DISCLAIMER: THIS IS A SAMPLE REPORT INTENDED TO EDUCATE THE PUBLIC ABOUT POST FIRE SAMPLING ONLY.

KAIZEN™
Safety Solutions, LLC

# RESIDENTIAL POST-FIRE COMPREHENSIVE INDUSTRIAL HYGIENE EVALUATION and SAMPLING REPORT

PROPERTY ADDRESS:

## UNDISCLOSED ADDRESS

**PREPARED FOR:**
REDACTED

**Date of Sampling:** June 29, 2020
**Date of Final Report**: July 29, 2020

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## Section 1.0 – Executive Summary

KAIZEN SAFETY SOLUTIONS, LLC was hired to investigate damage, quantify potential contamination and provide repair and remediation recommendations following the ABC fire and associated toxic smoke that occurred on or about November 25, 2020 and impacted the single family residence located at UNDISCLOSED ADDRESS. The homeowner reported that his family could not inhabit the residence due to the smoke like post-fire odor and adverse health effects he experienced after being in the residence for short periods of time.

The ABC fire engulfed and destroyed over 6,000 building structures and thousands of personal and commercial vehicles. The toxic smoke generated by the burning contents of the thousands of residential/commercial structures and vehicles, permeated every remaining structure in its path. The toxic chemical and respirable particulate insults to the structures left standing is unprecedented from a health hazard evaluation perspective.

Prior to KAIZEN SAFETY SOLUTIONS, LLC site visit, no repairs have been made to the residence. The homeowner boarded up the home to prevent unauthorized entry into the home. Windows on the east side of the home had been damaged or broken from the heat of the fire.

This residence survived the fire storm even though, in every direction around this residence, all structures (residential homes, sheds and garages) were reduced to ashes with the exception of chimneys and the metal shells of a variety of personal vehicles left behind. The home owner reported that the remains of the residence to the west of his property was a home-based pesticide business.

On June 29, 2020, Dawn Bolstad-Johnson, MPH, CIH, CSP of KAIZEN SAFETY SOLUTIONS, LLC conducted the site visit and performed the industrial hygiene evaluation and sampling. Real Time Direct Read instrumentation was utilized to scan the entire residence for airborne respirable sized particulate and airborne toxic chemicals that may contribute to the reported health effects. Tape lift samples of dust were collected from various locations and analyzed for soot using both visual and TEM analysis. Bulk samples of carpet dust were collected from each bedroom and a section of the filter from the HVAC unit was collected and analyzed for particle/fiber characterization. Bulk samples of drywall were collected and analyzed for asbestos.

Mold sampling was conducted within the residence. Finally soil samples were collected and analyzed for potential contamination.

At first glance, the obvious fire damage appeared to be limited to the east side of the residence where the entire side was scorched by fire and high heat. The sampling conducted in and around this residence was completed 8 months after the initial fire and toxic smoke insult.

It is important to note that average residences are not designed to be airtight. It is expected that concentrations of particulates and molds would be lower inside a residence when compared to outside air because of the installed HVAC system and the presence of filtered air. When the outside air consists of bellows of toxic smoke, any residence in its path is going to be adversely impacted as the toxic smoke will find its way through the cracks in construction, open/broken doors and windows and porous materials that are used to build the structure.

Direct read airborne chemical results revealed that the highest concentration of airborne toxic chemicals was discovered in the main living area (living room) of the residence. The average phosphine levels in this residence are above the Agency for Toxic Substances and Disease Registry (ASTDR) Emergency Response Planning Guideline (ERPG) of 0.5 ppm which is a recommended public health exposure for no longer than one hour.

At least eighteen (18) sample locations were determined for toxic gases. The summary of all results is found in Section 7 of this report. The results show that there are a variety of airborne toxic chemicals in every living space within the house. Many of the airborne concentrations exceeded NIOSH and/or CAL-OSHA workplace standards.

Based on the observations and analysis of the samples collected, it is recommended that this residence not be occupied in its current condition. Based on the sample data, every porous material, including building materials and contents, that is capable of absorbing toxic chemicals is presumed to be contaminated.

Two (2) soil samples were collected. One was a composite sample consisting of soil collected from each side of the residence (north, west, south and east) and the second sample was collected from the entry to the crawl space under the residence. Levels of organochlorine pesticides were determined as well as soluble nitrates, chlorides and sulfates. The soil samples were used as a screening tool to determine potential levels of contamination. Additional soil samples are recommended to determine area of potential contamination as well as compliance with the California regulations on soil remediation limits in residential areas. The data for the soil samples is included in Tables 9A, 9B, 9C, and 9D

The toxic load of the smoke as it moved through this residence is significant due to all of the contents of all of the homes and vehicles that burned prior to the smoke reaching this residence. The toxicity of the smoke generated from the ABC fire includes but is not limited to the toxic gases generated by the pyrolysis of the following:

- building materials of multiple residences, commercial buildings;
- vehicles, gasoline, metals, tires;
- recreational vehicles, trailers;
- household chemicals, household pesticides;
- household furniture;
- household electronics;

- plastic toys;
- carpeting, laminate flooring, etc.
- misc plastic load – appliances, food storage, furniture, shelving, printers, etc..

The recommendation is that the home should either be properly remediated or it should be demolished and replaced. Based on the observed airborne toxic chemical concentrations still present eight months post fire, removing all contaminated materials and deconning the residence will be a challenge.

In order to ensure complete remediation, it is recommended that all porous materials, textiles, carpets, clothing, books, furniture, walls, ceilings and insulation be removed and replaced; non-porous materials should be decontaminated. After all porous materials are removed and non-porous materials are decontaminated, it is recommended that the industrial hygiene sampling be repeated to ensure that the structural members of the home are not off-gassing what may have been absorbed by the smoke insult on the home. In addition, the soil surrounding the residence and under the crawl space would need to remediated to California Soil Remediation Limits for residential areas.

A thorough cost benefit analysis is recommended to determine the efficacy of remediation and repair versus complete demolition and rebuild.



