499	2,499	2,499	2,499	2,499	2,499	2,499	2,499	2,499	2,499	2,499	2,499	2,499
Cobalt	28	***33***	***32***	***43***	***67***	***33***	***64***	28	***38***	***59***	***52***	***44***	***54***
Copper [1]	2,499	2,499	2,499	2,499	2,499	2,499	2,499	2,499	2,499	2,499	2,499	2,499	2,499
Lead [2]	80	80	80	80	80	80	80	80	80	80	80	80	80
Mercury	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Molybdenum	468	468	468	468	468	468	468	468	468	468	468	468	468
Nickel	588	588	588	588	588	588	***626***	588	588	588	588	588	588
Selenium [1]	99	99	99	99	99	99	99	99	99	99	99	99	99
Silver	468	468	468	468	468	468	468	468	468	468	468	468	468
Thallium [3]	6	6	6	6	6	6	6	6	6	6	6	6	6
Vanadium	468	468	468	468	468	468	468	468	468	468	468	468	468
Zinc [1]	4,999	4,999	4,999	4,999	4,999	4,999	4,999	4,999	4,999	4,999	4,999	4,999	4,999

Notes:
All results presented in milligram per kilogram (mg/kg).
*Values in **bold italics** are calculated background threshold values.*

1 Cleanup goal selected using the higher value of background threshold value or appropriate health-based screening level. The selected cleanup goals for indicated metals is the Hazardous Waste TTLC Limit. The TTLC limits are "less than values." Thus, the cleanup goals were lowered by 1 mg/kg to be less than the TTLC limit for each of the metals.

2 Per the State IMT, the lead cleanup level is based on the California Department of Toxic Substances Control, Office of Human Health and Ecological Risk Assessment, Note 3, June 2018 (DTSC 2018) value for lead without an adjustment for laboratory margin of error.

3 The State IMT selected the California Human Health Screening Level (OEHHA 2010) of 5.0 mg/kg for thallium as a result of laboratory technical limitations and based on past fire incident experience. A 20 percent laboratory margin of error was added for thallium.

If confirmation soil sample results from a property appeared to demonstrate elevated ambient metals (for example, most or all of the results for a metal exceed the cleanup goal or concentrations remained elevated after additional soil was removed [rescrape] from the property), several approaches were used to evaluate whether a property met the cleanup goals for the program. These approaches included:

1. If confirmation sample results from a property at or near the boundary of another geologic unit appear consistent with the nearby geologic unit, the background values set for the nearby geologic unit were also considered.
2. Site-specific borings were collected to evaluate site-specific ambient levels for the subject property.

3. Site-specific borings on nearby properties were considered. Generally, nearby properties with soil borings were considered if the properties were less than 0.5 mile from the subject property. It should also be noted that properties were evaluated as the confirmation sampling results became available and the nearest soil borings available at the time of review were used in the evaluation. In many cases, additional soil borings were requested for a given area. Thus, in some cases soil boring results existed at the end of the sampling effort closer to a subject property that were not available when a property was initially evaluated. Properties were not re-evaluated after approved for erosion control.
4. Soil boring results collected for the background soil study were also considered. Specifically, BK-063 in Tvp was used as a nearby soil boring to clear two properties during confirmation sample review.
5. Whether the property was in a localized area that has elevated ambient metal concentrations ("Zone X" areas as discussed below) was considered. In these areas, the cleanup goals were increased to account for elevated ambient metals concentrations observed in multiple soil boring results from locations that did not have ash or fire debris.
6. Multiple rescrapes performed or removal of soil to bedrock were considered.
7. Results of site-specific XRF surveys of the property were evaluated.
8. Indications of historical agricultural or mining activities, fill material, or debris on the property not related to the Camp Fire Incident were considered.

Any revised background levels, or consideration of background levels identified on a site-specific basis, were proposed to and approved by the State IMT. The site-specific borings collected during the confirmation sampling process and use of soil borings to determine that nearby properties have met cleanup requirements are further discussed in Section 7.3.

Area-specific trends of elevated metal concentrations were identified during the confirmation sampling process. The background concentrations for arsenic were re-evaluated based on the results of additional soil boring samples collected outside of ash or debris areas during confirmation sampling. Revised cleanup values for arsenic in certain subareas in geologic units Tvp and Tc were identified as "Zone X" areas. The Zone X areas and the revised arsenic cleanup goals for these areas were proposed to and approved by the State IMT. The following exhibit provides a list of the Zone X areas, the number of properties included in each area, and the revised arsenic cleanup goal applied at each area.

Geologic Unit /Area Name	Revised Arsenic Cleanup Goal	Affected Number of Properties
Tc / Honey Run Zone X	5.2	31
Tvp / Apple View Zone X	43	25
Tvp / Del Mar Zone X	73	21
Tvp / Opal Zone X	33.6	71
Tvp / Patrick Zone X	43	106

Note:
All concentrations in milligram per kilogram (mg/kg).

7.2 CONFIRMATION SOIL SAMPLE REVIEW PROCESS

Analytical reports with confirmation sample results were received in electronic format and reviewed for completeness against the chain-of-custody forms prepared in the field. Electronic results were loaded into a database for sample tracking and reporting. Cleanup goals screening tables comparing confirmation samples to the cleanup goals for each individual property were generated through the database.

The review process consisted of (1) evaluating the sampling map for completeness regarding property information and sample frequency, (2) reviewing confirmation sample results compared to cleanup goals and laboratory margin of error, and (3) providing draft recommendations to the State IMT for review and approval.

If all confirmation sample results were below the cleanup goals and laboratory margin of error, the property was recommended for erosion control. If any confirmation sample result was above the cleanup goal and laboratory margin of error, it was recommended for a rescrape. If confirmation sample results from a property appeared to demonstrate elevated background metals, results were compared to nearby properties with soil borings, if available, or site-specific borings were recommended to establish site-specific background levels.

Results just below the cleanup goals or exhibiting other qualities such as elevated metals commonly associated with ash were identified for evaluation by the State IMT. Tetra Tech provided draft recommendations for each property to the State IMT for review, approval, and debris contractor direction. For rescrape recommendations, Tetra Tech identified structures to be rescraped, and the State IMT provided the depth of rescrape to the debris removal contractor.

In some instances, properties did not meet the numeric cleanup goals even following multiple rescrapes. Several approaches were used to evaluate whether a property met the cleanup goals for the program. These approaches included use of on-site soil borings, additional rescrapes performed or removal of soil to bedrock, or results of site-specific XRF surveys of the property. At some properties, there were indications of historical agricultural or mining activities, fill material, or debris on the property not related to the Camp Fire Incident. Clearance using soil boring results is discussed in Section 7.3. Table 7-2 provides the list of properties that could not meet the numeric cleanup goals but were determined to meet the program cleanup goals based on rationales other than soil boring results.

7.3 SITE-SPECIFIC SOIL BORING CLEARANCES

If confirmation soil sample concentrations remained greater than established numeric cleanup levels after debris at a property was cleared, the State IMT authorized various approaches to evaluate whether the

property met the cleanup goals for the program. In select cases, additional subsurface soil boring samples were collected to evaluate whether metals concentrations extended to depth.

The diverse geology of Butte County results in a high variability in metals concentrations between geologic units and even within the small area of an individual property. In addition, there are past activities, such as agriculture or mining, that can result in elevated concentrations of certain metals. Site-specific soil borings were collected at 298 properties. Samples were collected outside the ash footprint at various depth intervals to evaluate whether elevated confirmation soil sample results were consistent with background or ambient concentrations for the property. The site-specific borings were also used to evaluate whether the cleanup goals of the program were achieved at 300 nearby (within 0.5 mile) properties. All soil boring recommendations and numbers of borings were reviewed and approved by the State IMT. Sample collection procedures for the site-specific borings were consistent with background soil samples, as described in Section 4.5.

Site-specific borings were collected at 298 properties. Results from the site-specific soil borings were used to support that confirmation soil results from 300 nearby properties were also representative of background or ambient conditions. The properties with soil borings collected and the rationale for collecting the borings are provided on Table 7-3. Properties evaluated using nearby soil borings are provided on Table 7-4. The locations of the properties with soil borings and the properties cleared with nearby soil borings are depicted on Figures 7-1 through 7-14.

Properties Cleared by Soil Borings		
Properties with on-site soil borings	298	2% of total
Properties with on-site soil borings that cleared with rescrape(s)	64	0.5% of total
Properties with on-site soil borings with debris or fill not related to the Camp Fire Incident	7	0.06% of total
Properties cleared by nearby soil borings	300	2% of total
Total properties cleared by soil borings	583	5% of total

Note:
Fifteen properties (050-150-037_16, 050-370-022, 051-040-071, 053-170-145_1558_1560, 053-230-141, 054-201-047_07, 054-201-047_17, 058-450-017, 064-340-011, 064-350-058, 064-550-001, 064-550-002, 065-540-024_HOUSE, 066-180-018, and 066-230-050) have site-specific borings but were cleared for erosion control using borings from nearby properties. These 15 properties are included in both the properties with on-site borings and the properties cleared by nearby borings but only included once in the total properties.

Properties were evaluated as the confirmation sampling results became available. The nearest soil borings available at the time of review were used in the evaluation. In many cases, multiple soil borings were requested within a specific area. As a result, some properties were cleared by a soil boring farther than the nearest soil boring. Properties were not re-evaluated at the conclusion of all sampling events.

7.4 LEAD ARSENICAL EVALUATION

This section summarizes the results of the assessment of elevated arsenic and lead results from soil confirmation sampling at impacted properties in association with confirmation samples collected following debris removal activities. Tetra Tech presented information regarding the arsenic and lead patterns, agricultural history, and pesticide use in Paradise, summary of results, and recommendations for further action in Elevated Arsenic and Lead Patterns, Camp Fire Incident, dated March 10, 2020 (Tetra Tech 2020), included as part of Attachment 6. Within the report, Tetra Tech recommended that the report outlining the

hypothesis of pesticide use in these historic agricultural areas resulting in significant arsenic and lead contamination be provided to Butte County and the California DTSC.

7.4.1 Elevated Arsenic and Lead Patterns

During review of confirmation sample results, elevated levels of arsenic and lead were observed at several properties. These properties were rescraped per the Soil Sampling Plan. As more properties were cleared of debris, the confirmation sampling data set became more robust, and patterns of the two elevated metals became apparent in eight groups of properties, herein defined as "clusters," and presented on Figure 7-15. The elevated pattern is unusually distinct and has not been observed at any previous fire incidents.

Generally, ash-related metals appear as combinations of a variety of metals, consisting of antimony, arsenic, cadmium, cobalt, copper, lead, nickel, and zinc (Tetra Tech 2019c). Typical ash-contamination is demonstrated by a variety of the metals listed above their cleanup goals, with no discernable pattern. Confirmation results from the clusters indicated only soil concentrations of arsenic and lead over cleanup goals, with remarkably consistent results throughout the confirmation samples. Examples of the elevated arsenic and lead patterns are presented in Appendix J. The concentrations of arsenic and lead are well above established state and federal guidelines for the protection of human health and the environment.

The State IMT directed Tetra Tech to collect samples from soil borings outside of debris ash footprints at multiple depths to determine if the elevated metals were related to the Camp Fire Incident. Soil borings were collected at several clusters, and sample results confirmed elevated arsenic and lead concentrations away from ash debris and at depth. New background levels were established for arsenic within four of the clusters sampled: Apple View Way, Del Mar Drive, Patrick Drive, and Opal Lane. Each of these clusters included properties modified with the Zone X designation to reflect elevated arsenic concentrations as the established background levels. Lead background levels were not adjusted at the direction of the State IMT. Properties with elevated arsenic or lead concentrations at the other four clusters, Apple Lane, Nielsen Drive, Orchard Drive, and Sawpeck Way, were not designated Zone X areas, and were cleared through excavation or use of nearby site-specific soil boring results.

Debris removal activities continued, and properties were excavated and cleared per standard operating procedures. At several properties, debris removal could not meet the established background levels for arsenic or lead, and debris removal activities were directed as complete by the State IMT, with the justification that contamination was not attributed to the Camp Fire Incident. The State IMT discussed each of these properties with Butte County prior to approval of completion.

Tetra Tech provided an initial assessment of the clusters via email to Todd Thalhamer, Camp Fire Operations Chief, CalRecycle, on August 30, 2019. The email provided a hypothesis that the elevated arsenic and lead concentrations were related to historic application of lead arsenate pesticides at fruit tree orchards in the Town of Paradise, and not from the Camp Fire Incident. The email summarized Tetra Tech's review of the Town of Paradise history, aerial photographs, and historical surveys which supported the hypothesis. The email indicated the challenge of separating the two sources of contamination (Camp Fire Incident debris ash and agricultural use), since both metals are also known contaminants within debris ash, as observed in ash sample results collected during the Camp Fire Incident response. Diane Lampkin and Amber Lane, Planning Chiefs, California Governor's Office of Emergency Services (CalOES) and Alan Zamboanga, Finance Chief, CalRecycle, were also provided briefs of the email, as well as Tom Parker, Senior Hazardous Materials Management Specialist, Butte County.

7.4.2 Agricultural History and Pesticide Use in Paradise

Agriculture is known to have existed in the Town of Paradise since the late 1800s. The first harvest festival in the area occurred in 1888. In the early 1900s, the irrigation district and railroad were established in the area. Farmers growing apples, plums, and pears used the water supplied by the irrigation district to grow their crops and the railroad to transport the crops to markets (Town of Paradise 2019).

Review of historical aerial photographs and topographical maps of the area shows many former orchards in areas identified as clusters. Many of these former orchards have been converted to residential or commercial areas and in 2018 were burned during the Camp Fire Incident. The historic agricultural land use of these properties, and subsequent fill, grading, and construction activities, likely impacted metals concentrations at the surface and near surface soils. Figures 7-16 and 7-17 show orchards in historical aerial photographs correlated with two of the identified clusters. Each figure shows an example of the distinct elevated arsenic and lead concentrations from an example property within the cluster. Figure 7-18 provides a historical topographical map indicating widespread agricultural use within the Town of Paradise including the eight clusters.

If a property contained orchards that date back to the mid-1900s or earlier, it was widespread practice, and therefore likely, that arsenic-containing pesticides were used. Lead arsenate ($PbHAsO_4$) was first introduced in 1892 and soon came to be the preferred pesticide, especially in apple orchards, because of its excellent control of codling moths, a major pest of apples. Lead arsenate was popular with growers because it was inexpensive, easy to mix, and very persistent (Schooley et al. 2008). In addition to apple orchards, lead arsenate was used on other fruit trees, garden crops, turfgrasses and against mosquitos.