## Section 2.0 - Definitions

1. Ca: Carcinogen

2. Cal OSHA: California Occupational Safety and Health Administration. A branch of the California Department of Industrial Relations responsible for assuring the safety and health of California's workers
3. CEILING VALUE The concentration that should not be exceeded during any part of the working exposure
4. PID: Photo Ionization Detector
5. $mg/M^3$: Milligrams per cubic meter. 1 $mg/M^3$ is 1 milligram of material per cubic meter of air.
6. $\mu g/M^3$: Micrograms per cubic meter. 1 $\mu g/M^3$ is 1 microgram of material per cubic meter of air.
7. µm: Unit of measure in microns. One micron is 1/1,000,000 of a meter.
8. ND: Not Detected
9. NIOSH: National Institute of Safety and Health. A branch of the U.S. Department of Health and Human Services responsible for creating and standardizing methods used in detecting and analyzing workplace chemical hazards.
10. OSHA: Occupational Safety and Health Administration. A branch of the U.S. Department of Labor responsible for assuring the safety and health of America's workers.
11. PEL: Permissible Exposure Limit. Published and updated by Cal/OSHA, PEL's are legally enforceable maximum employee exposures to listed chemical compounds over an 8-hour shift, intended to produce no adverse health effects (Title 8, Section 5155, Table AC-1).
12. PPB: Parts per Billion. 1 ppb is $1/1000^{th}$ part per million by volume.
13. PPM: Parts per Million. 1 ppm is 1 part of material per million parts of measurable volume. This is a volume to volume ratio.
14. REL: Recommended Exposure Limit. Published and recommended by NIOSH.
15. STEL: Short Term Exposure Limit is the acceptable average exposure over a short period of time, usually 15 minutes as long as the time-weighted average is not exceeded.
16. TCLP: Toxicity Characteristic Leaching Procedure.



## Section 3.0 – Background

The REDACTED Fire (REDACTED) was one of the most destructive wildfires in California history. The fire began (REDACTED) and an urban firestorm quickly followed that engulfed the town of

REDACTED. The fire reached 100% containment on (REDACTED) and destroyed over 6,000 structures and thousands of vehicles.

On June 29, 2020, KAIZEN SAFETY SOLUTIONS, LLC conducted a site visit and comprehensive industrial hygiene sampling at the residential property located at UNDISCLOSED ADDRESS. Dawn Bolstad-Johnson, MPH, CIH, CSP, FAIHA performed the industrial hygiene services at the site.

Representatives of KAIZEN SAFETY SOLUTIONS, LLC met with the homeowner REDACTED, and REDACTED at the property. The homeowner explained how there was little time to evacuate the area, as the winds were carrying hot embers ahead of the fire that resulted in multiple spot fires ahead of the massive fire storm. Due to the post-fire odors and poor air quality inside the home, the homeowner and his family (wife and two young children) have been unable to reoccupy the residence.

The residence located at UNDISCLOSED ADDRESS is a single family residence, approximately 960 square feet, one story, and was constructed in approximately (REDACTED). This residence has a crawl space foundation.

This residence survived the fire storm even though in every direction around it, all structures (residential homes, sheds and garages) were reduced to ashes with the exception of chimneys and the metal shells of a variety of personal vehicles left behind.

INSERT HOMEOWNERS COMMENTS AND OBSERVATIONS ABOUT THE FIRE (REDACTED)

While the structure of the residence remained largely intact, there is evidence of substantial particulate and chemical intrusion throughout the residence and significant fire damage on the east side of the residence from the high heat and smoke generated by the fire.

## Section 4.0 – Scope of Work

KAIZEN SAFETY SOLUTIONS, LLC was hired to investigate damage, quantify potential contamination and provide repair and remediation recommendations following damage from the ABC fire and associated toxic smoke that occurred on or about REDACTED and impacted the single family residence located at UNDISCLOSED ADDRESS.

## Section 5.0 - Observations

REDACTED – KAIZEN SAFETY SOLUTION, LLC OBSERVATIONS DURING THE SITE VISIT.

The residence was boarded up. The windows on the east side of the residence were damaged from the fire. The homeowner noted that looters had broken in and stolen personal property.

Inside the garage and residence there was a slight "fire smoke" odor noticed during the inspection and sampling in nearly all areas. KAIZEN SAFETY SOLUTIONS, LLC representatives wore respirators while inside the residence.

***Front Entry/Living Room***

The front door leads right into the living room. There was a smoke like odor immediately upon entering the residence. The front entry door remained closed during all particulate and chemical sampling. The flooring in this area consisted of a wood laminate.

***Kitchen***

The same wood laminate flooring extended to the kitchen. There was visible mold growth on top of the remaining coffee in the coffee pot and a loaf of moldy bread was noted on the counter. The homeowner reported that the refrigerator in the kitchen had not been opened since before the fire. There was dried liquid staining around the refrigerator. KAIZEN SAFETY SOLUTIONS, LLC did not open the refrigerator.

***Bedroom #1***

This room has bunk beds, a dresser, book shelves and multiple books on the floor. The windows in this room had been broken/damaged by the fire. The window has been boarded up but is not sealed from outside air. There are cracks around the board that allow outside air to enter this room. The blinds in this room are distorted/melted from heat. There is carpeting in this room. A significant amount of dust had collected on the frame of the bunk bed.

***Bathroom***

The bathroom window was damaged by the fire. The outside framing is melted. This window was not boarded up. There is a tub/shower and a tile floor in this room.

***Master Bedroom***

This room has queen size bed, a dresser, and night stands. The east facing window in this room had been broken/damaged by the fire. The north facing window did not have obvious fire damage. The windows had been boarded up but are not sealed from outside air. There are cracks around the board that allow outside air to enter this room. The sheets on the bed show small burn holes likely from small hot embers that entered through the broken windows. The blinds in this room are distorted/melted from heat. There is carpeting in this room.

***Master Bathroom***

This room had a significant odor. No obvious fire damage.

***Bedroom #3***

This room was on the opposite side of the home. There was significant collection of soot,char and other fire debris noted.

***Inside Garage***

This area serves as storage. There was a treadmill and several tools and miscellaneous items. There is a refrigerator in this space that has also not been opened since before the fire.

***Attic***

The attic was not entered and only observed from the access door in the garage. The condition of the attic was typical with dust, cobwebs and insulation.

***Crawl Space Under Residence***

There was visible ash observed in the crawl space. There was also wet soil observed. The FLIR camera revealed that the source of the water in the crawl space was likely originating from a leaking toilet.

***East Side of Residence***

There is evidence that this side of the home experienced high heat from the ABC fire. The cement board siding is lifted in several areas. The paint is blistered and discolored in several areas. Broken bedroom windows and melted window framing was observed. Cracks in the cement board siding and in the foundation wall were observed. In the areas where the cement board siding had lifted, the vapor barrier under the cement board siding was observed to be melted.

## Section 6.0 – Field and Analytical Methodology

Real Time Direct Read instrumentation was utilized to scan the entire residence. Samples utilizing all of the direct read instrumentation listed below were collected from each room in the residence.

The residence was first scanned using the particle detectors and then scanned a second time utilizing the gas and vapor real time detection equipment.

Tape lift samples were collected for soot in various areas.

Carpet dust was collected and analyzed in both the master and kid's bedrooms and a sample of the filter in the HVAC system was collected.

Mold sampling was completed utilizing high volume pumps calibrated to 15 liters per minute (lpm) equipped with Zefon spore traps.

Asbestos sampling was conducted in the master bedroom only as a spot check due to the age of the residence. These samples do not constitute a full asbestos survey. Additional sampling would be necessary to determine the presence or absence of asbestos building materials. The samples collected were from an inspection hole in the wall.

Two (2) soil samples were collected. One sample is a composite from all four sides of the residence and the second soil sample was collected from the crawl space under the residence.

The following is a list of equipment utilized in this Industrial Hygiene Evaluation. All equipment was properly pre/post calibrated when applicable according manufacturers' instructions and standard industrial hygiene practices. The GASMET unit was flushed with nitrogen, prior to use, as per manufacturer's recommendations to zero the instrument.

**Real Time Particulate Sampling was accomplished utilizing the following instruments:**

**TSI 9306-V2 Aero Trak Handheld Particle Counter – SN 93061342008**
This instrument measures up to six channels of particles simultaneously. The specific cut sizes (aka particulate diameters) measured were: 0.3 µm, 0.5 µm, 1.0 µm, 2.0 µm, 5.0 µm, 10.0 µm.

**P-Trak Ultrafine Particle Counter 8525 – SN 8525-02130004**
This instrument measures ultrafine particulate having a diameter of less than 0.1 µm.

**Real Time Gas and Vapor Sampling was accomplished utilizing the following instruments:**

**GASMET DX4040 Portable Ambient Air Analyzer – SN 183954**
The Gasmet DX4040 FTIR gas analyzer can detect up to 25 gases simultaneously. This instrument using Fourier Transform Infrared Spectroscopy (FTIR) and provides reliable measurements with low detection limits.

**IonScience Tiger Photo Ionization Detector (PID) – SN T-108354**
This instrument can measure a broad range volatile organic compounds (VOC) that have an ionization potential (IP) of 10.6 ev or less with a range of 0 – 20,000 ppm.

**Mold/fungal sampling pumps:**
ZEFON BIO-PUMP PLUS MODEL ZBP-200 Serial no 2194
ZEFON BIO-PUMP PLUS MODEL ZBP-200 Serial no 2195



## Section 7.0 – Sampling and Analyses of Results

***Settled Dust – Tape Lift Sampling for Soot***

ASTM Method D6602. This method identifies soot like particulate that has settled and is present in-house dust. This is often an indicator of cleanliness. The residential property had not been cleaned prior to KAIZEN SAFETY SOLUTIONS, LLC site visit.

A total of eleven (11) tape lift samples were collected in areas that were suspected to have smoke intrusion based on information provided on-site by the homeowner. Samples were submitted to REDACTED for ASTM D6602 analysis.

Table 1 summarizes the results of the tape lift samples. The results show 1-20% concentrations of soot in the settled dust of the samples collected. Please note that the results only correspond to the samples collected and may not be extrapolated or applied to other areas of the residence.

**TABLE 1: JUNE 29, 2020 - Summary of OPTICAL Tape Lift Sample Results**
**Single Family Residence – UNDISCLOSED ADDRESS**

| LOCATION | % | SOOT LIKE | FUNGI | POLLEN | FIBER | VEG | MINERAL | UNK | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| BED FRAME | 25 | 20 | 1 | 1 | ND | 15 | ND | 63 | 100 |
| BED FRAME | 10 | 10 | Trace | Trace | Trace | 5 | ND | 85 | 100 |
| BED FRAME | 40 | 10 | 1 | Trace | ND | 15 | Trace | 74 | 100 |
| Picture Frame hall | 15 | 1 | ND | 2 | Trace | ND | ND | 97 | 100 |
| KITCHEN | 15 | 2 | Trace | ND | Trace | 1 | ND | 97 | 100 |
| Window Sill | 5 | Trace | Trace | 1 | ND | 1 | ND | 98 | 100 |
| Top of Living room fan | 25 | 2 | 10 | 1 | 2 | 5 | ND | 80 | 100 |
| Master Window sill | 30 | 3 | Trace | 10 | Trace | 5 | ND | 82 | 100 |
| Master Bedding | 20 | 5 | ND | 1 | Trace | 15 | ND | 79 | 100 |
| Master Bath | 50 | 5 | Trace | 10 | Trace | 35 | ND | 45 | 100 |
| Bedroom #3 | 55 | 5 | Trace | 10 | Trace | 15 | ND | 70 | 100 |

% = % coverage on tape lift
ND = Not Detected

Additional Transmission Electron Microscopy (TEM) was conducted on these samples to confirm the presence of soot concentrations. All three samples collected in the bedroom were confirmed to contain elevated concentrations of soot. TEM Results can be found in Appendix A.

***Bulk Dust Characterization***

Dust from the carpeting was collected using a dust collector and power from a hand-held battery powered vacuum cleaner. One sample was collected from the kid's room and one from the master bedroom. Approximately 1 gram of bulk dust material was collected within the dust collector. In addition, a section of the air filter from the HVAC duct was collected and sent for dust characterization analysis. The homeowner could not recall if the HVAC system was in use at the time of the evacuation from the fire.

The samples were submitted to REDACTED for particle/fiber identification and characterization. REDACTED is an AIHA Accredited Laboratory. Soot-like particles were identified to represent 10% of the bulk sample in the Kid's room and 35% of the bulk sample in the Master Bedroom. Soot was not found on the HVAC Filter.