Current and former agricultural soils may contain elevated levels of arsenic and lead resulting from past pesticide use. Lead arsenate and other arsenical pesticides were designed to be persistent in the environment. Once lead arsenate reaches soil through over-spray, spillage, rainfall wash-off, or fallen fruit and leaves, the lead arsenate undergoes hydrolysis, separating into lead and arsenic bound to organic particles in the soil. The lead, being poorly soluble, is immobilized, and typically remains within the top 12 to 18 inches of topsoil. The fate of the arsenic is similar, but slightly more complicated. Arsenic, as arsenate, is somewhat soluble, and can be transported by water (Hood 2006), possibly leaching into ground water, rivers and lakes. These contaminants may also have been mixed into native soil during tilling between crop cycles, generally at a depth of 12 to 18 inches. Common and widespread use of these pesticides may also have led to their application beneath home slab foundations for the same purpose. It is also possible that when orchards were eliminated, the topsoil was used as graded backfill in nearby new housing developments, as there is not always a one-to-one correlation with the historical maps and the noted elevated arsenic and lead patterns.

The persistence of arsenic compounds can result in contamination being present decades after the pesticide use ends. Soil on agricultural land treated with arsenical pesticides may retain substantial amounts of arsenic because the arsenic binds very tightly to soil particles. Mean total arsenic concentrations of 50 to 550 mg/kg have been recorded for agricultural soils treated with arsenical pesticides (Walsh & Keeney 1975; Takamatsu et al. 1982; Sanok et al. 1995). A more recent study from Australia (Ng et al. 1998) measured total arsenic concentrations of 32 to 1,597 mg/kg in soil where arsenical pesticides had been applied 30 years previously.

7.4.3 Confirmation Sampling Results

At the completion of all debris removal activities, approximately 250 properties were identified as Zone X, of which approximately 220 were within the TVP Background set. Not all properties demonstrating the elevated arsenic and lead results were selected as Zone X. For example, if too few samples were collected

to confirm the pattern, the debris removals proceeded with the original cleanup levels for arsenic. To provide context of the arsenic concentrations, the background for arsenic in the TVP Background is 7.7 mg/kg. Properties with the pattern most frequently have arsenic concentrations ranging from the 20s to 40s mg/kg and can extend as high as 360 mg/kg.

Background levels for lead were not established for the Camp Incident by the State IMT, and instead the health-based screening level of 80 mg/kg was applied as the cleanup level for all properties. Properties with the pattern most frequently have lead concentrations ranging from the 150s to 250s mg/kg and can extend as high as 2,000 mg/kg.

The eight clusters identified within the Camp Fire Incident have shown consistently distinct and uniquely elevated levels of both arsenic and lead in the soil before and after debris removal, and in soil borings collected from the properties. During the debris removal operations, approximately 250 of the properties within the clusters had their background screening levels modified as Zone X during confirmation reporting. Background levels were modified based on arsenic concentrations reported in soil borings collected outside of building footprint ash areas to adjust the ambient level of arsenic used as the cleanup level. There were many properties, likely between 50 and 100, within the other clusters and other areas within the Camp Fire Incident where the arsenic and lead contamination pattern were noted but were not classified as Zone X due to lesser occurrence of the distinct pattern, or fewer samples collected in that area to justify a Zone X designation. These properties were often still cleared for fire-related contamination by nearby soil borings, but their background arsenic levels were not adjusted.

Soil borings are used to identify site-specific elevated levels of metals which may not have been captured during the initial background soil investigation (Tetra Tech 2019c). Soil confirmation samples collected in areas with combined elevated arsenic and lead often have concentrations similar to levels in the soil boring samples, further supporting that elevated concentrations are not fire debris related. For example, four properties on Del Mar Avenue have soil borings collected outside of ash areas with arsenic concentrations ranging from 4.7 mg/kg to 160 mg/kg, and lead concentrations ranging from 15 mg/kg to 328 mg/kg. The soil confirmation samples for these four properties have arsenic concentrations between 4.4 mg/kg and 39 mg/kg, and lead concentrations between 13.4 mg/kg to 484 mg/kg, as well as a 2,000 mg/kg lead detection. The repeated instances of this pattern of arsenic and lead concentrations required numerous rescrapes of affected properties, sometimes with the final results still not meeting the original background levels for arsenic or health-based screening levels for lead. Appendix J provides examples from each cluster of the elevated arsenic and lead patterns. The examples do not have the adjusted Zone X background concentrations, to demonstrate the distinction between established background concentrations and possible historic agricultural contamination.

Throughout the debris removal process, Tetra Tech maintained a geographical-based database with all metals results. This database was used to model concentrations of arsenic and lead throughout the incident boundary. The elevated arsenic concentrations are consistent with the clusters identified, but also indicate elevated arsenic concentrations outside of the clusters, which were either removed, or cleared through site-specific borings as mentioned previously. The modeled arsenic concentration results are shown on Figure 19. The pattern of elevated concentrations of lead observed in confirmation soil samples is not as pronounced because of the prevalence of lead contamination from other sources such as lead-based paint, leaded gasoline, ammunition, etc. Maps for each of the eight clusters are included as Figures 7-20 through 7-27.

There are numerous additional properties in these areas that have consistently elevated arsenic concentrations, but not elevated lead. The consistently elevated arsenic is also likely attributable to historic pesticide use, either from arsenical pesticides other than lead arsenate, or because the lead in the surface soil in these areas was moved or removed during development while that arsenic remained in deeper soil.

7.4.4 Arsenic and Lead Areas Conclusions and Recommendations

Some historic agricultural practices have caused anthropogenic pollution and should be considered as a potential source of arsenic and lead contamination in former orchards. Past environmental studies have demonstrated some orchards show the unique and distinctive pattern of elevated arsenic and lead concentrations in soil samples. Based on these studies of other agricultural areas, elevated lead from lead arsenate use is not expected greater than 12 to 18 inches below ground surface. Because arsenic is more soluble, arsenic contamination can be deeper and more widespread from the area of pesticide application.

While the debris removal operations successfully removed the fire-related contamination within the footprints of burned structures, the environmental data supports that arsenic and lead contamination is likely to be present in areas not excavated throughout the areas identified by Tetra Tech. Additionally, some properties outside of the known areas, and properties not affected by the Camp Fire may also be impacted. This anthropogenic pollution may exceed acceptable human health levels and should be further evaluated.

While the confirmation samples collected represent an extremely robust coverage of arsenic and lead throughout the Town of Paradise, for the reasons listed above, they do not characterize all potentially affected properties. Further evaluation may be conducted through the application of portable XRF technology, which is successful in identifying shallow, highly contaminated soil. XRF is an effective tool to evaluate the soil outside the ash footprints at properties identified with the elevated arsenic and lead pattern, or at properties not evaluated. XRF results can be used to determine if any additional sampling is necessary and can be used to evaluate residual soil conditions for protection of human health and the environment. If required, addressing any additional data needs or mitigation efforts would be most effective if conducted prior to construction activities at the subject properties.

7.5 DEVIATIONS FROM THE WORK PLAN

The evaluation of confirmation sample and soil boring results followed the processes and guidelines presented in the DROP (CalRecycle 2019), the Camp Fire Soil Sampling Plan, Revision 3 (Tetra Tech 2019b) and the Camp Fire Background Summary Report, Revision 2 (Tetra Tech 2019f), with the exception of the results from the properties identified in Table 7-5. The deviations noted in Table 7-5 do not impact the overall cleanup objectives for each property or the Camp Fire Incident response objectives.

7.6 SUMMARY STATISTICS

Results for the 12,487 properties with soil confirmation samples were compared to cleanup goals developed specifically for the Camp Fire Incident as discussed in Section 7.1. More than 100,000 confirmation soil samples and 3,000 soil boring samples were collected throughout the response. Each property in the program was assigned the appropriate background screening data set based on geologic unit or area-specific ambient screening levels (i.e., Zone X properties). The cleanup goals are based on health-based screening levels established by USEPA (USEPA 2018) and DTSC (DTSC 2018) for residential use and the local background concentrations of metals in soils (Tetra Tech 2019f).

Confirmation samples were collected from the former ash footprints of 26,160 damaged structures and vehicles on each property where debris removal occurred. Structures were divided into sampling DU based on the square footage of the ash and debris footprint for each structure as recorded during the site assessment survey and updated as appropriate during the soil sampling. The number of structures in each category is presented in exhibit below.

Estimated Square Footage of Structure Footprint	Number of 5-Point Aliquots	Number of Structures	Percentage of Total Structures [1]
0 to 100 square feet	1	7.201	28%
101 to 1,000 square feet	2	7,702	29%
1,001 to 1,500 square feet	3	3,428	13%
1,501 to 2,000 square feet	4	3,085	12%
2,001 to 5,000 square feet	5	4,603	18%
Greater than 5,000 square feet	Determined case-by-case	131	0.5%
	Total	**26,160**	**100%**

Note: Due to rounding of the individual results, the percentages may not add to 100%.

If initial confirmation sampling results were above a numeric cleanup goal, the debris removal contractor was mobilized to the property to conduct a rescrape. An additional 3- to 6-inches of soil was removed from the sampling area for the rescrape. In some cases, particularly those involving lead, the State IMT requested rescrapes for exceedances of the cleanup goal without accounting for the laboratory margin of error, or if elevated sampling results indicated that ash remained at a property even if cleanup goals were not exceeded in any sample. Another confirmation sample was collected from each completed rescrape location and compared to the numeric cleanup goals. This process was repeated until the most recent sample results were below the cleanup goals, or it was determined by the State IMT that the elevated metal concentrations were not related to the Camp Fire Incident as described in Section 7.2.

The summary of confirmation soil sample results (including samples after rescrapes) exceeding the cleanup goals is presented below.

Analyte	Samples Above Cleanup Goal	Number of Properties with Exceedance [1]	Percent of Exceedances [2]
Antimony	77	73	0.6%
Arsenic	5,256	2,068	39%
Beryllium	3	2	0.02%
Cadmium	128	116	1%
Chromium	1	1	0.008%
Cobalt	1,610	596	12%
Copper	157	142	1%
Lead	5,513	2,435	41%
Mercury	259	150	2%
Nickel	233	80	2%
Thallium	5	4	0.04%
Vanadium	10	5	0.08%
Zinc	62	61	0.5%
Total	**13,314**		**100%**

Notes:

1 Properties frequently had exceedances of multiple metals, so the total number of properties with at least one exceedance is not the sum of the column.

2 Due to rounding of the individual results, the percentages may not add to 100%.

The number of properties with samples that exceeded cleanup goals and required rescrapes or soil borings are summarized below.

Status	Properties	Percentage (%) [3]
Initially Clean	8,192	66%
One Rescrape	3,496	28%
Two Rescrapes	655	5%
Three Rescrapes	131	1%
Four Rescrapes	12	0.1%
Five Rescrapes	1	0.008%
Total	**12,487**	**100%**
Soil Borings [1]	583	5%
Other [2]	21	0.2%

Notes:
1 Properties with site-specific soil borings or cleared by nearby soil borings are included in the totals for properties with rescrapes. Most properties cleared by soil borings had one or two rescrapes prior to soil borings being requested.
2 Properties cleared using other criteria than the numeric cleanup goals and soil borings. Examples include establishing that contamination existed from sources other than the Camp Fire Incident or soil was cleared to bedrock. These properties are presented on Tables 7-2 and 7-5.
3 Due to rounding of the individual results, the percentages may not add to the total.

Because of the large scale of the Camp Fire Incident, the statistical evaluations presented above were also applied to the four general types of properties impacted by the fire: residential properties (other than those in mobile home parks), mobile home parks, commercial properties, and school properties. An analysis of these properties is provided in the following subsections.

7.6.1 Residential Properties

The Camp Fire Incident burned all or part of 10,732 residential properties, not including residences in mobile home parks. A total of 3,374 (31 percent) residential properties had exceedances of cleanup goals based on samples collected after the initial debris clearing. Consistent with the overall program, lead and arsenic most commonly exceeded their respective cleanup goals. The percentages of exceedances are similar to the overall program, since they make up the majority of the properties within the program. A summary of confirmation soil sample results for residential properties is presented below.

Analyte	Samples Above Cleanup Goal	Number of Properties with Exceedance [1]	Percent of Exceedances [2]
Antimony	68	64	0.6%
Arsenic	4,541	1,748	39%
Beryllium	3	2	0.03%
Cadmium	117	106	1%
Chromium	1	1	0.009%
Cobalt	1,477	533	13%
Copper	141	126	1%
Lead	4,793	2,145	41%
Mercury	221	129	2%
Nickel	212	61	2%
Thallium	5	4	0.04%
Vanadium	10	5	0.09%

Analyte	Samples Above Cleanup Goal	Number of Properties with Exceedance [1]	Percent of Exceedances [2]
Zinc	56	55	0.5%
Total	**11,645**	-	**100%**

Note:
1 Properties frequently had exceedances of multiple metals, so the total number of properties with at least one exceedance is not the sum of the column.
2 Due to rounding of the individual results, the percentages may not add 100%.

Of the 3,680 residences with initial cleanup goal exceedances, 2,993 were cleared after one rescrape, 561 required two rescrapes, 114 required three rescrapes, 11 required four rescrapes, and one required five rescrapes to meet the numeric cleanup goals. In addition, site-specific soil borings were used to clear 249 residences and nearby soil borings were used to clear an additional 255 residences. Other or additional criteria were used to clear 15 residences. The number of residential properties with samples that exceeded cleanup goals and required rescrapes or soil borings is summarized below.

Status	Properties	Percentage (%)
Initially Clean	7,052	66%
One Rescrape	2,993	28%
Two Rescrapes	561	5%
Three Rescrapes	114	1%
Four Rescrapes	11	0.1%
Five Rescrapes	1	0.009%
Total	**10,274**	**100%**
Soil Borings [1]	504	5%
Other [2]	15	0.1%

Notes:
1 Properties with site-specific soil borings or cleared by nearby soil borings are included in the totals for properties with rescrapes. Most properties cleared by soil borings had one or two rescrapes prior to soil borings being requested.
2 Properties cleared using other or additional criteria than the numeric cleanup goals and soil borings. Examples include establishing that contamination existed from sources other than the Camp Fire Incident or soil was cleared to bedrock. These properties are further discussed in Section 7.1 and 7.5.
3 Due to rounding of the individual results, the percentages may not add to the total.

7.6.2 Mobile Home Parks

The Camp Fire Incident burned all or part of 31 separate mobile home parks, consisting of 1,450 individual spaces. Of the individual mobile home spaces, 456 (31 percent) had exceedances of cleanup goals based on residential exposure levels after the initial debris clearing. Arsenic most commonly exceeded its cleanup goal, followed by lead. The frequency of arsenic exceedances (51 percent) for mobile homes was higher than overall program and the frequency of lead exceedances (34 percent) was lower than the overall program. The differences in metals concentrations are likely attributable to differences in construction materials as compared to other properties within the program. Nine metals exceeded their cleanup goals for mobile home park spaces compared to 13 metals which had exceedances for the entire program. A summary of confirmation soil sample results exceeding the cleanup goals is presented below.