The same samples were further analyzed for chloride and cyanide both of which are typically present in fire smoke. Table 2 summarizes the results.

**TABLE 2: JUNE 29, 2020 – Particle/Fiber Identification and Characterization**
**Single Family Residence – – UNDISCLOSED ADDRESS**

| Bulk Dust | HVAC FILTER | BEDROOM CARPET DUST | MASTER BEDROOM CARPET DUST |
|---|---|---|---|
| **FIBROUS COMPONENTS** | **Approx % of sample** | **Approx % of sample** | **Approx % of sample** |
| Cellulose | 47 | 45 | 24 |
| Synthetic Fibers | 2 | 5 | 2 |
| Hair | 1 | 3 | 2 |
| Fibrous Glass | ND | Trace | Trace |
| Asbestos | ND | ND | Trace |
| Other mineral fibers | ND | ND | ND |
| **NON-FIBROUS COMPONENTS** | **Approx % of sample** | **Approx % of sample** | **Approx % of sample** |
| Minerals: quarts/calcite | ND | 2 | Trace |
| Ferrous metal fragments | ND | ND | ND |
| Non-ferrous metal fragments | ND | ND | ND |
| Starch grains | ND | ND | ND |
| **Soot-like particles** | **ND** | **10** | **35** |
| Small particles – too small to IDENTIFY | ND | 5 | 5 |
| **BIOLOGICALS** | **Approx % of sample** | **Approx % of sample** | **Approx % of sample** |
| Fungi | Trace | Trace | Trace |
| Pollen | ND | Trace | 2 |
| Diatoms | ND | ND | ND |
| Insect parts | ND | 5 | 10 |
| Epithelial cells | 50 | 25 | 20 |
| **Additional Analysis** | | | |
| EPA 300 Chloride | 4,180 µg/g | 27,900 µg/g | 23,100 µg/g |
| SW-846 9014- Cyanide | ND | <20.0 mg/kg | 23.0 mg/kg |

ND = Not Detected

***Asbestos Sampling – Spot Check***

The original construction of this residence is estimated to be in REACTED. The residence has undergone multiple renovations and has numerous types of drywall texture and paint colors. Based on the age of the residence, it was decided to do a spot check for asbestos. Please note these samples do not satisfy the number of samples required for a full asbestos survey.

A total of three (3) drywall samples were collected from the master bedroom. Samples were collected from the same area an inspection hole was cut in the master bedroom. Samples were submitted to REDACTED for Polarized Light Microscope (PLM) Analysis under method EPA 600/R-93/116. Table 3 summarizes the results.

**TABLE 3: JUNE 29, 2020 – Asbestos Bulk Sampling – PLM Analysis**
**Single Family Residence – – UNDISCLOSED ADDRESS**

| Sample Analysis Summary | Master Bed 1 | Master Bed 2 | Master Bed 3 |
|---|---|---|---|
| Layer #1 Paint | No Asbestos Detected | No Asbestos Detected | No Asbestos Detected |
| Layer #2 Paint | No Asbestos Detected | No Asbestos Detected | No Asbestos Detected |
| Layer #3 Paper | No Asbestos Detected | No Asbestos Detected | No Asbestos Detected |
| Layer #4 Drywall Core | No Asbestos Detected | No Asbestos Detected | No Asbestos Detected |
| **OVERALL RESULT** | **NO ASBESTOS** | **NO ASBESTOS** | **NO ASBESTOS** |

***Particulate Sampling – Real Time Detection***
The TSI 9306-V2 Aero Trak Handheld Particle Counter instrument and the P-Trak Ultrafine Particle Counter 8525 were utilized to sample particulates throughout the residence. Both instruments were used simultaneously in each sample location.

Respirable and inhalable sized particulates were observed in each area sampled. The specific cut sizes (aka particulate diameters) measured were: 0.3 µm, 0.5 µm, 1.0 µm, 2.0 µm, 5.0 µm, 10.0 µm. Respirable size particulates are defined as particulates < 5.0 µm and inhalable sized particulates are 10 µm in size. Respirable sized particulates are small enough to deposit in the lower regions of the lungs. The Inhalable size particles usually get trapped in the upper respiratory system.

The PTrak measures ultrafine particulates, defined to have a diameter of 0.1 µm**.** The ultrafine particulates can be inhaled and are small enough to also be present in the exhaled breath.

Indoor particulate counts are compared to those observed outside. In theory, concentrations of indoor air particulates should be equal to or less than those observed outside because the indoor environment has filtered air. When indoor particulate levels are higher than those observed outside, it is can be related to an indoor source.

TABLE 4 provides a summary of the real time particulate data collected on JUNE 29, 2020. All areas where higher than outside levels of particulates were observed are highlighted in yellow. Ultrafine particulate counts were not observed to be higher than the samples collected outdoors.

**TABLE 4: June 29, 2020 - Summary of Real Time Particulate Results**

**Single Family Residence – UNDISCLOSED ADDRESS**

| SAMPLE LOCATION | | Particulate Cut Sizes | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 0.3 µm | 0.5 µm | 1.0 µm | 2.0 µm | 5.0 µm | 10 µm | Ultrafine 0.1 µm |
| 1 | Outside North | 86,739 | 9,605 | 3,818 | 1,410 | 297 | 50 | 5,980 |
| 2 | Outside East | 96,112 | 11,034 | 3,419 | 916 | 130 | 12 | 7,337 |
| 3 | Outside West | 89,184 | 9,273 | 3,226 | 1,021 | 208 | 35 | 6,030 |
| 4 | Outside South | 85,906 | 9,049 | 3,118 | 999 | 189 | 46 | 6,410 |
| 5 | Front Entry (door closed) | **123,567** | 7,442 | 1,502 | 425 | 100 | 27 | 4,111 |
| 6 | Living Room | **130,675** | 7,319 | 1,542 | 420 | 97 | 25 | 4,087 |
| 7 | Kitchen | **121,050** | 7,473 | 1,725 | 579 | 132 | 30 | 4,113 |
| 8 | Bedroom | **155,459** | **29,056** | **18,735** | **10,203** | **4,456** | **890** | 4,005 |
| 9 | Front Closet | **101,572** | **18,236** | 1,724 | 781 | 217 | **121** | 2,913 |
| 10 | Bathroom | **121,216** | 8,248 | 2,348 | 943 | 257 | **189** | 4,035 |
| 11 | Hallway by bedroom | **123,366** | 7,901 | 2,009 | 704 | 140 | 27 | 4,272 |
| 12 | Master Bedroom | **142,832** | **25,168** | **16,821** | **9,319** | **2,778** | **1,098** | 4,348 |
| 13 | Hall Closet | **127,145** | **20,823** | **6,788** | **2,941** | **783** | **167** | 3,660 |
| 14 | Garage (door closed) | 82,384 | 8,809 | 3,623 | 1,588 | 410 | 80 | 4,610 |

***Spore Trap Analysis for Fungi and Other Particulates***

Nine (9) samples were collected utilizing high volume pumps calibrated to flow rates of 15 lpm equipped with ZEFON Spore Traps. Pumps were calibrated before and after use to ensure consistent flow rates. The spore traps were submitted to REDACTED for analysis. REDACTED is an AIHA-LAP, LLC Accredited Microbiology Lab.

The same sample media was analyzed for both Fungal Spores and Other Biological Particles.

Analysis for fungal spore sampling includes identification to genus or group of all fungi present, quantification to spores/$M^3$, and a general assessment of background debris.

The Other Biological Particles analysis is a supplement to the standard "Spore Trap analysis" and includes quantification and identification in terms of particles/$M^3$ and a general assessment of background debris.

The results are summarized in Tables 5A, 5B, 6A and 6B.

**TABLE 5A: June 29, 2020 - Summary of Spore Trap Results**
**Single Family Residence – UNDISCLOSED ADDRESS**

| Genus | OUTSIDE 1 Spores/M³ | OUTSIDE 2 Spores/M³ | Kitchen Spores/M³ | Living Rm Spores/M³ | Bathroom Spores/M³ |
|---|---|---|---|---|---|
| Alternaria | 120 | 80 | | | 13 |
| Ascopores | 370 | 480 | 210 | 320 | 53 |
| Basiodiospores | 1,900 | 1,200 | 53 | 53 | 110 |
| Chaetomium | | | | | |
| Cladosporium | 2,700 | 1,700 | 480 | 530 | 590 |
| Curvularia | | | | | 13 |
| Epicoccum | 53 | | | | |
| Oidium | 27 | 130 | 40 | | |
| Other brown | | 53 | 13 | | |
| Other colorless | | | | 13 | |
| Penicillium/Aspergillus | | 270 | 53 | | 1,910 |
| Pithomyces | | 13 | | | |
| Rusts | 210 | 67 | 13 | 40 | 13 |
| Smuts | 290 | 230 | 13 | 80 | 40 |
| Stachybotrys | | | | | |
| Stempjylium | | | | | |
| Torula | 27 | | | 27 | |
| Total Spores | 5,600 | 4,200 | 880 | 1,100 | 1,700 |



**TABLE 5B: JUNE 29, 2020 - Summary of Spore Trap Results**
**Single Family Residence – UNDISCLOSED ADDRESS**

| Genus | Master Bed 1 Spores/M³ | Kid's Bedroom 1 Spores/M³ | Master Bed 2 Spores/M³ | Bedroom 2 Spores/M³ | Bedroom 3 Spores/M³ |
|---|---|---|---|---|---|
| Alternaria | 27 | 40 | 27 | 67 | 47 |
| Ascopores | | 53 | | | |
| Basiodiospores | | 800 | 53 | 110 | 60 |
| Chaetomium | | | | | |
| Cladosporium | 590 | 640 | 480 | 530 | 450 |

| | | | | | |
|---|---|---|---|---|---|
| Curvularia | | | | | |
| Epicoccum | | 13 | | | |
| Oidium | | | 13 | | |
| Other brown | | | 13 | | |
| Other colorless | 67 | | | | |
| Penicillium/Aspergillus | 570 | | | | |
| Pithomyces | | | | | |
| Rusts | 80 | | | 13 | |
| Smuts | 190 | 160 | 67 | 53 | 56 |
| Stachybotrys | | | | | |
| Stempjylium | | | | | |
| Torula | | | | | |
| Total Spores | 1,300 | 1,700 | 650 | 770 | 613 |

**TABLE 6A: JUNE 29, 2020 - Summary of Other Biologic Particles Results**
**Single Family Residence – UNDISCLOSED ADDRESS**

| Type | OUTSIDE 1 Particles/M³ | OUTSIDE 2 Particles/M³ | Kitchen Particles/M³ | Living Rm Particles/M³ | Bathroom Particles/M³ |
|---|---|---|---|---|---|
| **POLLEN** | | | | | |
| Other | 550 | 830 | 93 | 93 | 40 |
| Pine | 80 | 130 | 13 | | |
| **OTHER PLANT** | | | | | |
| Other | 27 | 27 | 13 | 13 | 40 |
| **OTHER PARTICLES:** | | | | | |
| **ANIMAL** | | | | | |
| Epithelial (skin) cells | 27 | 93 | 870 | 490 | 990 |
| Hair | | | | | |
| Insect Parts | 40 | | 13 | | 40 |
| Mites | | | | | |
| **FUNGI** | | | | | |
| Hyphal Fragments | 210 | 270 | 13 | 120 | 53 |
| **NON-BIOLOGICAL** | | | | | |
| Cellulose Fibers | 67 | 13 | 250 | 120 | 310 |
| Glass Fiber | | | | 13 | 40 |
| Starch Particles | | | | | |
| Synthetic Fibers | | | | | |