Analyte	Samples Above Cleanup Goal	Number of Properties with Exceedance [1]	Percent of Exceedances [2]
Antimony	5	5	0.5%
Arsenic	516	253	51%
Cadmium	8	7	0.8%
Cobalt	93	48	9%
Copper	14	14	1%
Lead	339	173	34%
Mercury	18	12	2%
Nickel	13	13	1%
Zinc	1	1	0.1%
Total	**1,007**	-	**100%**

Notes:
1 Properties frequently had exceedances of multiple metals, so the total number of properties with at least one exceedance is not the sum of the column.
2 Due to rounding of percentages, the total may not add to 100 percent.

Of the 456 mobile home spaces with initial cleanup goal exceedances, 369 were cleared after one rescrape, 50 required two rescrapes, and seven required three rescrapes to meet the numeric cleanup goals. A similar percentage (31 percent) of the mobile home properties required rescrapes as for the overall program (34 percent). Site-specific soil borings were used to clear 28 individual mobile home spaces and nearby soil borings were used to clear an additional 30 mobile home spaces. The need for soil borings was just slightly lower than the overall program. The number of mobile home park properties with samples that exceeded cleanup goals and required rescrapes or soil borings is summarized below.

Status	Properties	Percentage (%) [3]
Initially Clean	994	69%
One Rescrape	399	28%
Two Rescrapes	50	3%
Three Rescrapes	7	0.5%
Total	**1,450**	**100%**
Soil Borings [1]	58	4%
Other [2]	4	0.3%

Notes:
1 Properties with site-specific soil borings or cleared by nearby soil borings are included in the totals for properties with rescrapes. Most properties cleared by soil borings had one or two rescrapes prior to soil borings being requested.
2 Properties cleared using other or additional criteria than the numeric cleanup goals and soil borings. Examples include establishing that contamination existed from sources other than the Camp Fire Incident or soil was cleared to bedrock. These properties are further discussed in Section 7.1 and 7.5.
3 Due to rounding of the individual results, the percentages may not add to the total.

Commercial Properties

The Camp Fire Incident burned all or part of 296 commercial properties. A total of 152 commercial properties had exceedances of cleanup goals based on unrestricted use (residential exposure levels) after the initial debris clearing. For the commercial properties, lead most commonly exceeded its cleanup goal, followed by arsenic. The frequency of lead exceedances (59 percent) for commercial properties was higher than overall program and the frequency of arsenic exceedances (29 percent) was lower than the overall program. Cobalt was also less likely to exceed cleanup goals at commercial properties, while mercury was

slightly more likely to exceed cleanup goals. The differences in metals concentrations are likely attributable to differences in construction materials or in part, to the use and activities formerly occurring at the respective commercial properties, as compared to other properties within the program. Nine metals exceeded their cleanup goals compared to 13 metals for the entire program. The summary of confirmation soil sample results exceeding the cleanup goals for commercial properties is presented below.

Analyte	Samples Above Cleanup Goal	Number of Properties with Exceedance [1]	Percent of Exceedances [2]
Antimony	4	4	0.6%
Arsenic	182	62	29%
Cadmium	3	3	0.5%
Cobalt	38	14	6%
Copper	2	2	0.3%
Lead	376	116	59%
Mercury	20	9	3%
Nickel	8	6	1%
Zinc	4	4	0.6%
Total	**637**	-	**100%**

Notes:
1 Properties frequently had exceedances of multiple metals, so the total number of properties with at least one exceedance is not the sum of the column.
2 Due to rounding of percentages, the total may not add to 100 percent.

Of the 152 commercial properties with initial cleanup goal exceedances, 99 were cleared after one rescrape, 42 required two rescrapes, ten required three rescrapes, and one required four rescrapes to meet the numeric cleanup goals. A higher percentage (51 percent) of the commercial properties required rescrapes than for the overall program (34 percent). In addition, site-specific soil borings were used to clear 13 commercial properties and nearby soil borings were used to clear eight additional commercial properties. The number of commercial properties with samples that exceeded cleanup goals and required rescrapes and/or soil borings is summarized below.

Status	Properties	Percentage (%) [3]
Initially Clean	144	49%
One Rescrape	99	33%
Two Rescrapes	42	14%
Three Rescrapes	10	3%
Four Rescrapes	1	0.3%
Total	**296**	**100%**
Soil Borings [1]	21	7%
Other [2]	2	0.7%

Notes:
1 Properties with site-specific soil borings or cleared by nearby soil borings are included in the totals for properties with rescrapes. Most properties cleared by soil borings had one or two rescrapes prior to soil borings being requested.
2 Properties cleared using other or additional criteria than the numeric cleanup goals and soil borings. Examples include establishing that contamination existed from sources other than the Camp Fire Incident or soil was cleared to bedrock. These properties are further discussed in Section 7.1 and 7.5.
3 Due to rounding of the individual results, the percentages may not add to the total.

7.6.3 School Properties

There were nine school properties affected by the Camp Fire Incident:

- Ponderosa Elementary School
- Paradise High School
- Paradise Elementary School
- Paradise Intermediate School
- Paradise Adult School
- Paradise Unified School District Food Facility
- Golden Feather Elementary School
- Pine Ridge School
- Ridgeview High School

Sample results from seven of the nine school properties (Ponderosa Elementary School, Paradise High School, Paradise Elementary School, Paradise Intermediate School, Paradise Unified School District Food facility, Pine Ridge School, and Ridgeview High School) exceeded cleanup goals based on residential exposure levels after the initial debris clearing. Arsenic most commonly exceeded its cleanup goal, followed by lead. The frequency of arsenic exceedances (65 percent) for school properties was higher than the overall program and the frequency of lead exceedances (23 percent) was lower than the overall program. Only four metals exceed their cleanup goals compared to 13 metals for the entire program. The differences are difficult to attribute to any one factor because of the small number of school properties.

Analyte	Samples Above Cleanup Goal	Properties [1]	Percent of Exceedances [2]
Arsenic	17	5	65%
Cobalt	2	1	8%
Lead	6	2	23%
Zinc	1	1	4%
Total	**26**	**-**	**100%**

Notes:
1 Properties frequently have more than one analyte exceed. Thus, the totals exceed the total number of properties.
2 Due to rounding of percentages, the total may not add to 100 percent.

Of the seven school properties with initial cleanup goal exceedances, five were cleared after one rescrape and two required two rescrapes to meet the numeric cleanup goals. A higher percentage (78 percent) of the school properties required rescrapes than for the overall program (34 percent). No soil borings or other approaches were needed to clear school properties. The differences are difficult to attribute to a single factor because of the small number of school properties.

Status	Properties	Percentage (%)
Initially Clean	2	22%
One Rescrape	5	56%
Two Rescrapes	2	22%
Total	**9**	**100%**

8.0 ADDITIONAL ACTIVITIES

This section describes activities conducted beyond those described in the previous sections, including unforeseen activities that are not specifically described in the DROP (CalRecycle 2019). Specific activities include events that generated an incident report, ash sampling, commercial waste profiling, staging area sampling, hydrant sampling, subslab sampling, dug well abandonment, and hazardous materials response activities.

Tetra Tech presented briefings regarding the SOW for these additional activities, schedule, implementation, and results of various activities to the State IMT at formal semi-weekly IMT planning meetings every Tuesday and Friday throughout the duration of the Camp Fire Incident debris removal program. The State IMT provided additional direction and concurrence for the various activities at the semi-weekly planning meetings.

8.1 INCIDENT REPORTS

On a case-by-case basis, the State IMT requested that Tetra Tech prepare incident reports documenting various incidents. Tetra Tech generated incident reports for extenuating events and activities that were not within the scope of normal activities identified in the DROP (CalRecycle 2019). Tetra Tech documented incidents in both short report format and e-mail format.

During the Camp Fire Incident debris removal program, the State IMT directed Tetra Tech to document and report 26 incidents to the State IMT, including 16 legacy fill evaluations, two elevated mercury evaluations, five radiation evaluations, two debris truck spills, and one water sampling event. Incident reports and incident e-mails are included in Appendix K and summarized in Table 8-1. A brief description of each type of incident is presented below.

8.1.1 Legacy Fill

During the soil rescrape and XRF assessment process, 16 properties were identified as locations of legacy fill material. Legacy fill includes debris or other fill material containing elevated levels of contaminants that was deposited prior to the Camp Fire Incident. Specific areas within these properties contained pre-fire debris such as artifacts, lead- or arsenic-contaminated soil, or mine tailings. Multiple rescrapes were performed at each property in attempts to meet the lead and arsenic cleanup goals established for the Camp Fire Incident. The cleanup goal is 80 mg/kg; arsenic cleanup goals are location-dependent. Soil samples collected from the affected decision units of 15 of the 16 properties did not meet the established cleanup goals. The State IMT determined that the legacy fill contamination was not related to the Camp Fire Incident and halted rescrape activities at these 15 properties. The State IMT approved the properties for erosion control. Incident reports documented the evaluation efforts at each site and TT then notified the County of Butte, Environmental Health Department.

8.1.2 Elevated Mercury

Tetra Tech collected confirmation soil samples within the footprint of destroyed structures at all sites after debris removal. At five properties, confirmation sample results exceeded the mercury cleanup goal of 1 mg/kg by an order of magnitude and the properties were referred to DTSC for follow up. DTSC was tasked with the responsibility for rescrapes and confirmation sampling at these properties. Rescrapes successfully removed elevated mercury concentrations and the properties were approved for erosion control. At the direction of the State IMT, incident reports were prepared for two of the properties.

8.1.3 Radiation

Radiological readings were recorded at each property during the triage assessment discussed in Section 2. Radiological readings above screening levels during the triage assessment could not be reproduced during SA surveys with the exception of two properties: 054-050-087 and 054-171-131. Elevated radiation was also detected at 054-171-087. Incident reports were provided to the State IMT for each property. A summary of the properties is described below.

During the SA at 054-050-087 conducted on March 28, 2019, elevated radiation was detected adjacent to the primary structure. Similar levels of radiation were detected during an additional radiological survey on May 31, 2019. A small trench in the affected area was excavated and elevated radiation was detected in the excavated soil and the trench. The trench and excavated soil were left to acclimate to ambient temperatures and resurveyed three times between May 31, 2019 and June 1, 2019, with observed levels of radiation declining during each additional survey. During the final radiological survey on June 1, 2019, elevated levels of radiation were not detected. Tetra Tech and State IMT deemed the site safe to continue with debris removal operations.

During the SA at 054-171-131 conducted on April 5, 2019, elevated radiation was detected near a burned computer case. Similar levels of radiation were detected during an additional radiological survey on April 8, 2019; however, a specific source could not be identified. During the final survey on April 9, 2019, a rock previously collected and stored in the home by the homeowner was identified as the source of radiation. The rock was containerized and removed from the site by DTSC.

During the SA at 054-171-087 conducted on April 4, 2019, elevated radiation was detected near a burned shed in the southwest corner of the property. The property was resurveyed on April 6, 2019 and elevated levels of radiation were not detected. Tetra Tech and State IMT deemed the site safe to continue with debris removal operations.

8.1.4 Debris Truck Spill

The State IMT tasked Tetra Tech to collect soil samples at two debris truck spill incidents: Clark and Meadow Song Road and Concow Road. Tetra Tech collected soil samples to confirm that debris spill cleanup activities removed debris constituents from the spill area. Tetra Tech arrived at the debris truck spill sites after spill cleanup occurred. For each debris truck spill incident, Tetra Tech collected soil samples up gradient, down gradient and in the spill zone for assurance any spill was cleaned by the contractor causing the accident consistent with the Truck Sampling Protocol guidance (Tetra Tech 2019b). Both debris truck spill incident reports are presented in Appendix K and include a soil sampling sketch, soil sample chain-of-custody form, and soil sampling results. The incident reports for both debris truck spills were referred to Butte County.

The Clark and Meadow Song Road accident involved a loaded debris truck. The accident area was cleaned prior to Tetra Tech arrival. There was no odor of diesel at the time of sample collection and Tetra Tech was informed the debris truck did not discharge the full debris load. Visual reconnaissance of the site indicated 6 inches of soil was removed from the spill area. Samples were collected and analyzed per the Truck Sampling Protocol (Tetra Tech 2019b).

The Concow Road accident also involved a loaded debris truck. The accident area was cleaned prior to Tetra Tech arrival. There was no odor of diesel at the time of sample collection. Tetra Tech was informed the debris truck did not discharge much of the load because it did not turn over. Samples were collected and analyzed per the Truck Sampling Protocol (Tetra Tech 2019b).

8.1.5 Water Sampling

Following debris removal activities, standing water developed within one of the excavation footprints at APN 051-094-035. There were no rain events or noted incoming water sources to the property; however, a stream is present approximately 200 feet to the west of the property. Tetra Tech conducted two sampling events to help identify the source of water within the excavation. Tetra Tech prepared a letter report for the State IMT, documenting the activities, results, and conclusion. The letter report and the complete analytical results are provided in Appendix K.

The objective of the sampling was to evaluate the excavation and stream water chemistry. For the June 27, 2019 sampling event, three samples were collected from different locations within the excavation. Three additional samples were collected from the stream: one upstream, one midstream, and one downstream from the property. Samples were analyzed for metals, total petroleum hydrocarbons, total recoverable hydrocarbons, semi-volatile organic constituents, volatile organic constituents, polychlorinated biphenyls, herbicides, and pesticides.

A summary of the constituents detected in the excavation and stream samples is presented below; all other constituents were not detected above reporting limits.

Excavation Sample Detections	Stream Sample Detections
Chloroform Barium Chromium Cobalt Copper Lead	Barium Beryllium Chromium Copper

A test pit was excavated approximately 25 feet from the original excavation to determine if the chloroform, cobalt, and lead are present outside of the debris excavation area. On July 23, 2019, one grab water sample was collected from the test pit and two grab water samples were collected from the excavation area. The samples were analyzed for the same constituents as those listed in the June 27 event. The results were similar between the test pit and the excavation samples, except that zinc was detected in one excavation sample. Chloroform was detected in all the July 23 samples.

The presence of chloroform in the excavation samples is an indicator that the source of water within the excavation is not consistent with the nearby stream and is likely attributable to a leaking municipal water line.

8.2 ASH SAMPLING

The State IMT directed Tetra Tech to conduct the ash sampling on April 1, 2019. Ash sampling was conducted at 41 residential properties to characterize contaminants within the ash and evaluate whether the ash located on properties within 50 feet of a natural waterway or drainage was above human health or ecological screening levels, as shown on Figure 8-1.

The ash samples helped characterize hazards associated with remnant debris from the Camp Fire Incident, which is removed as a part of the debris removal program. Ash samples were analyzed for a full suite of constituents. This assessment was a limited investigation to obtain field data and was not used for risk assessments.