**TABLE 6B: JUNE 29, 2020 - Summary of Other Biologic Particles Results**
**Single Family Residence – UNDISCLOSED ADDRESS**

| Genus | Master Bedroom 1 Particles/M³ | Kid's Bedroom 1 Particles/M³ | Master Bedroom 2 Particles/M³ | Bedroom 2 Particles/M³ | Bedroom 3 Particles/M³ |
|---|---|---|---|---|---|
| **POLLEN** | | | | | |
| Other | 1,200 | 93 | 280 | 240 | 440 |
| Pine | | | | | |
| **OTHER PLANT** | | | | | |
| Other | 160 | | | | |
| **OTHER PARTICLES:** | | | | | |
| **ANIMAL** | | | | | |
| Epithelial (skin) cells | 4,900 | 16,000 | 4,100 | 56,000 | 25,000 |
| Hair | 280 | | | | |
| Insect Parts | 80 | | 27 | 27 | |
| Mites | | | | | |
| **FUNGI** | | | | | |
| Hyphal Fragments | 120 | 200 | 210 | 360 | 560 |
| **NON-BIOLOGICAL** | | | | | |
| Cellulose | 120 | 390 | 1,100 | 2,600 | 4,800 |
| Glass Fiber | 13 | | | 53 | 67 |
| Starch | | | | | |
| Synthetic | | | | | |

**TABLE 7: June 29, 2020 - Summary of Photoionization Detector (PID) Results**
**Single Family Residence – UNDISCLOSED ADDRESS**

| | SAMPLE LOCATION | PhotoIonization Detector Results ppb |
|---|---|---|
| 1 | Front Entry | 959 |
| 2 | Living Room | 951 |
| 3 | Kitchen | 1,177 |
| 4 | Master Bedroom | 1,011 |
| 5 | Bathroom | 1,106 |
| 6 | Bedroom | 968 |
| 7 | Garage | 712 |

**TABLE 8: June 29, 20120 - Summary of GASMET Real Time Detection**
**Single Family Residence – UNDISCLOSED ADDRESS**

| CHEMICAL | NIOSH REL | CAL OSHA Exposure Limits | Average Conc in the Home | Highest Reading |
|---|---|---|---|---|
| Acetone | 250 PPM | 500 PPM | 0.18 PPM | 0.25 PPM - Living Room |
| Ammonia | 25 PPM | 25 PPM | 0.21 PPM | 0.34 PPM - Living Room |
| Benzene (Ca) | 0.1 PPM | 1.0 PPM | 0.03 PPM | 0.07 PPM - Living Room |
| Butane | 800 PPM | 800 PPM | 0.15 PPM | 0.39PPM - Living Room |
| Carbon Dioxide (CO2) | 5,000 PPM | 5,000 PPM | 580.01 PPM | 894.28 PPM - Master Bed |
| Carbon Monoxide | 35 PPM | 25 PPM | ND | ND |
| Carbon Disulfide | 1 PPM | 1 PPM | ND | ND |
| Desflurane | --- | --- | ND | ND |
| Dichloromethane (Ca) (aka Methylene chloride) | LFC* | 50 PPM | **1.84 PPM** | **2.0 PPM - HVAC Return Duct** |
| Ethanol | 1000 PPM | 1000 PPM | ND | ND |
| Ethylene | --- | --- | 0.95 PPM | 1.7 PPM – Living Room |
| Formaldehyde (Ca) | 0.016 PPM 0.1 CEILING | 0.75 PPM | **0.04 PPM** | **0.19 ppm Kitchen** |
| Hexane | 50 PPM | 50 PPM | 0.60PPM | 0.94 PPM Living Room |
| Hydrogen Chloride | 5 PPM CEILING | 0.3 PPM 2.0 CEILING | ND | ND |
| Hydrogen Cyanide (HCN) | 4.7 PPM ST | 4.7 PPM CEILING | 0.94 PPM | 1.09 PPM Crawl Space. 0.97 PPM –Bedroom |
| Hydrogen Fluoride | 3 PPM | 0.4 PPM | **0.39 PPM** | **0.51 PPM Living Room** |
| Methane | --- | --- | 2.3 PPM | 3.04 PPM – Living Room |
| Nitrogen Oxide (NO) | 25 PPM | 25 PPM | 0.17 PPM | 0.20 PPM Family Room |
| Nitrogen Dioxide (NO2) | 1 PPM ST | 1 PPM ST | **2.93 PPM** | **4.20 PPM Living Room** |
| Phosphine | 0.3 PPM 1.0 ST | 0.3 PPM | **0.71 PPM** | **1.09 PPM Crawl Space 0.92 PPM Master Bed** |
| **Phosphine ERPG-2 (Emergency Response Planning Guideline)** (maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious adverse health effects or symptoms that could impair an individuals's ability to take protective action) = **0.5 ppm** | | | | |
| Sulfur Dioxide (SO2) | 2 PPM | 2 PPM | 0.002 PPM | 0.09 PPM Master Bed/. 2nd Bed Room |
| Toluene | 100 PPM | 10 PPM | 1.67 PPM | 1.95 PPM Living Room |
| M-Xylene | 100 PPM | 100 PPM | 1.88 PPM | 2.0 PPM Living Room |

*LFC = Lowest Feasible Concentration
ND = Not Detected
Ca = Listed Carcinogen

**TABLE 9A: JUNE 29, 2020 - Summary of Soil Sample Results – Semi-Volatiles**
**Single Family Residence – UNDISCLOSED ADDRESS**

| CHEMICAL | Composite Sample | Crawl Space Sample |
|---|---|---|
| 1,2,4 -Trichlorobenzene | ND | ND |
| 1,2 -Dichlorobenzene | ND | ND |
| 1,2 -Diphenylhydrazine | ND | ND |
| 1,3 -Dichlorobenzene | ND | ND |
| 2,4,5 -Trichlorophenol | ND | ND |
| 2,4,6 -Trichlorophenol | ND | ND |
| 2,4 -Dichlorophenol | ND | ND |
| 2,4 -Dimethylphenol | ND | ND |
| 2,4- Dinitrophenol | ND | ND |
| 2,4 -Dinitrotoluene | ND | ND |
| 2,6 -Dinitrotoluene | ND | ND |
| 2-Chloronaphthalene | ND | ND |
| 2-Chlorophenol | ND | ND |
| 2-Methylnaphthalene | ND | ND |
| 2-MEthylphenol | ND | ND |
| 2-Nitroaniline | ND | ND |
| 2-Nitrophenol | ND | ND |
| 3 & 4 Methylphenol | ND | ND |
| 3,3'-Dichlorobenzidine | ND | ND |
| 3- Nitroaniline | ND | ND |
| 4,6-Dinitro-2-methylphenol | ND | ND |
| 4-Bromophenul phenyl ether | ND | ND |
| 4-Chloro-3-methylphenol | ND | ND |
| 4-Chloroaniline | ND | ND |
| 4-Chlorophenyl phenyl ether | ND | ND |
| 4-Nitroaniline | ND | ND |
| 4-Nitrophenol | ND | ND |
| Acenaphthylene | ND | ND |
| Anthracene | ND | ND |
| Benzo[a]anthracene | ND | ND |
| Benzo[a]pyrene | ND | ND |
| Benzo[b] fluoranthene | ND | ND |
| Benzo[g,h,i]perylene | ND | ND |
| Benzo[k]fluoranthene | ND | ND |
| Benzoic acid | ND | ND |

| CHEMICAL | Composite Sample | Crawl Space Sample |
|---|---|---|
| Benzyl alcohol | ND | ND |
| Bis(2-chloroethoxy)methane | ND | ND |
| Bis(2-chloroethyl)ether | ND | ND |
| bis(2-chloroisopropyl)ether | ND | ND |
| Bis(2-ethylhexyl) phthalate | ND | ND |
| Butyl benzyl phthalate | ND | ND |
| Chrysene | ND | ND |
| Diben(a,h)anthracnene | ND | ND |
| Dibenzofuran | ND | ND |
| Dimethyl phthalate | ND | ND |
| Di-n-butyl phthalate | ND | ND |
| Di-n-octyl phthalate | ND | ND |
| Fluoranthene | ND | ND |
| Fluorene | ND | ND |
| Hexachlorobenzene | ND | ND |
| Hexachlorobutadiene | ND | ND |
| Hexachlorocyclopentadiene | ND | ND |
| Hexachloroethane | ND | ND |
| Indeno [1,2,3-cd] pyrene | ND | ND |
| Isophorone | ND | ND |
| Naphthalene | ND | ND |
| Nitrobenzene | ND | ND |
| N-Nitrosodi-n-propylamine | ND | ND |
| N-Nitrosodiphenylamine | ND | ND |
| Pentachlorophenol | ND | ND |
| Phenanthrene | ND | ND |
| Phenol | ND | ND |
| Pyrene | ND | ND |
| Pyridine | ND | ND |

ND = Not Detected

**TABLE 9B: JUNE 29, 2020 - Summary of Soil Sample Results – Organochloride Pesticides**
**Single Family Residence – UNDISCLOSED ADDRESS**

| CHEMICAL | Composite Sample | Crawl Space Sample |
|---|---|---|
| Alpha-BHC | ND | ND |
| Gamma-BHC (Lindane) | ND | ND |
| Beta-BHC | ND | ND |
| Heptachlor | ND | ND |
| Delta-BHC | ND | ND |
| Aldrin | ND | **0.17 mg/Kg** |
| Heptachlor epoxide | ND | ND |
| Endosulfan I | ND | ND |
| 4,4' DDE | **0.083 mg/Kg** | ND |
| Dieldrin | ND | **29 mg/Kg** |
| Endrin | ND | **0.60 mg/Kg** |
| 4,4' DDD | ND | ND |
| Endosulfan II | ND | ND |
| 4,4' DDT | ND | ND |
| Endrin Aldehyde | ND | ND |
| Endosulfan sulfate | ND | ND |
| Methoxychlor | ND | ND |
| Toxaphene | ND | ND |
| Chlordate (Technical) | ND | ND |

ND = Not Detected

**TABLE 9C: JUNE 29, 2020 - Summary of Soil Sample Results – Polychlorinated Biphenyls (PCBs)**
**Single Family Residence – UNDISCLOSED ADDRESS**

| CHEMICAL | Composite Sample | Crawl Space Sample |
|---|---|---|
| PCB-1221 | ND | ND |
| PCB-1232 | ND | ND |
| PCB-1242 | ND | ND |
| PCB-1016 | ND | ND |
| PCB-1260 | ND | ND |
| PCB-1248 | ND | ND |
| PCB-1254 | ND | ND |

ND = Not Detected

**TABLE 9D: JUNE 29, 2020 - Summary of Soil Sample Results – Anions, Soluble**
**Single Family Residence – UNDISCLOSED ADDRESS**

| CHEMICAL | Composite Sample | Crawl Space Sample |
|---|---|---|
| Bromide | ND | ND |
| Nitrate as N | **7.3 mg/Kg** | **250 mg/Kg** |
| Chloride | **8.5 mg'Kg** | **870 mg/Kg** |
| Nitrite as N | ND | ND |
| Fluoride | ND | ND |
| Sulfate | **70 mg/Kg** | **169 mg/Kg** |

ND = Not Detected

## Section 8.0 – Discussion of Results

At first glance, the obvious fire damage appears to be limited to the northside of the residence where the entire side was scorched by fire and high heat. However, the highest concentration of airborne toxic chemicals were discovered in the main living area (living room) which is located in the center of residence away from the north wall.

It is important to note that typical residences are not designed to be airtight. It is expected that concentrations of particulates and molds would be lower inside a residence when compared to outside air, because of the installed HVAC system and the presence of filtered air. Air flow within rooms and even within wall cavities can shift as the pressure differential shifts when a window is opened or a door is closed.

The ABC fire engulfed and destroyed over 6,000 building structures and thousands of personal and commercial vehicles. The toxic smoke generated by the burning contents of the thousands of residential/commercial structures and vehicles, permeated every remaining structure in its path. The toxic chemical and respirable particulate insult to the structures left standing, is unprecedented from a health hazard evaluation perspective.

The sampling conducted in this residence was completed over REDACTED after the initial fire and toxic smoke insult. Every porous material that is capable of absorbing toxic chemicals is presumed to be contaminated.

The following paragraphs summarize findings with reference to each table of results.

***Tape Lift Samples***
Table 1 – High levels of soot were determined in the bedroom in several areas on the bunk beds. This is an indicator of fire contamination in the residence.

**Bulk Dust Characterization samples**
Table 2 - High levels of soot were determined in the carpet samples. Further analysis revealed high levels of chlorides and cyanide. These are common constituents of fire smoke.