Winter rains after the Camp Fire Incident meant hazardous contaminants from the fire soaked into the ground and ran into waterway tributaries. Some of these hazardous contaminants could have included:

- Metals from batteries, treated wood, and melted plumbing fixtures
- Pesticides and herbicides from residential use
- ACM from building materials
- PAHs, dioxins, and furans from burned tires and plastic
- PCBs from appliances, light ballasts, and automotive parts

Tetra Tech prepared the Camp Fire Incident - Abbreviated Sampling and Analysis Plan for Ash Sampling (Tetra Tech 2019e) for ash sampling and submitted it to the State IMT for review.

Briefings regarding the SOW, schedule, implementation, and results of this task were presented to and discussed with the State IMT at formal semi-weekly IMT Planning Meetings conducted every Tuesday and Friday throughout the duration of the incident.

Tetra Tech submitted the Final Assessment of Ash Sampling – Camp Fire Incident report to the State IMT on September 19, 2019 (Tetra Tech 2019m). This report (with tables, figures, and appendices), summarized the results of the ash assessment at burned residential areas bordering waterways.

8.2.1 Methodology

Ash sampling methodology was based on USEPA Superfund Lead-Contaminated Residential Sites Handbook (USEPA 2003) and DTSC Assessment of Burned Debris – 2007 Wildfires San Bernardino and San Diego Counties, California (DTSC 2007). Sampling was conducted consistent with the Camp Fire Incident Soil Sampling Plan, Revision 3 (Tetra Tech 2019b) and the Abbreviated Sampling and Analysis Plan for Ash Sampling (Tetra Tech 2019e).

A total of 150 samples were collected over the 41 residential properties. All sampled properties had at least one burned structure that was greater than 1,000 square feet and the property had not been cleared of debris. All properties had been granted access through ROE approval by each individual landowner prior to sampling. The samples were collected on April 12, 13, 15, 16, 17, and 18, 2019.

Sampling of the ash on the designated properties was performed on or near the footprint of the former structures, where the burn debris and ash is typically located. The number of ash samples collected at each property was selected based on the estimated square footage of the ash footprint. Field and laboratory QA/QC measures are detailed in the ash sampling report (Tetra Tech 2019m).

Ash analytical results were compared to established Camp Fire-specific background levels for metals as well as RSLs and to established human health and ecological screening levels (available USEPA RSLs and DTSC Screening Levels) for the organic analytes to evaluate whether chemicals were present at concentrations exceeding these levels (USEPA 2018, DTSC 2018). The cleanup and screening levels for the ash samples are included in Table 8-2.

The ash samples were analyzed for the following constituents of concern:

- TDS on Water Extract by USEPA 160.1
- Inorganic Anions by USEPA 300.0
- Trace Elements by USEPA 6010B

- Total Cyanide by USEPA 9012
- Total Metals by USEPA 6020/7471
- PAHs by USEPA 8270D-SIM
- Total Sulfides by USEPA 9030
- TTLC 17 metals by USEPA 6020/7471
- pH by USEPA 9045D
- Temperature by USEPA 9045D
- PFAS by USEPA 537M*
- PBDE by USEPA 1614*

** 20 percent of the samples were analyzed for these parameters*

8.2.2 Deviations from Work Plan

Approximately 50 residential properties were originally selected for ash sampling and analysis. Of the 50 selected, eight properties did not have structures over 1,000 square feet and one property had debris removal completed. As a result, 41 properties were sampled. The deviation does not adversely affect the objectives or goals of the investigation, and all results are considered usable.

8.2.3 Results

Of the 41 properties, results from four properties did not have metal results over the screening levels. The remaining 37 properties had at least one metal result over the screening level. Eight metals were identified over their applicable levels: antimony, arsenic, cadmium, cobalt, copper, lead, nickel, and zinc. All other chemical results were below the screening levels, or established screening levels do not exist.

Metals	Properties with Exceedances	Samples with Exceedances	Maximum Detected Concentration (mg/kg)	Average Detected Concentration (mg/kg)	Cleanup or Background Level [1] (Tvp/Tc Geologic Unit)
Antimony	10	14	18,000	136	31/31
Arsenic	22	44	1,100	19	7.7/2.3
Cadmium	8	12	170	9.0	5.2/5.2
Cobalt	4	4	120	9.2	36/28
Copper	19	26	65,000	2,568	2,499/2,499
Lead	27	53	51,000	706	80/80
Nickel	1	1	1,300	59	490/490
Zinc	10	15	38,000	1,891	4,999/4,999

Notes:
mg/kg milligrams per kilogram
1 Arsenic and cobalt levels for the Tvp and Tc units are based on background levels. For all other metals listed, the cleanup goal is the lower of the TTLC, USEPA RSL and DTSC HERO levels.

The results demonstrate that metals in ash in streamside residential areas affected by the Camp Fire Incident are above established screening levels. No organic analytical results were identified above screening levels. The results of this assessment confirm that elevated metal concentrations identified in ash are consistent with elevated metals concentrations identified in soil samples collected during debris removal activities at individual residential properties. Therefore, the established protocols used for residential properties affected by the Camp Fire Incident are adequate for addressing metals in ash. All affected residential properties located in streamside residential areas were addressed with these established protocols for residential properties affected by the Camp Fire Incident.

8.3 COMMERCIAL WASTE PROFILING

Due to the nature of certain commercial properties, the levels of heavy metals and other contaminants in ash, soil, and debris can be higher than residential properties. Ash and debris from commercial structures resulting from fires can contain concentrated amounts of metals, such as antimony, arsenic, cadmium, copper, lead, and zinc, as discussed in the Guidance for Conducting Emergency Debris, Waste, and Hazardous Material Removal Actions Pursuant to a State or Local Emergency Proclamation (CalEPA 2011) and Assessment of Burned Debris—2015 Wildfires Lake and Calaveras County, California (DTSC 2015).

Ash and debris can also contain pesticides and herbicides from commercial use; asbestos-containing materials from building materials; PAHs from burned tires and plastic; and PCBs from appliances, light ballasts, and automotive parts as well as hazardous materials specific to the particular commercial operation. Limited waste characterization testing of ash by CalRecycle from commercial properties destroyed during previous wildfires has verified that ash and soil from commercial properties can contain federally listed hazardous waste, also known as Resource Conservation Recovery Act (RCRA) hazardous waste and require proper handling and disposal.

The California Executive Order for the Camp Fire Incident provided an exemption from waste profiling of residential properties based on past structural ash studies conducted by DTSC (DTSC 2007, 2015). Since the Camp Fire destroyed properties identified as commercial, the State IMT directed Tetra Tech to develop a procedure to identify which type of commercial properties should have the ash and debris characterized for both state and federal hazardous waste criteria.

During Camp Fire Incident team meetings in January 2019, the State IMT directed Tetra Tech to initiate confirmation and classification of commercial properties. Field visits to confirm and classify commercial properties were conducted in January through March 2019. Tetra Tech prepared the Camp Fire Incident - Soil Sampling Addendum 2, Revision 2 (Tetra Tech 2019h) and submitted it to the State IMT for review and approval on May 13, 2019. Briefings regarding the SOW, schedule, implementation, and results of this task were presented to the State IMT at weekly planning meetings every Tuesday throughout the duration of the incident.

Tetra Tech submitted the final Commercial Properties Waste Profile Report – Camp Fire Incident report to the State IMT on November 19, 2019 (Tetra Tech 2019n). This report summarizes the rationale and sample results for profiling the commercial properties addressed during debris removal actions. However, Appendix C (Laboratory Reports) of the Commercial Properties Waste Profile Report was too large for the electronic submittal and was provided under separate cover.

A total of 291 commercial properties were identified by Butte County as impacted by the incident based on land use permits or zoning. However, after the submittal of the final Commercial Properties Waste Profile Report – Camp Fire Incident report to the State IMT on November 19, 2019 (Tetra Tech 2019n), some of these properties were split into two or more parcels, and other properties were withdrawn from debris removal program. A total of 296 commercial properties were addressed through the State debris removal

program, as shown on Figure 8-2. This section contains the updated totals of commercial properties since the issuance of the November 2019 report.

The changes to commercial properties listed in the November 2019 report and this summary report are presented below.

November 2019 Report Listing	Update to Summary Report
Non-Exempt Properties	
050-150-002	Split into two APNs: 050-150-002_CML; 050-150-002_RESI
052-123-006	Withdrawn from the State program, deleted from summary report
052-211-006	Withdrawn from the State program, deleted from summary report
054-010-115	Withdrawn from the State program, deleted from summary report
054-120-070	Withdrawn from the State program, deleted from summary report
Exempt Properties	
052-122-033	Split into two APNs: 052-122-033_6023; 052-122-033_740
052-141-003	Split into two APNs: 052-141-003_5859A; 052-141-003_5859B
052-191-024	Split into four APNs: 052-191-024_3857; 052-191-024_3859; 052-191-024_6119; 052-191-024_6129
052-201-013	Split into two APNs: 052-201-013_5673; 052-201-013_5675
052-244-039	Split into two APNs: 052-244-039_HOUSE; 052-244-039_SHOP
053-102-017	Split into two APNs: 053-102-017_6047; 053-102-017_6053
054-040-016	Split into two APNs: 054-040-016_573; 054-040-016_575
054-152-077	Split into two APNs: 054-152-077_1181; 054-152-077_5579
058-200-085	Withdrawn from soil sampling program, fill impacted by 2008 fire per property owner
055-090-013	Incorrectly identified as commercial property, removed from commercial property listings, deleted from summary report

8.3.1 Methodology

Tetra Tech conducted site visits and historical reviews of all commercial properties to evaluate construction type and specific land uses summarized in Table 8-3. In January and February 2019, Tetra Tech conducted a site reconnaissance of commercial properties to help determine property eligibility for the residential exemption. The site reconnaissance was intended to identify general building type and property use prior to the Camp Fire Incident. During the site reconnaissance, Tetra Tech also contacted Butte County staff to help assess a property's historical use. However, most records related to the City of Paradise were lost during the Camp Fire Incident.

In February and March 2019, background reviews were conducted on a subset of the commercial properties based on their potential for (1) hazardous materials present and (2) changes in previous site use. Environmental Data Resources (EDR) reports were reviewed regarding current and historical site conditions. Specific EDR reports reviewed for each property consisted of Certified Sanborn Map Reports, Historical Topo Map Reports, Aerial Photo Decade Packages, Radius Map Reports with GeoCheck, Environmental Lien and Activity and Use Limitations Searches, Property Tax Map Reports, City Directory Image Reports, and Building Permit Reports, if available. The background review included a review of the CalEPA's online Regulated Site Portal regarding current and historical site conditions. The online CalEPA Regulated Site Portal (https://siteportal.calepa.ca.gov/nsite/) contains information from a variety of state environmental databases, including the California Environmental Reporting System which identifies business type and associated hazardous materials classes.

Based on the site visits and reviews as well as the recent splits, 214 properties were proposed to CalRecycle as exempt from additional hazardous waste characterization per the executive order and past waste characterization studies. Per the State IMT, a commercial property is exempt from waste characterization if the parcel is: (1) a structure consistent with residential construction standards or materials, such as apartments, mobile home parks, office complexes or boutique stores; or (2) the property land use was historically consistent with residential type uses (or non-commercial or industrial uses), such as churches or care facilities. Based on the site visits and reviews as well as the recent updates listed above, 198 properties are listed as exempt. Following the State IMT approval of the exempt commercial list, these commercial parcels were included within the debris removal and disposal activities with all other residential properties. Exempt commercial properties, like residential properties, did not require ash sampling prior to debris removal.

The remaining 99 non-exempt commercial parcels included, but were not limited to, auto repair shops, commercial shopping centers, commercial vehicle or RV sales and repair, gas stations, gun stores, hardware stores, medical facilities, paint stores, shops and maintenance facilities, tire shops, and industrial facilities. Since there had not been a comprehensive waste characterization study of commercial properties destroyed by wildfires, the State IMT directed Tetra Tech to collect ash samples from the 99-non-exempt commercial properties.

Ash from the non-exempt commercial properties was then sampled to characterize contaminants within the ash and identify whether the ash was designated as federal hazardous waste under RCRA or California hazardous waste. The waste characterization results were then used for waste classification, waste profiling, determination of disposal facilities, and additional analyses necessary for future confirmation soil sampling.

Ash sampling at the designated non-exempt commercial properties was conducted in May and June 2019 on or near the footprint of the former structures, where the burn debris and ash is typically located. All properties had been granted access through ROE approval by each individual landowner/business owner prior to sampling. Ash sampling for waste profiling was based on USEPA Superfund Lead-Contaminated Residential Sites Handbook (USEPA 2003) and DTSC Assessment of Burned Debris – 2007 Wildfires San Bernardino and San Diego Counties, California (DTSC 2007). Ash sampling was conducted in accordance with the Soil Sampling Plan, Addendum 2, Revision 2 (Tetra Tech 2019h), and the Background Sampling and Cleanup Goals Report, Camp Fire Incident, Revision 2 (Tetra Tech 2019f).

A minimum of five and maximum of nine soil and ash samples were collected from each property, depending on site-specific conditions at each property. The number of samples was selected during site visits prior to sampling based on the complexity and size of each property. Factors evaluated to determine the adequate number of samples included site history, building construction, construction materials remaining on site, total square footage of debris, and anticipated volumes to be excavated.

Each sample was composed of a 5-point aliquot as described in the Soil Sampling Plan, Addendum 2, Revision 2 (Tetra Tech 2019h), and Soil Sampling Plan, Addendum 3, Revision 1 (Tetra Tech 2019j). Specific sample locations and frequency were evaluated on a property-by-property basis, depending on such factors as size, surface cover, estimated ash and soil volumes, and types of foundations present. Ash samples were collected prior to debris removal.

Field documentation, sample handling, decontamination procedures, management of investigation-derived waste and other field QA/QC was performed in accordance with the Soil Sampling Plan, Addendum 2, Revision 2 (Tetra Tech 2019h) to the Soil Sampling Plan, Revision 3 (Tetra Tech 2019b) which included Tetra Tech SOPs. ALS Environmental Laboratories performed the analysis of all samples which included the QC parameters. Laboratory QC parameters are described further in the final Commercial Properties Waste Profile Report (Tetra Tech 2019n). Tetra Tech performed a Stage 2A validation on the laboratory

data packages as defined in the USEPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (USEPA 2009). These validations were performed in accordance with Tetra Tech SOP No. 203, "Laboratory Analytical Data Verification – Minimum Requirements" (Tetra Tech 2019b) and the National Functional Guidelines for Organic and Inorganic Superfund Methods Data Review (USEPA 2017a, 2017b).

The non-exempt commercial properties were sampled and analyzed for the following analytes using USEPA test methods:

- Total Metals by USEPA Method 6020A
- Mercury by USEPA Method 7471
- Total Recoverable Petroleum Hydrocarbons (TRPH) by USEPA Method 8015C
- BTEX by USEPA Method 8260C
- SVOCs by USEPA Method 8270D
- PCBs by USEPA Method 8082A
- Pesticides and Herbicides by USEPA Method 8081B

For the non-exempt commercial properties, the constituents of concern detected in the ash samples were compared to established screening levels and other established criteria to evaluate whether constituents of concern were present at concentrations exceeding the screening levels to estimate if the ash/debris would be considered either a federal or state hazardous waste for disposal purposes. All metals results were also compared to the cleanup goals established for the Camp Fire Incident; other analytes were compared to available USEPA RSLs and DTSC HERO values. The cleanup goals for the commercial properties are included in Table 8-4.