**Asbestos Bulk Sampling**
Table 3 – Three (3) samples of drywall were collected from an inspection hole in the master bedroom. All samples tested negative for asbestos in all layers. Please note these samples do not satisfy the number of samples of unique homogeneous areas required for a full asbestos survey. This was a screen test only.

***Real Time Particulate Samples***

Table 4 – Real time particulate sampling revealed elevated respirable sized particulate (0.3 um) in every room sampled compared to outside. When compared to outside air samples, the master bedroom, kid's bedroom and the hall closet reported elevated particulate counts on all six channels monitored.

***Mold/Fungal Spore sampling***

Table 5 – Higher than outside concentrations of penicillium/aspergillus spores were observed in the master bedroom and bathroom.

***Other Biologic Particulate sampling***

Table 6 – Higher than outside concentrations of cellulose fibers were observed in the kitchen, living room, bathroom, master bedroom and kid's bedroom. Higher than outside concentration of glass fibers was observed in the living room, master bedroom, bathroom and kid's bedroom. The elevated levels of epithelial (skin) cells is normal and expected.

***Photo Ionization Detector (PID)***

Table 7 – The results observed during the time each room in the residence was sampled were within normal range. There is nothing remarkable about this data.

The PID unit scans for a wide range of volatile organic compounds (VOC). The equipment cannot positively identify the VOC, it can only report presence or absence of the range of VOCs that it can detect. This unit can detect VOCs that have an ionization potential of 10.6 eV or less.

**GASMET DX4040 Portable Ambient Air Analyzer**

The Gasmet DX4040 FTIR gas analyzer can detect up to 25 gases simultaneously. The channel for 1,3 butadiene was removed from the analysis as it had a significant amount of background noise and was identified as a false positive. This chemical was removed from the table of results.

Eighteen (18) locations were sampled throughout the residence. Table 8 summarizes the data by providing average reading in the residence and the highest reading by location in the residence. Both NIOSH recommended workplace exposures limits and CAL OSHA Permissible Exposure Limits are provided for reference. The exceedances are highlighted in red and the cautions are highlighted in yellow. The areas highlighted in yellow did not exceed published 8-hour workplace exposure limits but would be undesirable for a 24 hour/7 day week residential exposure.

Elevated concentrations of methylene chloride, ethylene oxide, formaldehyde, hydrogen fluoride nitrogen dioxide and phosphine were found in various areas of the residence.

***Soil Sampling***

Two (2) soil samples were collected as a screening tool to determine if the soil surrounding the home and soil found in the crawl space could be potentially contaminated. One sample

consisted of a composite sample from soil collected from all four sides of the residence. The second sample was collected from the entry area to the crawl space and consisted of soil found in the crawl space only. The soil was analyzed for Semi-Volatiles, PCBs, Pesticides, Anions (soluble) and RCRA 8 metals. Tables 9A, 9B, 9C, 9D and 9E summarize the soil samples. The soil samples tested negative for semi-volatiles, and PCBs. In addition, pesticides were determined in each of the samples and nitrates, chloride and sulfates were determined as well.

California's regulations on Soil Remediation Limits are complex and associated with an overall Health Hazard Assessment. There are separate California regulations for pesticides. Please note the purpose of conducting the soil sampling was to use the results as a screening tool only. In order to determine a remediation scope of work for the soil, additional sampling may be needed.

## Section 9.0 – Recommendations

Based on the observations and analysis of the samples collected, it is recommended that this residence not be occupied in its current condition. Based on the sample data, every porous material, including building materials and contents, that is capable of absorbing toxic chemicals is presumed to be contaminated.

The results show that there are a variety of airborne toxic chemicals in every living space within the house. Many of the airborne concentrations exceeded NIOSH and/or CAL-OSHA workplace standards. The average phosphine levels in this residence are above the Agency for Toxic Substances and Disease Registry (ASTDR) Emergency Response Planning Guideline (ERPG) of 0.5 ppm which is a recommended public health exposure for no longer than one hour.

The real time sample results are limited to what the direct read instruments are able to detect. There are likely additional contaminants, not identified in this report, that were produced, carried by the smoke and fire and impacted this property that may also contribute to toxic contamination and potential adverse health effects. The tape lift samples show that there is fire contamination in the residence.

The toxic load of the smoke, as it moved through this residence, is significant due to all of the contents of all of the homes and vehicles that burned prior to the smoke reaching this residence. The toxicity of the smoke generated from the ABC fire includes but is not limited to the toxic gases generated by the pyrolysis of the following:

- building materials of multiple residences, commercial buildings;
- vehicles, gasoline, metals, tires;
- recreational vehicles, trailers;
- household chemicals, household pesticides;
- household furniture;
- household electronics;
- plastic toys;
- carpeting, laminate flooring, etc.
- misc plastic load – appliances, food storage, furniture, shelving, printers, etc.

The recommendation is that the home should either be properly remediated or it should be demolished and replaced. If it is determined that the home should be demolished, all applicable California and EPA regulations must be followed.

Based on the observed airborne toxic chemical concentrations still present eight months post fire, removing all contaminated materials and deconning the residence will be a challenge.

In order to ensure complete remediation, it is recommended that all porous materials: textiles, carpets, clothing, books, furniture, walls, ceilings and insulation be removed and replaced; non-

porous materials should be decontaminated. After all porous materials are removed and non-porous materials are decontaminated, it is recommended that the industrial hygiene sampling be repeated to ensure that the structural members of the home are not off-gassing what may have been absorbed by the smoke insult on the home.

A thorough cost benefit analysis is recommended to determine the efficacy of remediation and repair versus complete demolition and rebuild.

## Section 10.0 - Limitations

KAIZEN SAFETY SOLUTIONS, LLC industrial hygiene services have been performed using a degree of skill and care ordinarily exercised under similar circumstances by industrial hygiene consultants practicing on similar projects, in a similar time frame and/or locality and under similar conditions.

The conclusions and recommendations represent professional opinions based upon the latest scientific information available and expressly do not constitute a certification, warranty, or guarantee of any type. This report is limited to the time and date the samples were collected.

If you have any questions regarding this report or require further clarification, please contact Dawn Bolstad-Johnson at 602-881-3661.

# APPENDIX A:
## LABORATORY ANALYSIS REPORTS

# APPENDIX B:
## REPRESENTATIVE PHOTOS