To make a preliminary waste determination, commercial ash results were compared to the TCLP thresholds (20 times the TCLP limit) for the federal (RCRA) hazardous waste designations for the metals/inorganics. Ash results were also compared to established hazardous waste TTLC and soluble threshold limit concentrations (STLC) (10 times the STLC) for the California hazardous waste designations for metals/inorganics and organic analytes. Properties that had all results below established hazardous waste TTLC limits or STLC thresholds (10 times the STLC limit) for the California hazardous waste criteria were also analyzed for California hazardous waste via the waste extraction test (WET).

Samples with the constituents of concern present at concentrations exceeding the STLC and TCLP threshold levels were re-analyzed and subject to the full STLC and TCLP tests to evaluate whether these samples exceeded the STLC or TCLP regulatory limits.

8.3.2 Deviations from Work Plan

There were no deviations from the Camp Fire Incident - Soil Sampling Addendum 2, Revision 2 (Tetra Tech 2019h).

8.3.3 Results

Sample result at 16 properties exceeded the TCLP regulatory limits for metals under the RCRA hazardous waste criteria, as shown on Figure 8-3 and on Table 8-4. Two metals were identified over their applicable screening levels: cadmium and lead.

The exhibit below summarizes the frequency of the analytes found over their applicable regulatory limit for RCRA hazardous waste designation, by number of properties and samples.

Analyte	Properties with RCRA Exceedances	Samples with RCRA Exceedances	Minimum Detected Concentration (mg/L)	Maximum Detected Concentration (mg/L)	TCLP Regulatory Limit (mg/L)
Cadmium	2	2	1.30	2.07	1
Lead	15	17	7.41	193	5

Notes:
mg/L milligrams per liter
RCRA Resource Conservation and Recovery Act
TCLP Toxicity characteristic leaching procedure
Source:
40 CFR Part 261.24

A total of 96 commercial parcels also had at least one sampling result over the established hazardous waste TTLC limit or STLC threshold (10 times the STLC limit) for the California hazardous waste criteria for the metals and organic analytes as shown on Figure 8-4 and in Table 8-5. Nine metals were identified over their applicable screening levels: antimony, arsenic, barium, cadmium, copper, lead, nickel, selenium, and zinc. Benzene, endrin aldehyde, and TPH as gasoline, diesel, and motor oil were also identified over their applicable screening levels.

Properties that had all results below established hazardous waste TTLC limits or STLC thresholds (10 times the STLC limit) for the California hazardous waste criteria were also analyzed for California hazardous waste via the WET test. Four properties, with a total of six samples, exceeded the STLC levels based on the WET test. All the exceedances were for copper.

The exhibit below summarizes the frequency of the analytes found over their applicable regulatory limit or screening level for California hazardous waste designation (respectively), by number of properties and samples.

Analyte	Properties with Exceedances	Samples with Exceedances	Maximum Detected Concentration (mg/kg)	California Hazardous Waste TTLC Limit (mg/kg)	STLC Threshold Screening Level (10x STLC) (mg/kg)
Antimony	14	16	2,340	500	150
Arsenic	4	4	869	500	50
Barium	5	6	15,600	10,000	1,000
Cadmium	10	10	975	100	10
Copper	75	141	605,000	2,500	250
Lead	45	87	239,000	1,000	50
Nickel	3	3	15,900	2,000	200
Selenium	1	1	144	100	10
Zinc	68	172	97,800	5,000	2,500
Endrin Aldehyde	6	9	15	0.2	0.2
Benzene	3	3	2.19	0.44	--
TPH – gasoline	1	1	620	260	--
TPH – diesel	53	117	65,600	100	--
TPH – motor oil	45	87	177,000	1,600	--

Notes:
-- Not available
mg/kg milligrams per kilogram
STLC Soluble threshold limit concentration
TPH Total petroleum hydrocarbons
TTLC Total threshold limit concentration
Sources:
Total Threshold Limit Concentration (TTLC), California Code of Regulations, Title 22, Chapter 11, Article 3.

After all ash samples were analyzed and compared to their applicable screening levels for waste profiling, all results were compared to screening levels for residential sites as shown in Table 8-4 to evaluate whether additional organic constituents of concern required analysis during the subsequent confirmation soil sampling. Laboratory analytical data demonstrated that metals, pesticides, benzene, and TPH concentrations within the ash at some of the non-exempt properties sampled were above established screening levels; in some cases, significantly above the levels.

The laboratory analytical data were used for characterization for the removal and disposal of the ash and burn debris on a property-by-property basis. These data were used to guide the subsequent confirmation soil sampling underneath the structural foundations to further evaluate whether residual contamination above these screening levels remained.

The transport and disposal of ash and debris from properties designated with RCRA waste were addressed independently by DTSC, per direction by State IMT. Three landfills accepted the ash and soil generated during debris removal activities from the Camp Fire Incident: Waste Management Anderson landfill, Recology Ostrom Road landfill, and the Neal Road Recycling and Waste Facility. The Waste Management Anderson landfill and Recology Ostrom Road landfill have published sampling requirements (Tetra Tech 2019n). Both of these landfills required sampling for VOCs, SVOCs, TPH, metals, PCBs, pesticides, herbicides, and dioxins (when PCBs are present). Leachability testing was conducted as-needed based on the initial sampling results. The sampling strategy addressed analytical and sampling requirements from both the Waste Management Anderson landfill and Recology Ostrom Road landfill. As a result, either landfill could be used for disposal once the waste profile results were reviewed and disposal determinations were made. Concrete and metals were disposed of at recycling facilities per the debris removal program, as directed by the State IMT.

Ash from properties with RCRA hazardous waste was designated by the State IMT for disposal at a Class I Hazardous Landfill based on toxicity and referred to DTSC for removal. A total of 15 of the 17 RCRA sites were referred to DTSC for removal. At two RCRA sites (APN 050-081-042 and APN 066-440-023), debris was mistakenly removed by the debris removal contactors and sent to lined Class III solid waste landfills. All debris from APN 050-081-042 was sent to the Recology Ostrom Road landfill. Initial ash and soil material from APN 066-440-023 were sent to the Waste Management Anderson landfill, the Recology Ostrom Road landfill, and the Neal Road Recycling and Waste Facility. Rescrape soil material was sent to the Neal Road Recycling and Waste Facility and the Recology Ostrom Road landfill. The State IMT notified Butte County and each landfill verbally.

All other waste from non-exempt commercial properties, including California hazardous waste, was removed by CalRecycle's debris contractors and deemed appropriate by the State IMT for disposal at the Class III landfills accepting the residential debris. The profile samples were also used to evaluate whether additional analytes beyond metals were required during post-debris removal action confirmation sampling.

The removal activities consisted of removing all burned debris, including stucco, roofing, floor tile, linoleum, fireplaces, furnaces, vinyl tiles and mastic, sheetrock and joint compound, asbestos cement pipe, exterior building siding, thermal system insulation, concrete, white goods, vehicles, vegetation, construction debris, electronic waste, hazardous chemicals, and the top layer of soil beneath the debris.

After debris removal was completed, the non-exempt properties had confirmation soil samples collected and analyzed for metals concentrations.

Three properties required collection of VOC samples for subsequent confirmation soil sampling based on comparison of analytical results of the ash sampling results to residential screening levels. After the removal of the ash at these properties, confirmation soil samples were collected with additional VOC sample collection on these three designated properties. All VOC analytical results were either not detected or below established screening levels for two of the three properties. The third property was withdrawn from the State program and therefore no data are available.

8.4 STAGING AREAS SAMPLING

The scope of work as directed by the State IMT consisted of collecting surface material and soil samples prior to use as a staging area, and again following completion of staging area activities. The sampling is intended to document surface and/or native soil conditions prior to facility processing and following the completion of all debris removal.

All sampling was conducted consistent with the Soil Sampling Plan, Camp Fire Incident, Revision 3, dated February 6, 2019 (Tetra Tech 2019b) the Background Sampling and Cleanup Goals Report, Revision 2, Camp Fire Incident, dated April 1, 2019 (Tetra Tech 2019f) as well as the following additional plans:

- Soil Sampling Plan, Addendum 4, Revision 0 – Camp Fire Incident (June 17, 2019) (Tetra Tech 2019k) for the SPSG Truck Parking Area within the Industrial Park Base Camp in Oroville, California.
- Soil Sampling Plan, Addendum 3, Revision 1 – Camp Fire Incident (June 19, 2019) (Tetra Tech 2019j) for the ECC Truck Parking Area within the Tuscan Ridge Base Camp
- Soil Sampling Plan, Addendum 1, Revision 1 – Camp Fire Incident (February 21, 2019) (Tetra Tech 2019c) for the CHP Staging Area (metal processing facility), Granite Site Area (concrete facility), and Neal Road Area (concrete facility).

The staging areas generally consisted of compacted soil and gravel. Surface materials and soil samples were collected from each of the areas to help identify any contaminants that may have been introduced as a result of the truck contents containing debris prior to departure for the appropriate disposal facilities. Discrete samples were collected consistent with the protocols identified in the soil sampling plan for near-surface samples.

Field conditions dictated the ability to successfully collect the native soil samples, and Tetra Tech communicated any deviations or proposed changes to the sampling strategy directly to the State IMT prior to completing the sampling effort. Briefings regarding the SOW, schedule, implementation, and results of this task were presented to and discussed with the State IMT at formal semi-weekly IMT Planning Meetings conducted every Tuesday and Friday throughout the duration of the incident.

Pre-staging sampling was conducted at all seven designated staging areas prior to use. Four of the seven designated staging areas were used for the Camp Fire Incident. Therefore, only the four locations used for staging had post-staging samples collected. A summary of the samples collected at each staging area is presented below.

Staging Area Name	Pre-Staging Sampling *Number of samples, Date of collection*	Post-Staging Sampling *Number of samples, Date of collection*
ECC Truck Parking Staging Area 3100 Skyway Road, Paradise, CA	8 samples 02/19/2019	Area was never used No post-staging sampling
ECC Truck Preload Area 2903 Neal Road, Paradise, CA	46 samples 06/24/2019	Area was never used No post-staging sampling
SPSG Truck Parking Area 4801 Feather River Boulevard, Oroville, CA	46 samples 06/25/2019	Area was never used No post-staging sampling
SPSG Truck Preload Area 5399 Clark Road, Paradise, CA	3 samples 05/07/2019	3 samples 11/19/2019
Granite Site Concrete Staging Area 4714 Pacific Heights Road, Oroville, CA	21 samples 02/28/2019	21 samples 11/22/2019
Neal Road Concrete Area 1023 Neal Road, Paradise, CA	12 samples 02/27/2019	12 samples 11/21/2019
CHP Metal Processing Staging Area 3000 7th Avenue, Oroville, CA	26 samples 02/28/2019	15 samples 12/03/2019 1 sample 07/13/2020 6 samples 07/20/2020

Discussions of each staging area sampling protocols and results are presented below.

8.4.1 ECC Truck Staging Areas

This section provides the soil sampling protocols and sample results for two staging areas intended for ECC truck staging debris removal activities: (1) Truck Parking Area at the ECC Basecamp as outlined in the Soil Sampling Plan Addendum 3, and (2) Truck Preload Staging Area. Sampling was conducted consistent with the *Soil Sampling Plan, Camp Fire Incident, Revision 3*, dated February 6, 2019, and the *Background Sampling and Cleanup Goals Report, Camp Fire Incident, Revision 2*, dated April 1, 2019.

A summary report for these staging areas presenting the sampling protocols and results were provided to CalRecycle on July 21, 2020 and is included in Attachment 7. The document was reviewed and approved by CalRecycle on July 21, 2020.

Purpose

The sampling was intended to document surface and/or native soil conditions prior to any truck activity and following the completion of all debris removal. Neither area was ultimately used as a staging area for truck or debris removal activities; therefore, no post-debris removal samples were collected. The Truck Preload Staging Area was not identified within the Soil Sampling Plan, Addendum 3; however, locations were identified in the field and approved by the State IMT.

Surface Soil Sampling

All samples consisted of discrete samples collected by disposable trowel or hand-held auger, consistent with the soil sampling plan for background sample collection. 46 locations were sampled at the Truck Parking Area as shown on Figure 8-5. Four locations were added at the direction of the State IMT. Eight locations were sampled at the Truck Preload Staging Area as shown on Figure 8-6. Near surface samples (0 to 3 inches below ground surface) were collected from each area prior to debris removal activities.

Laboratory Analysis and Sample Identification

Each sample was analyzed for metals, TRPH, BTEX, SVOCs, pesticides; and PCBs. In accordance with the soil sampling plans established for the staging areas, soil samples were sampled and analyzed for the following analytes using USEPA test methods.

- Metals by USEPA Method 6020 or 7471 for mercury
- TRPH by USEPA Method 8015
- BTEX by USEPA Method 8260
- SVOCs by USEPA Method 8270
- Pesticides by USEPA Method 8081
- PCBs by USEPA Method 8082

Sample identifications are used to identify the fire incident, staging area, sample depth, and sample location as follows.

Butte County, Camp Fire Incident: BFI
Staging Area: ECC
Truck Parking Area Sample Locations: 001 through 046
Truck Preload Area Sample Locations: Staging-1-Pre-1 through Staging-Pre-1-8

Analytical Data Validation

Stage 2a data validation was completed upon all staging area sample results, consistent with all confirmation samples throughout the Camp Fire Incident.

Results

Sample results from the Truck Parking and Preload Staging Areas were not compared to post-staging area samples since no debris removal activities occurred at the locations and no post-staging samples were collected. The summary tables indicate that no sample results are above commercial screening levels. Sample results from all locations indicate exceedance of arsenic above human health screening level of 0.36 mg/kg. Background sampling from the geologic unit comprising the two areas indicates naturally-occurring arsenic concentrations of 7.7 mg/kg; all staging area samples are below 7.7 mg/kg. All other sample results are below commercial screening levels. Truck Parking Area summary tables and analytical results are presented in Attachment 7. Truck Preload Staging Area summary tables and analytical results are presented in Attachment 7.

8.4.2 SPSG Truck Staging Areas

This section provides the soil sampling protocols and sample results for two staging areas associated with SPSG debris removal activities: (1) Truck Parking Area as outlined in the Soil Sampling Plan Addendum

4, and (2) Truck Preload Staging Area. Sampling was conducted consistent with the *Soil Sampling Plan, Camp Fire Incident, Revision 3*, dated February 6, 2019, and the *Background Sampling and Cleanup Goals Report, Camp Fire Incident, Revision 2*, dated April 1, 2019.

A summary report for these staging areas presenting the sampling protocols, results, and conclusions were provided to CalRecycle on July 21, 2020, and is included in Attachment 7. The document was reviewed and approved by CalRecycle on July 21, 2020.

Purpose

The sampling was intended to document surface and/or native soil conditions prior to truck activities and following the completion of all debris removal. The Truck Parking Area was not used as a staging area; therefore, no post-debris removal samples were collected. The Truck Preload Area was not identified within the Soil Sampling Plan, Addendum 4; however, locations were identified and approved by the State IMT.

Surface Soil Sampling

All samples consisted of discrete samples collected by disposable trowel or hand-held auger, consistent with the soil sampling plan for background sample collection. 46 locations were sampled at the Truck Parking Area as shown on Figure 8-7. Four locations were added at the direction of the State IMT. Three locations were sampled at the Truck Preload Staging Area as shown on Figure 8-8. Near surface samples (0 to 3 inches below ground surface) were collected from each area prior to debris removal activities. Three Truck Preload Staging Area samples were collected following debris removal activities.

Laboratory Analysis and Sample Identification

Each sample was analyzed for metals, TRPH, BTEX, SVOCs, pesticides; and PCBs. In accordance with the soil sampling plans established for the staging areas, soil samples were sampled and analyzed for the following analytes using USEPA test methods.

- Metals by USEPA Method 6020 or 7471 for mercury
- TRPH by USEPA Method 8015
- BTEX by USEPA Method 8260
- SVOCs by USEPA Method 8270
- Pesticides by USEPA Method 8081
- PCBs by USEPA Method 8082

Sample identifications are used to identify the fire incident, staging area, sample depth, and sample location as follows.

Butte County, Camp Fire Incident: BFI
Staging Area: SPSG
Truck Parking Area Sample Locations: 001 through 046
Truck Preload Area Sample Locations: Staging-1-Pre-1, -2, -3, and Staging-1-Post-1, -2, and -3

Analytical Data Validation

Stage 2a data validation was completed upon all staging area sample results, consistent with all confirmation samples throughout the Camp Fire Incident.

Results

Sample results from the Truck Parking Area were not reviewed since no debris removal activities occurred at the location. Truck Parking Area summary tables and analytical results are presented in Attachment 7.

Sample results from the Truck Preload Staging Area were evaluated qualitatively to each other, as well as quantitatively to human health and environmental goals established in the *Background Sampling and Cleanup Goals Report, Camp Fire Incident, Revision 2*. Truck Preload Staging Area summary tables and analytical results are presented in Attachment 7. The qualitative review focused on the net difference between the pre-staging and post-staging sample results. Samples with concentrations of pre-staging sample results higher than post-staging sample results are not presented, as they would not indicate presence of contamination based on debris removal activities. The quantitative review focused on exceedances of human health and environmental screening levels of those concentrations identified in the qualitative review.

> **Qualitative Review.** The evaluation of metals results indicates lead at location 2 increased from 12.1 mg/kg to 210 mg/kg. Zinc at sample location 1 increased from 63.4 mg/kg to 520 mg/kg. These concentrations do not appear to indicate adverse impacts from truck activities. No other metals indicated significant differences between pre- and post-staging sample results. No other analytes indicated significant differences between pre- and post-staging sample results.
>
> **Quantitative Review.** Sample results from all locations indicate exceedance of arsenic above human health screening levels. Background sampling from the geologic unit at the Truck Parking Area has been identified at 7.7 mg/kg; all staging area samples are below 7.7 mg/kg. All other results were below commercial screening levels. The results indicate no chemical concentrations above commercial screening or background levels.

The concentrations of lead and zinc listed in the qualitative review are below the commercial screening level of 320 mg/kg and 350,000 mg/kg, respectively. All results are below background or commercial screening levels, and therefore, do not pose unacceptable concentrations for the current land use.

Conclusions

Pre- and Post-staging area results do not indicate adverse impacts from truck activities associated with the Camp Fire Incident.

8.4.3 Granite Site Concrete Staging Area

This section provides the soil sampling protocols and sample results for the Granite Site Concrete Staging Area. Sampling was conducted consistent with the *Soil Sampling Plan, Camp Fire Incident, Revision 3*, dated February 6, 2019, and the *Background Sampling and Cleanup Goals Report, Camp Fire Incident, Revision 2*, dated April 1, 2019.

A summary report for this staging area presenting the sampling protocols, results, and conclusions were provided to CalRecycle on July 21, 2020, and is included in Attachment 7. The document was reviewed and approved by CalRecycle on July 21, 2020.

Purpose

The sampling was intended to document surface and/or native soil conditions prior to facility processing and following the completion of all debris removal.

Soil Sampling

All samples consisted of discrete samples collected by disposable trowel or hand-held auger, consistent with the soil sampling plan for background sample collection. 21 locations were sampled at the Granite Site staging area as shown on Figure 8-9. At each location, a sample from 0- to 3-inches bgs was collected; the surface material consisted of rock or native soil. Locations were updated in the field and approved by the State IMT.

Laboratory Analysis and Sample Identification

Each sample was analyzed for metals, TRPH, BTEX, SVOCs, pesticides; PCBs, and dioxin and furans. In accordance with the soil sampling plans established for the staging areas, soil samples were sampled and analyzed for the following analytes using USEPA test methods.

- Metals by USEPA Method 6020 or 7471 for mercury
- TRPH by USEPA Method 8015
- BTEX by USEPA Method 8260
- SVOCs by USEPA Method 8270
- Pesticides by USEPA Method 8081
- PCBs by USEPA Method 8082
- Dioxins and Furans by USEPA Method 8290

Sample identifications are used to identify the fire incident, staging area, sample depth, and sample location as follows.

Butte County, Camp Fire Incident: BFI
Staging Area: 4714 Pacific Heights Rd
Sample Type: Pre- and Post-
Sample Location: 01 through 21

For example, BFI-4714 Pacific Heights-Pre-04 and BFI-4147 Pacific Heights-Post-04 represent samples collected from the same location 04 prior to and following debris removal and concrete staging activities.

Analytical Data Validation

Stage 2a data validation was completed upon all staging area sample results, consistent with all confirmation samples throughout the Camp Fire Incident.

Results

Pre- and Post-staging area results were evaluated qualitatively to each other, as well as quantitatively to human health and environmental goals established in the *Background Sampling and Cleanup Goals Report, Camp Fire Incident, Revision 2*. The qualitative review focused on the net difference between the pre-staging and post-staging sample results. Samples with concentrations of pre-staging sample results higher than post-staging sample results are not presented, as they would not indicate presence of contamination based on debris removal activities. The quantitative review focused on exceedances of human health and environmental screening levels of those concentrations identified in the qualitative review. Summary tables and analytical results are presented in Attachment 7.

Qualitative Review. The evaluation of metals results indicates one metal increased at sample location 08: lead from 13 mg/kg to 180 mg/kg. No other metals indicated significant differences between pre- and post-staging sample results.

No other analytes indicated significant differences between pre- and post-staging sample results.

Quantitative Review. Sample results from all locations indicate exceedance of arsenic above human health screening level of 0.36 mg/kg. Background sampling from a comparable geologic unit Q indicates naturally-occurring arsenic concentrations of 4.7 mg/kg; all staging area samples appear within the background range. All other results were below commercial screening levels.

The concentrations of lead listed in the qualitative review are below the commercial screening level of 320 mg/kg. All results are below background or commercial screening levels, and therefore, do not pose unacceptable concentrations for the current land use.

Conclusions

Pre- and Post-staging area results do not indicate adverse impacts from truck activities associated with the Camp Fire Incident.

8.4.4 Neal Road Concrete Staging Area

This section provides the soil sampling protocols and sample results for the Neal Road Concrete Staging Area, located at 1023 Neal Road, Paradise. Sampling was conducted consistent with the *Soil Sampling Plan, Camp Fire Incident, Revision 3*, dated February 6, 2019, and the *Background Sampling and Cleanup Goals Report, Camp Fire Incident, Revision 2*, dated April 1, 2019.

A summary report for this staging area presenting the sampling protocols, results, and conclusions were provided to CalRecycle on July 21, 2020, and is included in Attachment 7. The document was reviewed and approved by CalRecycle on July 21, 2020.

Purpose

The sampling was intended to document surface and/or native soil conditions prior to facility processing and following the completion of all debris removal.

Soil Sampling

All samples consisted of discrete samples collected by disposable trowel or hand-held auger, consistent with the soil sampling plan for background sample collection. 12 locations were sampled at the Neal Road staging area as shown on Figure 8-10. At each location, a sample from 0- to 3-inches bgs was collected; the surface material consisted of rock or native soil.

Laboratory Analysis and Sample Identification

Each sample was analyzed for metals, TRPH, BTEX, SVOCs, pesticides; PCBs, and dioxin and furans. In accordance with the soil sampling plans established for the staging areas, soil samples were sampled and analyzed for the following analytes using USEPA test methods.

- Metals by USEPA Method 6020 or 7471 for mercury
- TRPH by USEPA Method 8015

- BTEX by USEPA Method 8260
- SVOCs by USEPA Method 8270
- Pesticides by USEPA Method 8081
- PCBs by USEPA Method 8082
- Dioxins and Furans by USEPA Method 8290

Sample identifications are used to identify the fire incident, staging area, sample depth, and sample location as follows.

Butte County, Camp Fire Incident: BFI
Staging Area: 1023 Neal Rd
Sample Type: Pre- and Post-
Sample Location: 01 through 12

For example, BFI-1023 Neal Rd Pre-04 and BFI-1023 Neal Rd-Post-04 represent samples collected from the same location 04 prior to and following debris removal and concrete staging activities.

Analytical Data Validation

Stage 2a data validation was completed upon all staging area sample results, consistent with all confirmation samples throughout the Camp Fire Incident.

Results

Pre- and Post-staging area results were evaluated qualitatively to each other, as well as quantitatively to human health and environmental goals established in the *Background Sampling and Cleanup Goals Report, Camp Fire Incident, Revision 2*. The qualitative review focused on the net difference between the pre-staging and post-staging sample results. Samples with concentrations of pre-staging sample results higher than post-staging sample results are not presented, as they would not indicate presence of contamination based on debris removal activities. The quantitative review focused on exceedances of human health and environmental screening levels of those concentrations identified in the qualitative review. Summary tables and analytical results are presented in Attachment 7.

Qualitative Review. The evaluation of metals results indicates three metals increased at sample location 09: copper from 29 mg/kg to 1,400 mg/kg; lead from 8.8 mg/kg to 240 mg/kg; and zinc from 54 mg/kg to 1,000 mg/kg. No other metals indicated significant differences between pre- and post-staging sample results.

No other analytes indicated significant differences between pre- and post-staging sample results.

Quantitative Review. Sample results from all locations indicate exceedance of arsenic above human health screening level of 0.36 mg/kg. Background sampling from the geologic unit TVP comprising the area indicates naturally-occurring arsenic concentrations of 7.7 mg/kg; all staging area samples are below 7.7 mg/kg. All other results were below commercial screening levels.

The concentrations of copper, lead, and zinc listed in the qualitative review are each below their commercial screening levels of 47,000 mg/kg, 320 mg/kg, and 350,000 mg/kg, respectively. All results are below background or commercial screening levels, and therefore, do not pose unacceptable concentrations for the current land use.

Conclusions

Pre- and Post-staging area results do not indicate adverse impacts from truck activities associated with the Camp Fire Incident.

8.4.5 CHP Metal Processing Staging Area

This section provides the soil sampling protocols and sample results for the metal processing center, also referred to as the CHP Staging Area. Summary reports for each staging area are being submitted under separate submittals. Sampling was conducted consistent with the *Soil Sampling Plan, Camp Fire Incident, Revision 3*, dated February 6, 2019, and the *Background Sampling and Cleanup Goals Report, Camp Fire Incident, Revision 2*, dated April 1, 2019.

A summary report for this staging area presenting the sampling protocols, results, and conclusions were provided to CalRecycle on July 24, 2020, and is included in Attachment 7. The document was reviewed and approved by CalRecycle on July 24, 2020.

Purpose

The sampling is intended to document surface and/or native soil conditions prior to facility processing and following the completion of all debris removal.

Soil Sampling

All samples consisted of discrete samples collected by disposable trowel or hand-held auger, consistent with the soil sampling plan for background sample collection. 15 locations were sampled at the CHP Staging Area, as shown on Figure 8-11.

Surface Samples. A layer of base material consisting of gravel and river rock was laid down over the existing native soil prior to collection of the pre-stage samples. The State Incident Management Team directed the field team to sample the top gravel layer wherever possible. Near surface (0 to 3 inches) samples were collected from the gravel layer. A pre-staging gravel sample could not be collected from location 05 since there was no gravel present, only river rock. Post-staging samples were collected from all 15 locations.

Native Soil Samples. Once the top 3 inches of gravel were sampled and containerized, the remaining gravel was removed, and a soil sample was collected at the same location from the top 0 to 3 inches of native soil. The field team and staging area contractor pushed aside the top gravel layer so samples could be collected at other depths as well for those sampling locations. The sample depths of the native soil varied depending on the thickness of overlain gravel. The deeper sample depths were collected below the river rock. Pre-staging samples could not be collected from location 01, 02, and 03 due to the depth of gravel/river rock material. Post-staging samples were not collected from native soil.

Sample depths for pre- and post-staging samples are provided below.

Sample Depth	Sample Location														
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
0-3”	x,y	x,y	x,y	x,y	y	x,y	x,y	x,y	x,y	x,y	x,y	x,y	x,y	x,y	x,y
6-9”					x			x							
9-12”				x		x				x	x				x

Sample Depth	Sample Location														
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
12-15”							x		x				x		
15-18"														x	
21-24”												x			

Notes:
x Pre-staging sample
y Post-staging sample

Additional Confirmation Sampling

Based on the CHP Staging Area Summary Letter dated July 10, 2020, and a site walk by the State IMT on July 10, 2020, additional post-staging soil samples were requested by the State IMT due to high metals and site observations. Tetra Tech collected additional samples from the area marked out by the State IMT. Figure 8-11 shows the additional Areas 1 through 7. Additional soil was then removed from Areas 3, 4, 5, and 6 based on those results. Additional post-staging confirmation samples were collected from Areas 3, 4, 4a, 4b, 5, and 6 on July 20, 2020.

Laboratory Analysis and Sample Identification

Each sample was analyzed for metals, TRPH, BTEX, SVOCs, and PCBs. The native soil samples were evaluated for pesticides. A subset of the samples at locations 04, 07, 10, 11, and 13 were selected to be analyzed for dioxin/furans to determine a presence/absence of the constituents; the post-staging sample at location 13 was not analyzed.

In accordance with the soil sampling plans established for the staging areas, soil samples were sampled and analyzed for the following analytes using U.S. Environmental Protection Agency (USEPA) test methods, with the exception of soil samples collected on July 10 and July 20, 2020, which were analyzed for metals only.

- Metals by USEPA Method 6020 or 7471 for mercury
- TRPH by USEPA Method 8015
- BTEX by USEPA Method 8260
- VOCs by USEPA Method 8270
- Pesticides by USEPA Method 8081
- PCBs by USEPA Method 8082
- Dioxins and Furans by USEPA Method 8290

Sample identifications are used to identify the fire incident, staging area, sample depth, and sample location.

Butte County, Camp Fire Incident: BFI
Staging Area: CHP Staging
Sample Type: Pre- and POST-
Sample Depth: 0003, 0609, 0912, 1215, 1518, 2124 where the first two digits represent the top of sample in inches below ground surface, and the second two digits represent the bottom depth of sample in inches below ground surface
Sample Location: 01 through 15

For example, BFI-CHP Staging-Pre-0912-04, indicates the pre-staging sample at location 04 was sampled at a depth of 9 to 12 inches below ground surface. Sample depths are not provided for post-staging samples as they were all collected from 0 to 3 inches below ground surface.

Analytical Data Validation

Stage 2a data validation was completed upon all staging area sample results, consistent with all confirmation samples throughout the Camp Fire Incident.

Soil Removal Activities

Based on initial post-staging sample results for lead at location 06, Area 6 was scraped to 3 inches below ground surface. Based on post-staging samples collected on July 10, 2020 and site observations by the State IMT, Areas 3, 4, and 5 were scraped to 3 inches below ground surface, and Area 6 was rescraped by 3 inches. Confirmation samples were collected from Areas 3, 4a, 4b, 4, 5, and 6 following the soil removal activities.

Results

Pre- and Post-staging area results were evaluated qualitatively to each other, as well as quantitatively to human health and environmental goals established in the *Background Sampling and Cleanup Goals Report, Camp Fire Incident, Revision 2*. The qualitative review focused on the net difference between the pre-staging and post-staging sample results. Samples with concentrations of pre-staging sample results higher than post-staging sample results are not presented, as they would not indicate presence of contamination based on debris removal activities. The quantitative review focused on exceedances of human health and environmental screening levels of those concentrations identified in the qualitative review. Sample results from soil removed at Areas 3, 4, 5, and 6 during rescrape activities are not included in the evaluation. An additional report will be prepared once all results are validated. Summary tables and analytical results are presented in Attachment 7.

> **Qualitative Review.** Sample results from copper, lead, and zinc increased at locations 05 and 07. Copper increased from 31 milligrams per kilogram (mg/kg) to 840 mg/kg at location 05, and increased from 69 mg/kg to 700 mg/kg at location 07. Lead increased from 14 mg/kg to 170 mg/kg at location 05, and increased from 7.7 mg/kg to 270 at location 07. Zinc increased from 47 mg/kg to 1,200 mg/kg at location 05, and increased from 54 mg/kg to 1,900 mg/kg at location 07. No other metals indicated significant differences between pre- and post-staging sample results.
>
> No other analytes indicated significant differences between pre- and post-staging sample results.
>
> **Quantitative Review.** Sample results from all locations indicate exceedance of arsenic above human health screening level of 0.36 mg/kg. Background sampling from a comparable geologic unit Q indicates naturally-occurring arsenic concentrations of 4.7 mg/kg; all staging area samples appear within the background range.

The sample result from rescrape Area 4a of 3,800 mg/kg was above the commercial screening level for lead of 320 mg/kg. All other results presented in the qualitative review and additional sampling were below residential or commercial screening levels.

Recommendations

Sample results from Area 4a indicate elevated lead levels possibly attributable to debris removal activities. This material should be removed and resampled for metals to help ensure no concentrations above the commercial cleanup goals remain. A final report specific to this staging area will be issued following receipt of all analytical results and data validation.

8.4.6 Deviations from the Work Plan

The following deviations from the soil sampling plans (Tetra Tech 2019c,i,j) for the staging areas are noted below.

- Three designated staging areas identified above were never used and therefore no post-staging samples were collected. This deviation was approved by the State IMT.
- At the CHP Staging Area (metal processing center) base material (gravel and river rock) was laid down prior to collection of pre-stage samples. The State IMT directed the field team to sample the top gravel layer wherever possible. The field team and staging area contractor also pushed aside the top gravel layer so samples could be collected at other depths as well for those sampling locations. The deeper sample depths were collected below the river rock. The rationale for sampling those depth horizons was that some areas had no soil or top layer, only gravel. The depth intervals are included in the sample IDs, for example BFI-CHP Staging-Pre-0912-04, indicating sample location 4 was sampled at a depth of 9- to 12-inches bgs.
- At the Granite Site (concrete facility) the sampling plan called for 22 locations but 21 were sampled. The site was an active construction/work area and many areas were highly compacted. Therefore, samples could only be collected from 21 locations based on accessibility (truck traffic, equipment/material staging, and sampler refusal).

8.5 HYDRANT SAMPLING

The State IMT directed Tetra Tech to conduct hydrant sampling to investigate whether water used for dust suppression contained detectable levels of VOCs or SVOCs. The sampling event was designed to evaluate suspected elevated concentrations of benzene from the Camp Fire Incident in the local water supply since this was the primary water source used for dust suppression throughout the fire footprint. The sampling was conducted consistent with the approved Hydrant Sampling Plan, Camp Fire Incident, Butte County, California, Revision 0 (Tetra Tech 2019d). The results of the hydrant sampling were provided in Hydrant Sampling and Employee Industrial Hygiene Exposure Monitoring Report, Revision 0 (Tetra Tech 2019l). The report provided hydrant sampling results and workers exposures to VOCs and SVOCs during sampling and the use of water for dust suppression. The hydrant sampling laboratory reports and screening tables are provided in Appendix M.

8.5.1 Methodology

Tetra Tech collected 21 hydrant samples from 19 hydrants including two field duplicates. Hydrant sampling was conducted in accordance with the objectives and measures identified in the sampling plan (Tetra Tech 2019d).

Samples were collected in accordance with USEPA SOP No. 815-B-18-009, "Hydrant Sampler Procedure." Sampling locations were noted in the site logbook, in accordance with Tetra Tech SOP No. 024, "Recording of Notes in Field Logbook." The sampling methodology is described below:

- At each hydrant, the line was opened, and a flow control device was installed.
- The water line was purged for 3 minutes and the flow reduced.
- Samples to be analyzed for VOCs were placed in three 40-milliliter glass vials with Teflon-lined septa and open-top screw caps; samples were preserved with hydrochloric acid (HCl).
- Samples to be analyzed for SVOCs were placed in two 1-L amber glass bottles fitted with Teflon-lined screw caps.
- The collected samples were labeled, packed, and shipped in accordance with procedures outlined in Tetra Tech SOP No. 019, "Packing and Shipping Samples."
- The samples were shipped to Alpha Analytical, Inc. for VOC and SVOC analysis

Samples were collected from 19 hydrants within the incident area as shown on Figure 8-10. The sample locations and sample identifications are presented below:

Sample ID	Hydrant Location
BFI-Hydrant-01	Pentz Road and Gate Lane
BFI-Hydrant-02	Clark Road and Maple Leaf Lane
BFI-Hydrant-03	6701 Clark Road
BFI-Hydrant-04	6280 Clark Road
BFI-Hydrant-05	Pentz and Bille Roads
BFI-Hydrant-06	1081 Fairview Drive
BFI-Hydrant-07/20	1090 Shadowbrook Way (with duplicate sample)
BFI-Hydrant-08	Pearson Road and Paradise Avenue
BFI-Hydrant-09	5657 Recreation Drive
BFI-Hydrant-10	5720 Clark Road
BFI-Hydrant-11	Buschman Road and Berry Creek Drive
BFI-Hydrant-12/21	Clark Road and American Way (with duplicate sample)
BFI-Hydrant-13	5540 Pentz Road
BFI-Hydrant-14	5118 Country Club Drive
BFI-Hydrant-15	899 Waggoner Road
BFI-Hydrant-16	Sunset and Lauren Drives
BFI-Hydrant-17	Pinewood and Redbud Drives
BFI-Hydrant-18	5634 Little Grand Canyon Drive
BFI-Hydrant-19	5542 Schmale Lane

8.5.2 Results

All samples were analyzed for VOCs by SW-846 Method 8260C and SVOCs using USEPA Method 625 at Alpha. No detections were observed in all samples except for the following:

VOCs:

- Acetone: Detection in one sample at 12 micrograms per liter (µg/L) at BFI-Hydrant-15
- Bromodichloromethane: Detections in every sample with results between 0.61 and 1.8 µg/L
- Chloroform: Detections in every sample with results between 9.4 and 58 µg/L
- Total trihalomethanes: Detections in every sample with results between 9.4 and 26 µg/L

SVOCs:

- 2,4-Dinitrotoluene: Two detections at 6.2 µg/L at BFI-Hydrant-09 and BFI-Hydrant-21
- 2,6-Dinitrotoluene: One detection at 5.8 µg/L

The only chemical detected with a California Maximum Contaminant Levels (MCL) is Total Trihalomethanes (TTHM). MCLs are the primary and enforceable drinking water standards in California. The California MCL for TTHM is 80 µg/L (California Regulations Related to Drinking Water, Section 64533, 2019). TTHM are the sum of bromodichloromethane, bromoform, chloroform, and dibromochloromethane. Since TTHM are the result of the disinfection of water supply systems, they are expected in the source water. Neither the reported TTHM concentrations nor the sum of the maximum individual constituents detected exceeded the TTHM MCL. The maximum detected concentration of all detected SVOCs and VOCs exceed their respective USEPA tapwater RSLs, except for acetone and total trihalomethanes. No comparative values of any kind were found for bromofluorobenzene. These three chemicals are not discussed further.

Tapwater RSLs do not accurately reflect potential community exposure to water from these hydrants based on actual use (dust suppression). The maximum detected concentrations of bromodichloromethane and chloroform are less than all of their USEPA health advisories. RSLs are guidance and advisory levels; they are not enforceable.

The maximum detected concentrations of 2,4- and 2,6-dinitrotoluene are less than all their federal and state health advisories, except for the 10^{-4} cancer risk value, which is minimally exceeded. Because actual exposure to 2,4- and 2,6-dinitrotoluene is expected to be limited, infrequent, and less than a drinking water exposure (based on tapwater RSLs and USEPA health advisories), and there were a limited number of detections, the exceedances of the respective 10^{-4} cancer risk values by 2,4- and 2,6-dinitrotoluene are not a concern.

Based on a comparison to tapwater RSLs and health advisories, the detected concentrations of SVOCs and VOCs in hydrants do not present risks to the community.

8.6 SUBSLAB SAMPLING

The State IMT requested Tetra Tech to conduct subslab sampling to identify metals contamination in the surface soil directly below the concrete slab present prior to soil removal activities. The request was in response to FEMA inquiries regarding the possible contaminants present in soil beneath concrete slab foundations. The State IMT directed the three debris removal contractors to remove foundations from three properties each and tasked Tetra Tech with collecting soil samples. Only one contractor provided three properties for sampling, listed below:

- APN: 064-500-057
- APN: 051-460-014
- APN: 064-330-035

8.6.1 Methodology

Tetra Tech divided the subslab areas into DUs based on the square footage consistent with the soil sampling methodology. Tetra Tech collected the samples from 0- to 3-inches bgs immediately after the debris removal contractor removed the slab. Tetra Tech collected five discrete surface samples at each DU.

Samples IDs were BFI-APN-PRE-DU-location number 1-5 (example: BFI-064-500-057-PRE-A1-5). After debris removal was fully completed, confirmation soil sampling of the property was completed as normal. All subslab samples collected were analyzed for metals.

The cleanup goals screening table that includes the analytical results for the three APNs where subslab sampling was conducted is included in Appendix N.

APN	Number of Samples	Date Collected
064-330-035	20	2/23/2019
064-500-057	25	2/25/2019
051-460-014	25	6/12/2019

Note:
APN – Assessor Parcel Number

8.6.2 Results

All samples were analyzed for metals by USEPA Methods 6020 and 7471. Sample results were provided to the State IMT and no changes to confirmation sampling were made based on these results. Sample results above the 20 percent laboratory margin of error or the area cleanup goal for below each subslab are presented below:

APN	Cleanup Goal Geologic Area	Samples Above Cleanup Goal but Within LMOE	Samples Above LMOE and Cleanup Goal
064-330-035	Tvp Area	1 sample for arsenic	1 sample for arsenic, copper, lead and zinc 1 sample for lead 1 sample for arsenic
064-500-057	Tvp Area	18 samples for cobalt	1 sample for arsenic 2 samples for cobalt
051-460-014	Tvp Area	No samples	No samples

Notes:
APN – Assessor Parcel Number
LMOE – Laboratory margin of error

8.7 WELL ABANDONMENT

Throughout the assessment and debris removal process, the site assessment process identified a total of 104 dug wells on properties impacted by the Camp Fire. Historical dug wells from the early- to mid-1900s differ from more recent drilled wells as they were often dug by hand. Dug wells are typically relatively shallow (generally 12- to 79-feet bgs) uncovered open holes from 2- to 5-feet in diameter and are uncased below 3- to 6-feet bgs. These wells present not only a physical hazard to debris removal personnel and wildlife, but also may serve as a direct conduit for contaminants to enter the shallow groundwater system.

To eliminate the physical hazards and minimize the potential for impacts to shallow groundwater, the State IMT, with concurrence from the Butte County Public Health Department, tasked Tetra Tech with abandoning the identified dug wells following general guidelines presented in Exhibit H of the DROP (CalRecycle 2019). Butte County permit requirements were waived per the emergency declaration (Executive Order B-57-18) issued by the Office of the Governor of California on November 14, 2018.

Five dug wells were initially identified for abandonment to evaluate methodologies and cost. The State IMT approved moving forward with the five wells on June 6, 2019. Tetra Tech oversaw a local contractor who provided well abandonment services. The abandonment steps were as follows:

1. Identify whether the well qualifies per the Butte County definition requiring abandonment:
   a. Well is greater than 8 feet in depth, and;
   b. Well is located within an ash footprint or immediately adjacent to the ash footprint.

State Technical Specialists and the State IMT determined whether the well met the qualifications for abandonment.

2. Obtain approval for abandonment from property owner.
3. Remove debris and impacted soil and ash from around the well opening to prevent entry into the well during abandonment.
4. Emplace 3/8-inch bentonite chips in the bottom 2- to 6-feet of the well to seal the floor of the well. If no water was present in well, water was added to hydrate bentonite chips.
5. Fill well column with cement/sand slurry to within 5-feet of ground surface (cement slurry mix was adjusted as necessary to address wells with excessive water).
6. Remove surface expression of the well (rock/brick/concrete ring around opening), excavate soil around opening to create a 3:1 slope.
7. Emplace a 3-foot-thick mushroom cap (cement/sand slurry) to within 2-feet of ground surface.
8. Cover the mushroom cap with native soil or clean imported pea gravel; return former well area to existing grade.
9. Remove well debris (rock/brick/concrete ring, and any pump, piping, or electrical service) from site.
10. Replace disturbed erosion control material with straw (if well abandonment was completed after site debris removal and erosion control).

After successful abandonment of the initial five wells, the State IMT approved abandonment of the remaining wells on June 21, 2019. In total, 65 of the 104 hand dug wells encountered were abandoned per the steps outlined above. A summary of abandoned well locations and dimensions is provided in Table 8-6.

Twenty of the 104 qualifying wells were not abandoned based on property owner request or failure to obtain property owner approval for abandonment. The remaining 19 wells did not qualify for abandonment because of insufficient depth or location outside of the ash footprint. Dug wells that were not abandoned, were covered with plywood (or other materials) and fenced to reduce physical hazards.

Well abandonment documentation consisted of (1) a site map with former well location, (2) photographic documentation, and (3) a completed well abandonment diagram (with materials quantities). Well abandonment documentation is provided in Appendix O.

8.8 HAZARDOUS MATERIALS RESPONSE

The State IMT tasked Tetra Tech to contract a company to provide a comprehensive range of environmental services to mitigate environmental issues that were not in the SOW of the three contractors responsible for the debris removal. Tetra Tech contacted two local firms that were hazardous materials trained. National Response Corporation (NRC) was the only responsive contractor. Tetra Tech contracted with NRC, located in Chico, Butte County, California to provide services for the project.

8.8.1 Scope of Work

NRC provided the following services: hazardous materials emergency response, high hazard response, septic and wastewater removal, waste management and transportation, remedial construction, industrial cleaning, and maintenance. NRC was assigned environmental tasks that DTSC did not have the ability to perform within its contract with the State of IMT to remediate in association with debris removal activities at the Camp Fire Incident, located primarily in Paradise, California.

The primary work completed by NRC was pumping of septic tanks, heating oil tanks, damaged fuel tanks, and removal of drums of petroleum products, pesticides and fertilizers, standing water, and petroleum-contaminated soils within the debris remaining from the Camp Fire Incident.

8.8.2 Hazardous Response Process

During activities associated with site assessment, asbestos assessment, asbestos removal, or debris removal, a variety of environmental issues were identified that neither the debris removal contractor nor DTSC could mitigate based on contractual issues or lack of proficiency to handle a particular environmental issue. There were 26 individual hazardous responses.

Once an issue was identified, Tetra Tech consulted with technical specialists within the State IMT, then notified the State IMT with photos and information regarding the need for NRC to provide an estimate for an environmental service to be performed.

The State IMT was then provided an estimate for review. When Tetra Tech received approval from the State IMT, NRC was notified to proceed with the remediation.

8.8.3 Hazardous Response Completion

Tetra Tech provided oversight of all NRC activities during the remedial activities through completion. Tetra Tech followed up with NRC with the receipt of volumes of liquid, analytical results, and manifests when applicable. When each site remediation was complete, consistent with the SOW for the specific property, Tetra Tech notified the State IMT. When the State IMT concurred that the site remediation was complete, the site was re-opened for the debris removal contractor. Table 8-7 provides locations and types of environmental response activities NRC performed for the Camp Fire Incident.

9.0 INDIVIDUAL PROPERTY REPORTS

Tetra Tech prepared individual property reports (IPR) for 12,632 properties in the Camp Fire Incident debris removal program. Each IPR is composed of between 12 to 15 forms that document each of the debris removal program activities conducted at an individual property. While comprehensive debris removal program activities are described in detail in Sections 2.0 through 8.0 of this report, each IPR includes a summary of the activities. IPRs were not prepared for any property withdrawn from the program, whether by the property owner or the State IMT, although some activities may have been conducted at these properties.

Each IPR describes general debris removal and environmental activities conducted at each property and specific details for each property. The text is customized for each IPR depending on the property-specific activities conducted. For example, if an XRF survey was conducted at a property, then the XRF summary is included for that property IPR. Only text relevant to a property is included. Damage claims are included if provided by the property owner. The text for all activities included in the IPRs is included below. IPRs for each property are included in Appendix P.

OVERVIEW

This individual property report (IPR) describes general debris removal and environmental activities conducted at each property and specific details for this property. General program activities at each property included the following: Debris Removal Right-of-Entry Permit (ROE) review and eligibility determination, site assessment, asbestos survey, asbestos abatement (if appropriate), debris removal, soil confirmation sampling (if appropriate), additional soil removal (if appropriate), erosion control (if appropriate), and final State Incident Management Team (IMT) approval. All activities were conducted in accordance with the Debris Removal Operations Plan for the Camp DROP (CalRecycle 2019). Each activity is described below, and specific details and milestones for this property are included in the table at the end of this IPR.

PROPERTY ACCESS

Property owners submitted ROE forms to Butte County to authorize access to and cleanup of the property. Following County approval, the ROE was provided to the State IMT for eligibility review and the property was included in the debris removal program. The ROE provides the terms of the debris removal program and outlines the overall process. ROE for properties addressed as forced abatements are not included since none were provided.

SITE ASSESSMENT

The site assessment is the initial detailed activity at each property. Environmental consultants performed hazardous material surveys and recorded property conditions and hazards using electronic or paper field forms, photographs, and created a property sketch. Results of the site assessment guided safe removal and handling of burn debris and served as the baseline for all debris removal and environmental activities.

ASBESTOS SURVEY AND ABATEMENT

California CACs and CSSTs completed a visual asbestos survey (Appendix A of the Debris Removal Operations Plan for the Camp Debris Removal Incident, Version 5.4, dated June 13, 2019) at each property. Samples were collected from materials suspected to contain asbestos, including: (1) construction materials from destroyed and partially destroyed structures and (2) debris piles. If the asbestos inspectors did not

identify suspected asbestos-containing materials, no samples were collected. Materials confirmed to contain asbestos at concentrations specified in the DROP (CalRecycle 2019) were removed by California licensed abatement contractors before any other debris removal, and then this initial removal was visually verified by a CAC or CSST.

COMMERCIAL WASTE DISPOSAL PROFILING (EXEMPT)

Site inspections and historical reviews were conducted at 291 properties identified by Butte County as "commercial use" based on land use permits or zoning; these properties were evaluated for waste disposal profile sampling, including this property. Commercial properties with construction types and land uses similar to residential properties were determined to be exempt from requiring waste disposal profiling by the State IMT, and the debris removal at those properties followed the procedures for residential properties described below. If a commercial property was determined by the State IMT to be non-exempt from profiling, ash was sampled to ensure the debris was disposed at an appropriate landfill. This property was determined to be exempt from waste disposal profiling and no profile samples were collected. Waste disposal practices were conducted consistent with residential properties.

COMMERCIAL WASTE DISPOSAL PROFILING (NON-EXEMPT)

Site inspections and historical reviews were conducted at 291 properties identified by Butte County as "commercial use" based on land use permits or zoning; these properties were evaluated for waste disposal profiling, including this property. Commercial properties with construction types and land uses similar to residential properties were determined to be exempt from commercial waste profiling by the State IMT, and the debris removal at those properties followed the residential procedures described below. If a commercial property was determined by the State IMT to be non-exempt from profiling, ash was sampled to ensure the debris was disposed at an appropriate landfill. This property was determined to be non-exempt from waste disposal profiling. Waste disposal profile sampling was conducted before debris removal.

DUG WELL DESTRUCTION

A dug well was identified on this property during the site assessment. The environmental consultants obtained dug well destruction approval from the property owner. After approval, the contractor destructed the dug well by removing the portion above ground surface and to 3 feet below ground surface, then filling the dug well with concrete sand slurry or bentonite chips. The contractor placed a 3-foot concrete mushroom cap at the top and sloped the sides back to grade.

DEBRIS REMOVAL

Debris removal and asbestos abatement contractors conducted the removal of all building materials impacted by the fire, including but not limited to: stucco, roofing, floor tile, linoleum, fireplaces and chimneys, furnaces, vinyl tiles and mastic, sheetrock and joint compound, asbestos cement pipe, exterior home siding, thermal system insulation, concrete, appliances, vegetation, construction debris, electronic waste, household hazardous chemicals, and impacted soil beneath former structures or vehicles. Debris removal activities were guided by the site assessment results. An independent, third-party debris monitoring consultant and the State IMT representatives conducted oversight of all debris removal activities. All debris was disposed at State- and County-approved recycling facilities or landfills.

CONFIRMATION SOIL SAMPLING

Following debris removal activities, environmental consultants collected soil samples from the top 3 inches of soil to confirm any residual contamination from burn-impacted structures had been removed. Soil sampling results were compared to cleanup goals developed specifically for the Camp Fire Incident, as approved by the State IMT. The cleanup goals are based on health-based screening levels established by U.S. Environmental Protection Agency (EPA) and California Department of Toxic Substances Control (DTSC) for residential uses, and ambient or naturally-occurring "background" concentrations of metals in soils. Background levels were determined by extensive testing for metals in areas without burned debris. Cleanup decisions also incorporated a laboratory margin of error to account for common instrument variability within standardized EPA laboratory tests. Confirmation sample names use assessor parcel numbers (APN) followed by the structures sampled (A, B, C, etc.), and the number of samples per structure based on the structure footprint (A1, A2, A3, B1, C1, C2, etc.)

	APN		Structure/Sample Number
Example Confirmation Sample Name:	123-456-789	–	A2

RESCRAPE ACTIVITIES

If a confirmation soil sample result was greater than the cleanup goal and laboratory margin of error, the State IMT directed the contractor remove an additional 2 to 3 inches of soil from the area represented by the soil sample. Following the soil rescrape, new confirmation soil samples were collected from the specific area and results were again compared to the cleanup goals. The rescrape-resample process continued until all cleanup goals were met, or in rare case the State IMT determined that contamination was not attributable to debris from the Camp Fire but instead was representative of ambient soil conditions, as described below. Rescrape sample names add a suffix (R1, R2, R3, etc.) identifying the number of rescrapes within the relevant sample area.

	APN		Structure/Sample	Number	Rescrape
Example Rescrape Sample Name:	123-456-789	–	A2	–	R1

ADDITIONAL SOIL SAMPLING

If soil sample results indicated that metal concentrations above the cleanup goals were likely from local background or ambient pre-fire conditions, then additional soil samples were collected from 3, 6, and 9 inches below the surface and away from the burned structures. Results from these soil boring samples were used to evaluate background or ambient conditions at the subject property and nearby properties within ½ mile. If concentrations of metals in these soil boring samples were comparable to the soil from the structure footprints, then the State IMT determined that exceedances of the cleanup goals were not attributable to the Camp Fire, and the property was recommended for erosion control. In a small number of properties, the State IMT observed fill material or other evidence of soil contamination preceding the Camp Fire. These properties were rescraped several additional inches to remove elevated surficial metals concentrations. Some of these rescrapes were successful; however, for some properties the elevated concentrations persisted at depth, and the State IMT halted additional soil removal. Soil boring sample names are noted by SB01, SB02, etc. followed by the depths sampled (0306, 0609, 0912, where 0306 represents 3 to 6 inches below ground surface, etc.).

	APN		Soil Boring		Depth
Example Soil Boring Sample Name:	123-456-789	–	SB2	–	0306

XRF EVALUATION

The contractors conducted an XRF soil evaluation at this property based on the results of the initial confirmation or rescrape samples. XRF readings provide real-time estimates of metals concentrations in soil. XRF readings were compared to the established cleanup goals to guide real-time decisions regarding depths and locations, before final confirmation samples were collected. This approach helps reduce the amount of soil excavated and the need for additional rescrapes. XRF field screening allowed for focused removal of localized soil with metal concentrations exceeding the cleanup goals; this approach occasionally resulted in sampling areas being divided into smaller units. XRF sample names are noted as R1, R2, R3, etc., followed by S1, S2, S3, etc.

	APN		Structure/Sample		Number Rescrape		XRF Unit
Example XRF Sample Name:	123-456-789	–	B1	–	R2	–	S1

EROSION CONTROL

Once the State IMT determined the property met the overall cleanup objectives of the debris removal action, contractors implemented erosion control measures, if authorized by the property owner. Erosion control measures stabilized disturbed soil and reduced potential soil runoff by installing fiber rolls, compost filter socks, silt fences, erosion control blankets, hydraulic mulch and tackifier, soil binders, and other mechanisms to reduce soil erosion. Means and methods differed at each property depending on property conditions.

STATE IMT APPROVAL

Following completion of erosion control measures, the State IMT conducted a final on-site review of the property, approved all work completed, and recommended to Butte County that the debris removal objectives were complete. Butte County completed the process with approval of the Debris Removal Final Signoff Form.

10.0 PROJECT COST SUMMARY AND WASTE DISPOSAL SUMMARY

Project costs and waste disposal information was gathered from inception through completion of debris removal and reporting activities. This section summarizes the cost and waste disposal information. The Cost Summary Table for each property is provided in Appendix Q.

10.1 PROJECT COSTS

The Final Property Cost Allocation located within the IPR cost appendices serves to illustrate the charges incurred on a per property basis. During the course of the project, all debris contractor and Tetra Tech charges are tracked on a per-property basis via the APN and address of the property. These charges include material sampling, Tetra Tech labor associated with debris monitoring and environmental services, material sampling, and debris contractor removal charges. At project close, all contractor charges incurred were brought together and summarized to display the total cost incurred per property. In addition, any contractual charges billed on a "community" basis are also included. These charges are allocated on a per property basis using a weighted allocation based on the tonnage of debris removed on the property versus the overall project tonnage.

10.2 WASTE DISPOSAL SUMMARY

The total debris collected on the Camp Fire project summed to over 3.6 million tons. This debris was collected by the three contracted firms: Ceres Environmental, ECC and SPSG. The debris material was classified into the following waste streams: burned debris and ash, concrete, contaminated soil, and metal. Contaminated Soil/Rescrape was distinguished as a separate debris class but classified as Contaminated Soil by landfills. The following landfills were utilized as final disposal sites: Franklin Neal Road Recycling Facility, Granite Pacific Heights Recycling Facility, Butte County Neal Road Landfill, Odin Metal Processing Facility, Recology Ostrom Road Landfill, and Waste Management Anderson Landfill. Debris was classified during collection and brought to the appropriate final disposal site for the waste stream.

Tables 10-1 through 10-3 provide the summaries by debris contractor. Tables 10-4 through 10-6 provide Waste Stream Summary per Camp Contract Line Items by debris contractor.

Contractor	Concrete	Metal	Burned Debris and Ash	Contaminated Soil	Contaminated Soil - Rescrape
Ceres	148,791.83	13,942.89	447,778.26	146,726.40	7,776.80
ECC	284,667.50	18,919.38	1,040,650.57	210,784.19	13,532.33
SPSG	273,633.91	19,136.54	745,515.87	272,552.53	15,507.42

Total costs provided are based off of data reconciled and paid by CalRecycle through June 30, 2020, and do not represent final project totals.

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